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CHAPTER

Recent Advances in Multidisciplinary Research

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**Recent Advances in
Multidisciplinary Research**

Editors
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Studies on kinetic Parameters of Zinc Accumulation by Yeast

Sarla Kumari *
Chandra Mohan **

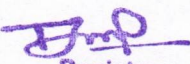
ABSTRACT

Physico-chemical technologies for metal removal are expensive. At low initial metal concentrations these are ineffective. Therefore, alternative method such as Bio-accumulation is widely used in recent years. Biological treatment offers a reducing level of toxic metals in environmentally acceptable limits. It is cost-effective, ecofriendly and non-hazardous. It was planned to study the correlation between metal concentrations in the environment and accumulation by yeast along with the involvement of metal binding proteins. Enzyme kinetics plays an important role for understanding of the rate of biochemical reactions which occurs in living cells. Enzymatically controlled reactions depend upon substrate as well as enzyme concentrations. The dependence of reaction rate on enzyme concentration is very important as it regulates the cell metabolism. The concentration of substrate [S], affects the rate of reaction catalyzed by an enzyme. Therefore bio-accumulation of Zn by *Saccharomyces cerevisiae* and its kinetic parameters were investigated at various supplied concentrations of zinc.

KEY WORDS- Bio-accumulation, *Saccharomyces cerevisiae*, Zinc, Enzyme, Kinetics.

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3 Need for Advanced Materials and Technologies

The Sustainability Argument

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3.1 INTRODUCTION

Efforts to design materials that achieve advantageous properties and applications at the atomic/molecular scale are going on in the field of advanced materials and technology (1). Research on advanced materials varies from basic scientific studies related to their fabrication and interactions to applied engineering efforts that help in translation of such basic knowledge to advanced technological developments. Engineered materials designed at the atomic/molecular scale having dimensions in the range of 1–100 nm and enhanced properties such as tensile strength, thermal stability, and electrical and optical properties are known as advanced materials. They provide better performance with cost effectiveness, reduce energy consumption, and show less dependency on imports of critical and strategic materials (2). Over the past few decades, these advanced materials have played a key role in the advancement of technology, which is considered the present stage of human knowledge and is used to generate valuable products to fulfill all necessities by resolving all problems. These advanced materials include metal alloys, composites, carbon fiber, polymer composites, ceramics, metals, and metal oxide nano-materials and are used as lightweight materials for application in the automotive and building sectors. They are used as bio-derived materials for food packaging and agriculture by replacing petrochemical products, as graphene in touch screens and solar cells, as nano-materials for water purification and radioactive waste cleanup, and in many more applications (3–5). These novel physicochemical properties of advanced materials make them more desirable and functional for sustainable development of technologies. Sustainability means the ability to meet all necessary requirements of the present without compromising with the possibilities of upcoming generations. For sustainable development, three pillars have great importance: economic (profit), social (people), and environment (planet) (6). For sustainable development, it is necessary that these advanced materials and technologies should be used for real-life applications involving all the conditions under which a material will be used.

The main objective of this chapter is to study the role of advanced materials and technologies for sustainable development, how they are affecting the economy and society, and how they are responsible for environmental degradation and depletion of natural resources instead of having a large number of functional properties.

3.2 ADVANCED MATERIALS

Technology developers are continually discovering new and useful materials that exhibit novel or enhanced physicochemical properties such as tensile strength, hardness, thermal stability, and electrical and optical properties in comparison with conventional materials (7). These innovative and useful materials are known as advanced materials. Over the past three decades, these materials have been used



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continuously for different purposes (8), but in recent years they have become a legend for nano-enabled materials.

However, no protocol exists in the field of environmental safety and occupational health (ESOH) for defining these materials. In several ways, the definition of advanced materials is a great challenge, such as defining nano-materials.

There are different ways to define the advanced materials. The broader definition is materials that signify enhancements over traditional materials that have been used for several hundred years.

Alternatively, they are defined as "Materials having engineered properties formed through the development of specified processing and synthesis technology." There are mainly six advanced materials subgroups:

- a. Alloys and metals, such as amorphous and shape-memory alloys, aluminum-lithium alloys, and metals that are porous and solidify rapidly;
- b. Structural ceramics, such as alumina (Al_2O_3), silicon carbide (SiC), nitride (Si_3N_4), beryllia (BeO), boron nitride (BN_x), titanium carbide (TiC), and thorium (ThO_2);
- c. Industrial polymers, such as polyphenylenesulphide, polyacrylate, polyetheretherketone, and an array of polyamide-imides;
- d. Advanced composites, including metal, ceramic, or polymer matrix-comprising particles, whisker and fiber reinforcements made up of different atoms/metal oxides such as carbon, boron, zirconia, aluminum silicates;
- e. Materials having magnetic, electrical, and optical properties, such as gallium (Ga), indium (In), yttrium (Yt), zirconium (Zr), barium (Ba), lanthanum (La), and rare earth elements called lanthanides;
- f. Medical and dental materials, including alumina (Al_2O_3) and calcium phosphate (Ca_3PO_4), glasses and carbon fiber-strengthened polylactic acid composites (8, 9);
- g. Nano-materials, such as metal oxide nano-materials TiO_2 , ZnO , SnO_2 , ZrO_2 , and Fe_3O_4 (10).

All the above materials provide the potential of reduced energy consumption, better performance with cost effectiveness, and less dependence on imports of critical and strategic materials.

3.3 TECHNOLOGY

Technology is the knowledge of science that can be applied for practical purposes or can be considered as the sum of methods, processes, techniques, and skills that are applied to produce essentials to fulfill various purposes such as scientific investigation. In simple way, it is the advancement and application of basic tools (11). Technology is the present stage of knowledge used to produce required products by combining resources, to solve undefined problems, and to fulfill all necessities by using technical methods, tools, techniques, skills, processes, and raw materials (12).


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Over the past few decades, technology has advanced to nanotechnology, in which materials are manipulated to atomic, molecular, or supra-molecular scale, having at least one dimension in the range of 1–100 nm. Nanotechnology has a huge range of applications using innovative advanced materials and devices in different fields such as nano-electronics, nano-medicines, production of biomaterials, etc. (13).

When nanotechnology merges with another term, such as “medical nanotechnology,” “automobile nanotechnology,” or “state-of-the-art nanotechnology,” it describes the state of knowledge and tools of the respective field and refers to the highest technology accessible to human beings in any field (14).

Technology has various consequences in positive and negative ways. If we talk in a positive way, due to technology, more advanced economies have been developed, resulting in the growth of a leisure class. Most of the nano-technological practices generate unwanted effects, such as pollution, that are responsible for the depletion of natural resources and damage the Earth's environment, demonstrating the negative impact of technology. Inventions of new technology always show an effect on the morals of a society, resulting in a generation of new issues in the principles of technology, such as the concept of effectiveness regarding human efficiency and the challenges of bioethics (15).

3.4 NEED FOR ADVANCED MATERIALS

Materials are at the core of our day-to-day life that ensure the functioning, stability, long-term durability, security, and environmental compatibility of all the devices and services around us. Over the past few decades, the so-called conventional/traditional materials, such as metals, concrete, and plastics, have undergone innovative developments, such as new-fangled composites, smart coatings, biomimetic materials (such as hydrogel and surface texturing), and light alloys to diminish weight and CO₂ emissions; in other words, the applications of advanced materials have spread from nanotechnology to ceramics, biomaterials related to health products, and to the newest energy materials for reducing our carbon footprint (16).

As discussed in Section 3.2, advanced materials outperform traditional materials because they contain certain properties that are far superior including physicochemical properties such as thermal stability, strength, hardness, and flexibility. They have capacity to carry these novel characteristics with ability to retain their form, or they can sense that variations have occurred in their nature and respond to all variations (17). Advanced materials and technologies are the new home for research and applications of technology-related materials, with specific efforts on advanced design, production, and incorporation of devices.

Recently, new and novel materials, also called advanced materials, are classified in terms of three distinct engineering and social demands:

1. sustainability and materials security
2. materials for energy
3. high-value markets

Basics of Clay Minerals and Their Characteristic Properties

Neeraj Kumari and Chandra Mohan

Abstract

Clay minerals such as kaolinite, smectite, chlorite, micas are main components of raw materials of clay and formed in presence of water. A large number of clays used to form the different structure which completely depends on their mining source. They are known as hydrous phyllosilicate having silica, alumina and water with variable amount of inorganic ions like Mg^{2+} , Na^+ , Ca^{2+} which are found either in interlayer space or on the planetary surface. Clay minerals are described by presence of two-dimensional sheets, tetrahedral (SiO_4) and octahedral (Al_2O_3). There are different clay minerals which are categorized based on presence of tetrahedral and octahedral layer in their structure like kaolinite (1:1 of tetrahedral and octahedral layers), smectite group of clay minerals (2:1 of tetrahedral and octahedral layers) and chlorite (2:1:1 of tetrahedral, octahedral and octahedral layers). The particle size of clay minerals is <2 microns which can be present in form of plastic in presence of water and solidified when dried. The small size and their distinctive crystal structure make clay minerals very special with their unique properties including high cation exchange capacity, swelling behavior, specific surface area, adsorption capacity, etc. which are described in this chapter. Due to all these unique properties, clay minerals are gaining interest in different fields.

Keywords: Clay minerals, cation exchange capacity, swelling capacity, adsorption, tetrahedral

1. Introduction

Georgius Agricola (1494–1555), the founder of geology, was seemingly the first who gave the definition of clay in 1546. It has been modified several times due to which the clay definition raises the questions related of constituents of clay and implicitly which was very important [1]. The latest effort to solve all these issues was done by the Joint Nomenclature Committees (JNCs) of the Association Internationale pour l'Etude des Argiles (AIPEA) and the Clay Minerals Society (CMS). According to these societies, clay, a naturally occurring material, composed mainly of fine-grained minerals, become plastic in presence of water and become hard when dried or fired. By this definition of clay, engineered clays and clay-like materials can be distinguished as clay (fine grained minerals) exhibiting plasticity in presence of water and become hard on drying and firing [2, 3].

1.1 Clay


Clay is a soft, freely bound, fine grained natural rock or earthy material having diameter less than 0.005 mm and composed essentially of clay particles. Based on

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Clays, especially montmorillonite and bentonite are environmentally benign, recyclable, and economical when used as a catalyst. Heteropoly catalysts are also used in a wide variety and high potential, because of their higher catalytic activity and acidic strength than the mineral acids. By the modification of clays with a variety of HPAs, we can achieve the benefits of using both clay and HPAs. We can use various HPAs such as Silicotungstic acid (STA), Phosphotungstic acid (PTA), Silicomolybdic acid (SMA), Phosphomolybdic acid (PMA) for the modification of clay and may be obtained a series of HPA modified clays. HPA modified clays have proved to be a prominent catalyst for different acid-catalyzed organic reactions. This book represents the basic properties of clays and heteropoly acids and the modification techniques of clays with HPAs. These modified clays further characterized by using analytical, thermal, and spectral techniques and find applications as catalysts in organic reactions.



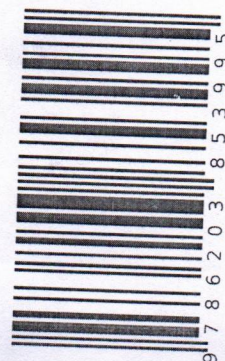
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Chandra Mohan

Advances in Heteropoly Acid Modified Clays as Acid Catalysts

Synthesis and Characterization of Heteropoly Acid
Modified Montmorillonite and Bentonite Clays as
Solid Acid Catalysts


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PHYTOCHEMICALS FOR HEALTHY LIVING: EXTRACTION AND USAGE

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Abstract- Plants are the chief source of active ingredients or chemicals which are used in pharmaceutical industry. Pharmacological activity of plants makes them useful for curing bacterial, fungal contagions and also chronic-progressive diseases like diabetes and cancer etc. The synthetic molecules prepared in the laboratories, when used as medicine for treating for different diseases produce several side effects and continuous usage of those medicines is not recommended. The search for new plant based molecules for the pharmaceutical and agrochemical manufacturing companies are continuous process that necessitates continual optimization. In this article, we present the process of extraction of phytochemicals, isolation and identification of organic compounds. Antioxidant and anticancer properties of some of the plants are also discussed.

1. INTRODUCTION

Phytochemicals or phytonutrients are the chemicals obtained from plants, produced through 1° and 2° metabolism and show biological activity. They are biologically active compounds which possess disease protective or preventive properties. Various chemicals in fruits and vegetables are not only beneficial for deterrence and management of various ailments but color, aroma and taste of food prepared by these plants is also due to their presence. Phytochemicals are mainly concentrated in colorful parts of the plants like fruits, vegetables, nuts, legumes etc. Color of blueberries, odor of broccolis, and pungent odor of garlic is attributed to presence of phytochemicals [1]. They provide protection to plants from disease, infection and guard against pathogens or predators and take part in plant growth by providing beneficial nutrient to them [2].

Researchers are now heading towards to find new ways to obtain them by synthetic methods in lab [3]. Apart from providing nutrition, plants are used from centuries for preparation of medicines, dyes etc. [2]. In the process of exploring new chemicals, various methods were developed to establish the structure of compound responsible for healing properties [3]. Each phytochemical works differently and accomplish a number of purposes such as antioxidant activity, hormonal action, antibacterial effect, antimicrobial action and anticancer activity.

Till now scientists have researched about 3,000 different phytochemicals with possible health benefits. Phytochemicals extracted from plants have been used in pharmaceuticals for cancer, urinary disease, fever, cardiovascular diseases, diabetes etc. Different medicines and techniques are used for handling these diseases but they also have been shown to produce side effects on our health. Chemotherapy is given to patients so as to treat cancer but it also has been found to generate some side effects which unduly affect patient's health. So now researchers focus on the use of such drugs and medicines extracted from natural products; that would show remarkable effect on antigens of disease and would not show any side effect on healthy cell. So now, modern science has changed its path and move towards the natural products [4].

Phytochemicals produces good and positive effects on human body i.e. they strengthen our immune system, improve our digestive system and acts as antioxidant [5]. Isoindoles, Isothiocyanate and sulforaphane present in broccoli, allylic sulfides from onion, garlic, isoflavonoids from soybeans etc. show positive impact on human health.

Studies suggest that the food having good servings of fruits, vegetables, and whole grain provide defense against cancer, cardiovascular problems, diabetes and neurodegenerative ailment etc. Plants having favorable phytoconstituents may enhance the immunity of humans by providing natural antioxidants. Broccoli, sprouts, carrots, sweet potato, soybean etc. contain antioxidants. Dark colored fruits and vegetables have more antioxidants than other fruits and vegetables. Consumption of antioxidants can prevent or slow down the damage to cell caused by free radicals [6]. Similarly, sulfides in onion and garlic may strengthen the immune system. Anthocyanins found in grapes, blueberries and raspberries because of their dark color have anti-inflammatory and anti-tumor properties. Phytochemicals are power packed bites of plants known to be essential for health, like vitamins and minerals. Studies show that high intakes of fruits and vegetables minimize the risks of chronic diseases. Different phytochemicals present in plant exhibit different impact on the humans [7-8].

Evidence suggests that ingesting soy having isoflavones and cocoa having polyphenols may decrease the possibility of cardiovascular disease by improving endothelial function by dilating blood vessels. Consumption of wide range of phytochemicals helps in lowering blood pressure, inflammation, LDL oxidation and may increase HDL cholesterol. Phytochemicals like anthocyanins, phytosterols, phenolic acids, lignans and carotenoids present in wheat, rye, oats, rice and other grains are known to have cardio protective effects.

Intake of phytochemicals may not cure the disease but consumption of these phytochemicals may help in prevention of disease or reduce the risk of disease. Further research is going on for the extraction and usage of phytochemicals in pharmaceutical industries [9].

Phytochemicals show potential to [10] –

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- Enhance immunity
- Prevent formation of carcinogenic substances in the body
- Diminish infection
- Avert DNA damage
- Lessen impairment to cells due to oxidation.
- Limit speed of formation of tumor
- Triggered damaged cells to apoptosis afore they replicate
- Gene expression
- Activate insulin receptors

It was observed that increasing the ingestion of fruits and vegetables from fewer to 3-4 times a day may cut the danger of illness by 17% [11].

Phytochemicals have been divided into six groups depending upon their chemical structure as well as properties such as carbohydrate, lipids, phenolic, terpenoids, alkaloids and other nitrogen containing molecules etc. as explained in the figure 1 given below [3].

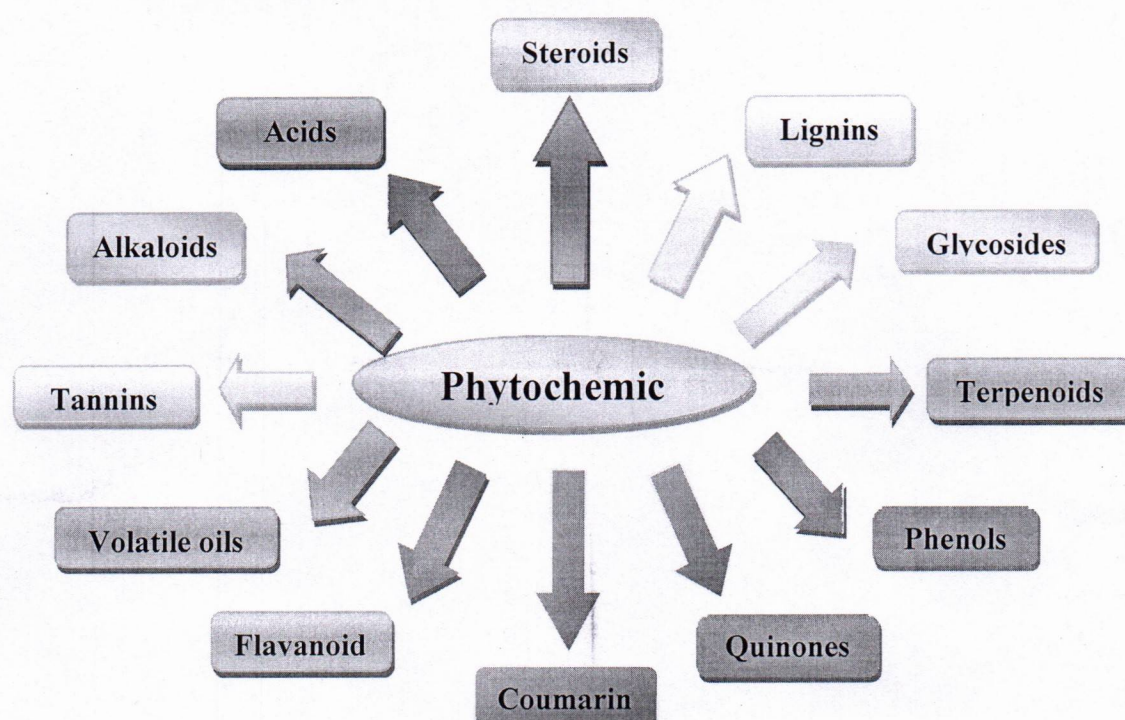


Fig. 1.1 Major group of Phytochemicals

1.1 Need for Phytochemicals

Phytochemicals plays an important role to lead a healthy life. In vegetables and fruits a protective layer is present which can minimize the hazard of developing prolonged diseases. Flavanoids, plant's pigments decrease oxidation, enhance the level of vitamin C and provide strength to the tissues. Intake of isothiocyanates through certain vegetables like broccoli, cauliflower, cabbage etc. can hinder growth of cancer cells as well as causing their death [12-14]. Carotenoids are prevalent in colored fruits and vegetables like berries, tomatoes, carrots, watermelon, etc. They exhibit antioxidant properties and protect against certain cancer like prostate. The most common dietary carotenoids are α - carotene, β - carotene and it will further be converted into retinol which enhances the level of vitamin A, lutein, lycopene, and zeaxanthin [15-16]. Quercetin are present in apples, onions, citrus fruits, berries, red grapes, broccoli , cocoa , and tea and are useful for protecting against heart diseases and cancer [12]. Phytochemicals provide protection against cancer and cardiovascular diseases as they tend to prevent the creation of new blood vessels which is a trademark of cancer and also control nitric oxide, soothing blood vessels resulting in good blood flow [12].

Presence of certain phytochemicals in majority of foods, herbs etc. act as nutraceutical and produce remarkable influence for prevention or control of various ailments [7]. The phytochemicals may arouse immunity, decrease the rate of growth of cancer cells and avert DNA impairment to prevent diseases [16]. Phytochemicals shows antioxidant properties by reacting with free radicals [17-18].

Broccoli, cabbage and cauliflower are known to diminish the danger of prostate, lung, breast and colon cancers [19]. Isothiocyanate and sulforaphane found in cruciferous vegetable and broccoli respectively helps in preventing cancer. Polyphenols present in tea provide defensive against diverse kinds of cancer [20].

Some medicinal plants like Bearberry, rose bay willow herb, aloe vera, tinospora cordifolia etc. have been used in pharmaceuticals because of their various disease resisting properties. T. Cordifolia has been used for fever, dyspepsia, jaundice, skin and urinary disease. Aloe Vera is used in skin related problems; possess anti-oxidant, anti-inflammatory and immune-modulatory properties. Rose bay willow herb is used as an intestinal astringent, anti-spasmodic in whooping cough and asthma and in balms to cure skin problems. Phytochemicals are also effective for treating bacterial and fungal infection. Intensity of chemical constituents decreases on processing of food in comparison to raw food. They protect plants from harmful agents such as insects and microbes. When oxidative stress increases means there is imbalance between free radicals and antioxidants.

Phytochemicals also acts as a supplement to boost immune system. It helps to arrest carcinogen forming substances, decrease the inflammation that stimulates cancer growth and helps to stabilize unstable molecules that can trigger cancer. Phytochemicals also help in hormone regulation. They significantly reduce the risk of cancers by stopping tumor cell propagation, modification of carcinogen and tumor metabolism, initiation of carcinogen detoxification and many more [21].

2. METABOLISM OF PHYTOCHEMICALS

Metabolism is a type of chemical reactions in which complex substances are breakdown into simpler one, or to degrade complex into simpler one (Figure 2). Plants (autotrophs) have two metabolism namely primary metabolism and secondary metabolism which leads to the production of phytochemicals [2].

1° is present in all living beings and is necessary for the functioning of various plants function like photosynthesis, respiratory processes etc. 2° metabolites also called natural products or by-products of plants which occur in superior plants. Superior plants are those that possess flowers and have seeds. The reproductive organs of these plants are visible and hence are known by the name spermatophytes. The reproductive mechanisms of these plants are different from the inferior one [2].

2° metabolites possess biological properties showing applications in Medications, pesticides, fungicide, cologne and colourant. They also provide defense in opposition to predators, pathogens or ecological stress while others help in reproductive mechanism of plants by attracting of insects for pollination.

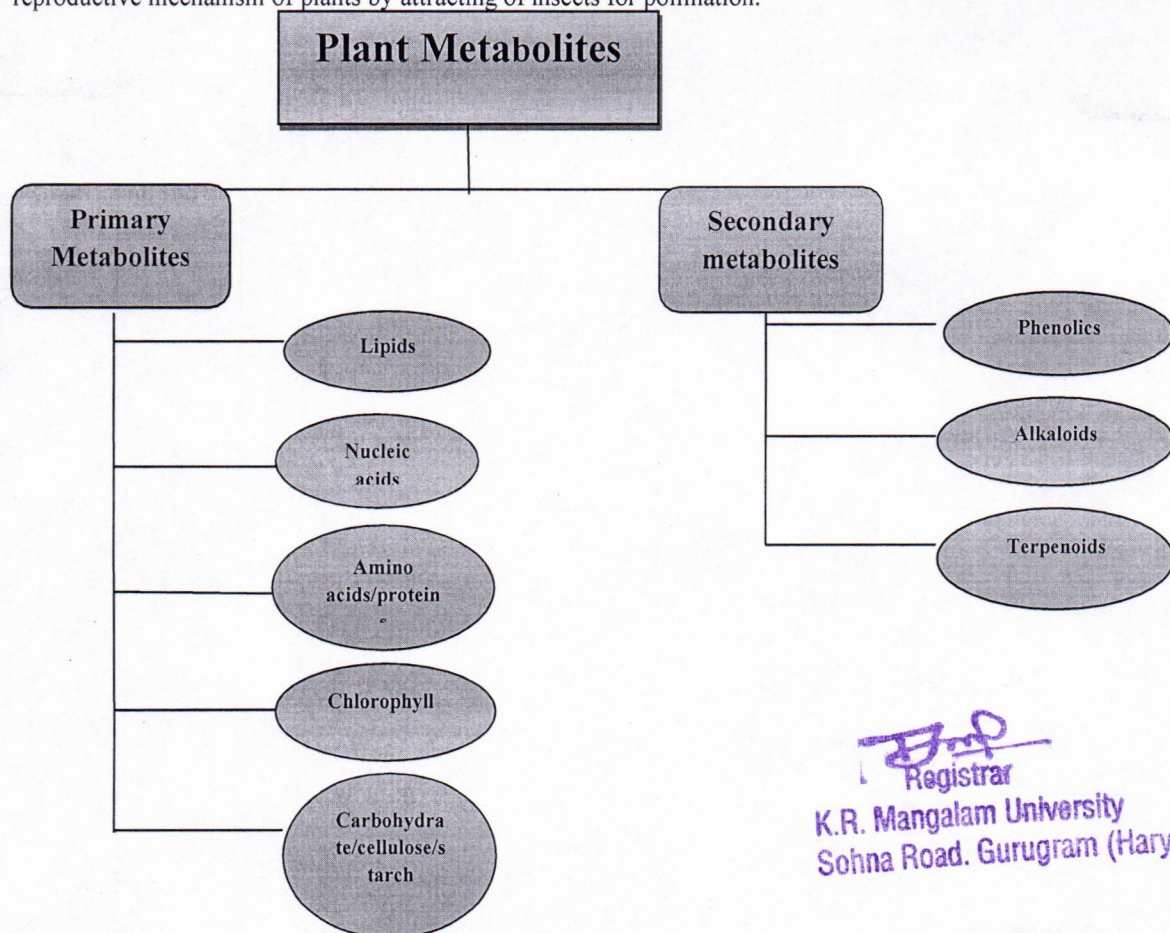


Fig. 2.1 Classification of plant metabolites

3. METHOD OF EXTRACTION, SEPARATION AND IDENTIFICATION OF ORGANIC COMPOUNDS

Extraction is a significant process to study the medicinal therapeutic plants/herbs. Extraction simply means separating out each phytochemicals from a mixture one by one and clarifying each one of them by physical or chemical methods. It is obligatory to separate the active constituent of the plant for identifying its chemical structure [22].

Basic operation included in the extraction process is:-

- Pre-washing
- Cutting/slicing of parts of plant or freeze desiccating
- Crushing to get a homogeneous material

The targeted compound (i.e. Phytochemical) to be extracted may be polar, non-polar and heat labile [23] and different extraction methods are used. Botanical excerpts are developed by maceration or percolation of living/dried parts of the plants in aqueous or organic solvents. Various methods are used for extraction purpose these are sonification, refluxing, extraction through Soxhlet/Solvent etc. are generally used. With the development of science modern techniques are used for the extraction as they possess certain advantages over the classical methods. While extracting out phytochemicals with classical method; the compound obtained upon extraction is in very minor/less amount and it becomes difficult to study the structural properties so in place of these modern techniques are used. Because in classical method various reactions are there such as chemical degradation, derivative synthesis which is difficult to carry out with minute amount of compound; while in modern techniques they work with a little amount of sample as much as possible for structure identification [24].

The advantages of modern methods over traditional one are as follows-

- There is reduction in amount of solvent consumed.
- Additional sample clean-up is not required.
- Congregation stages beforehand chromatographic investigation
- Enhancement in separation, development, regulation and refinement of process.
- Easy to operate [25].

3.1 Solvent-Extraction Methods

It is the most basic technique. The purpose of this method is to select an appropriate solvent to separate the specific (Targeted) phytochemicals. It can be classified as cold or hot extraction depending on whether we provide heat or not. Selection of solvent is based upon "like dissolves like" principle. Appropriate polarity solvent to be used i.e. polarity of solvent and the solute (i.e. the compound to be extracted) should be same. A solvent of same polarity as that of solute will dissolve the solute completely [26]. For the extraction of hydrophobic or lipophilic component of plants non polar solvents are used. Oils, fats, chlorophyll, lactones and alkaloids are extracted with these non-polar solvents.

This method is specially used for the extraction of phenolic compounds. Solvents of appropriate polarity as that of solute are used. Many solvents successively can be made use of to extract all phytochemicals present in them without wasting a little part of it [27].

Plant compounds like terpenoids and steroids possess low polarity i.e. hydrophobic in nature and dissolve in non-polar solvents like chloroform, ether etc. while other constituents such as carbohydrates; amino acids are highly polar, therefore polar solvents like water, aqueous ethanol etc. are used. The most popular solvents used are water, methanol, acid water and acetone.

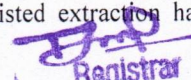
3.2 Microwave – Assisted Extraction (MAE)

Researchers have been working hard to find out a technique to extract out the phytochemicals in which there is no loss of bioactive compounds and less time is required; after researching a lot they come to microwave-assisted extraction, and it seems to be a good technique from every point of view i.e. reduction in loss of bioactive compounds, less time consumption, easy to operate etc. Maximum temperature for extracting out phenols effectually is 170 °C and increasing the temperature beyond this limit, results in the opposite i.e. in the reduction of the extracted yield.

This method uses microwave radiations to separate the active components of plants. This method combines both microwave and traditional solvent extraction. Microwaves have electromagnetic radiation occurring between 300MHz to 300GHz [27]. The concept used behind this method is that it heated up that part of object that can absorb EMR and convert them to heat. Instrument used in microwave assisted extraction has a frequency of 2450MHz which corresponds to energy of 600-700 Watts.





Some factors that can increase the efficiency of microwave radiations are-


- Extraction temperature
- Extraction time
- Solvent Constitution [28]
- There are many advantages of MAE over conventional method which are as follows:-
- Lower solvent Constitution




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Computational fluid dynamics based analysis for optimization of various thermal enhancement techniques used in evacuated tubes solar collectors: A review

Sorabh Aggarwal^a, Raj Kumar^a  , Sushil Kumar^b  , Mona Bhatnagar^b, Pawan Kumar^c

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Abstract

Nowadays a sharp increase in the energy demand has put a huge load on the conventional sources of energy resulting in their depletion. So uses of non-conventional sources of energy in different applications have been emphasized. Energy of sun is vast and green energy source and India is blessed with solar energy. Evacuated Tube Solar Collectors (ETSCs) are equipment utilized to trap solar energy. The energy trapped in the ETSCs can be used for domestic and industrial applications. Various techniques have been used to enhance the efficiency of ETSCs. This article provides an outline of various techniques which have been utilized to enhance the efficiency of ETSCs. In some of these efficiency enhancement techniques, collectors have been used as a basis for optimization process. Parameters which were optimised in the literature include tube length, tube radius, number of tubes, heat pipe geometry and shape of the evacuated tube. This review article discuss Computational Fluid Dynamics(CFD) based studies showing influence of nano-fluids as heat transferring fluid, effect of different phase changing materials on ETSCs efficiency. The work also summarizes the influence of reflectors and different techniques used for reducing heat losses on performance on ETSCs. The present study is worthy in applications involving optimum performance and low costs.

Introduction

With the increasing energy requirements, it is very important to use alternate energy sources and sun energy is among the most exploited renewable energy sources now a days. Water heating also requires a lot of energy on daily basis, so it is crucial that we utilize solar energy for this purpose. To accomplish water heating, different solar based water heaters have been designed over the years. Now the focus remains at improving the performance of solar based water heaters and a lot of research work has been done in this respect. There are different categories of solar collectors (SC) depending on their temperature of operation. Unglazed panels, Flat plate forms part of low temperature SC and evacuated tube collector, line focusing and point focusing collectors forms the category of High temperature SC. For reducing the cost and time for research and development, tools like CFD can be used to simulate solar water heating system by providing dummy conditions which can yield near to realistic results. By using CFD simulation models, the cost of installation and maintenance can be ignored

which is a major hindrance in experimentation. Simulation analysis not only saves our cost and time but also provides us in depth analysis which is not possible through experimentation for example using CFD simulation we can know the temperature distribution inside the apparatus [1]. Simulation also helps in calculating the optimum design of the system and then they can also analyse the complex energy systems. Also, we can study the apparatus under different weather conditions which is otherwise very time consuming. This review is focused on the various techniques used in ETSCs to improve their performance using CFD. Some article presents the optimization of various parameters like geometry and shape of the heat pipe of ETC collector to improve its efficiency. Others have used various nanofluids to enhance the heat transfer which again improves the performance by reducing the losses. Use of phase change material have been discussed which enhances the heat energy retaining capacity. Reflectors have been used to capture more radiations from the sun.

In CFD the systems having fluid stream, heat transfer and chemical reactions are analysed using computer-based simulation. The equation which govern these processes are solved using a CFD package such as ANSYS 16.0 (Fluent) version. The selection of turbulence model used in the CFD analysis is carried out in two steps; preliminary selection of suitable turbulence models from the literature and final selection of the most suitable model by comparison of predictions of distinct appropriate models with experimental outcomes.

The walls influence the turbulent flows and stream is influenced by viscous effects near wall region (NWR). At the wall condition of no slip is obeyed and this condition influences the average velocity field. Improvements in the turbulences occurs in the because of high gradients in average velocity in outer of NWR. The correct depiction of the stream in the NWR predicted wall-bounded turbulent flows. None of model or any single model provides accurate predictions in all type of problems. Various factors are considered in the choice of turbulence model. Some of such deciding factors are physics of the stream, type of problem, desirable accuracy, accessible sources and time for the simulation. The model which give results in best agreement with experimental data is taken as best turbulence model.

- Renormalization k- model,
- Standard k- ϵ model
- Realizable k- model
- Standard k- model
- Shear stress transport k- model

The selection and validation of turbulence model are carried out by comparing the Nusselt number calculated by distinct models; RNG k-Model, standard k-Model, realizable k-Model, and shear stress transport (SST) k- models. The outcomes are compared with the Dittus-Boelter empirical relations. The coefficient of determination (R^2) statistical method was used to determine how well the distribution of two data sets matched.

The energy coming from sun can be used in two ways; direct and indirect methods. The solar collector converts incoming solar radiation directly into useful energy. Different types of ETSC are

- Thermosyphon
- U-pipe
- Heat pipe ETSC

These are also known as water in glass ETC, because here the evacuated tube is filled with water. These evacuated tubes are open from one end and closed from the other. Open end is fixed with the storage tank. Water enters the evacuated tube from the storage tank due to gravity. Here water gets heated up due to solar radiations and the density of this hot water reduces which gives rise to thermosyphon effect hence the name thermosyphon is also used here. Hot water travels into the water tank and cold water enters into evacuated tube from the tank. In this way water heating is accomplished in Thermosyphon ETC

Evacuated tube solar collector with U-pipe uses a copper U-pipe which is normally 8–10 mm in diameter and aluminium fins are inserted between these copper pipes and inner surface of the evacuated tube. Fluid is passed from this U-pipe which gains the energy.

Heat pipe ETSC is also known as two phase ETSC. It consists of a copper tube which can be assumed to be divided into two parts one is evaporator section which is placed at the lower end and the other one is condenser section which is above the evaporator section. Working fluid which is in liquid form is present in the evaporator section which is heated and transformed into the gaseous state which moves up to the condenser section which is fixed to the bottom of water tank so that the heat energy is then moved to the water present in the tank and the vapours in the condenser section regain their liquid state and settles at the evaporator section to again repeat this process. Different types of ETSC are depicted in Fig. 1. This study aims to compare the studies of CFD analysis on the performance improvement in ETSCs by using heat pipe geometry, shape of evacuated tube, effect of nanofluids as heat transfer fluid, effect of phase change material. This work also summarizes the effect of using various reflectors to enhance the performance of ETSCs.

Section snippets

Performance enhancement methods and technical developments in ETSCs

The efficient heat transfer to working fluid is main goal of any solar thermal system (STS). The performance of STS is directly proportional to heat taken away by fluid. The techniques used to enhance heat transfer and developments made by different researchers in the area are discussed in this section....

Comparative study

Thermal properties of fluids plays important role in their applications for heating and cooling purposes. HTR in the STS depends on the Thermal conductivity of fluids. The noble properties of nanoparticles; very small sizes and large surface areas make them efficient candidate in HTE applications. The use of nanofluids is accompanied by few problems. The nanofluids result increase in viscosity lead to more pumping power. The summary of findings of various CFD based studies involving heat...

Conclusions

A comprehensive review on CFD based studies on heat transfer augmentation of ETSCs is presented in this work. The effect of utilization of reflectors, tilt angle, Evacuated tube and heat pipe geometry, PCMs and nano fluids on thermal performance of ETSCs is reviewed. From the literature study, significant conclusions are summarized below.


- Rectangular geometry of heat pipe is most effective, also the water inlet should be at bottom most position and the outlet at topmost position to get the...

...

CRedit authorship contribution statement

Sorabh Aggarwal: Conceptualization, Visualization, Writing - original draft. **Raj Kumar:** Supervision, Conceptualization, Methodology, Formal analysis, Writing - original draft, Writing - review & editing. **Sushil Kumar:** Conceptualization, Methodology, Writing - review & editing, Data curation. **Mona Bhatnagar:** Conceptualization. **Pawan Kumar:** Visualization....

Declaration of Competing Interest


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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper....

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2023, Materials Today: Proceedings

Citation Excerpt :

...Solar thermal collectors are used to convert solar energy into thermal energy. There are various thermal collectors such as flat plate collector [13], evacuated tube collector [14–17] and solar air heaters [18–27] used to capture the sunlight coming from the sun and to convert the solar energy into thermal energy. The solar energy reaching on the surface of earth in one year is more than the world energy needs....

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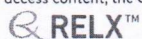

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REVIEW ON COMPARATIVE STUDY FOR REMOVAL OF ORGANIC POLLUTANTS USING DIFFERENT FORMS OF GRAPHENE OXIDE

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Abstract- Textile wastewater due to the presence of dyes effluents has become a severe environmental problem worldwide and has reached on alarming stage. Therefore, from past few decades, different practices have been used by researchers and scientist to eliminate these effluents. Among them, adsorption is one most effective method due to its low cost, ease availability and handling. Recently, graphene oxide and its composites are gaining a lot of attention for removing not only dye effluents but other contaminants also. The present review reveals the importance of graphene oxide and their composites to eliminate dyes affluents from waterbodies along with classification of dyes and different adsorption techniques.

Keywords: Dye effluents, Adsorption, Graphene oxides, Textile wastewater.

1. INTRODUCTION

In 21st century, the major problem faced by the world is water pollution which is due to the rapidly growing industrialization, urbanization results in creating huge stress on use of water. The major contributor of water pollution is wastewater effluents such as dyes, heavy metals, pesticides, drugs etc. Among air, soil, noise and water pollution, water pollution is major problem as water has capacity to dissolve most of the substance as compared to any other liquid present on the earth [1]. Moreover, the resources of water like oceans, rivers, lakes and ponds are flooding with plastics, chemicals, dyes and other toxic pollutants which also cause water pollution. The environment and human health are both impacted in the short and long term when untreated and poorly handled wastewater is discharged into waterways. As a result, to protect the health of residents of both rural and urban areas, environmental rules related to water pollution should be strictly enforced. According to World Water Council report, there will be around 3.9 billion peoples by 2030 who are living in water scare areas [2]. Due to water shortage, it is very necessary to treat wastewater which fit for household, manufacturing, and agricultural activities. Textile processing is a huge industry that produces a lot of wastewater all over the world. Therefore, the management of wastewater and purification of potable water are important for the rapid progress of human society while also reducing contamination and health risks.

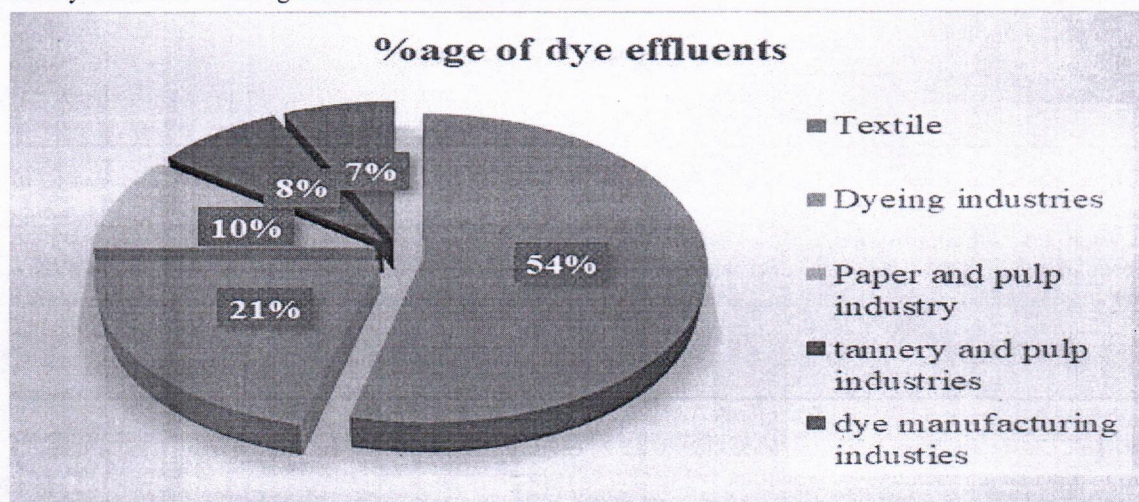


Fig. 1.1 Discharge of dye effluents from various industries

In India's major cities, approximate 38354 million litres per day (MLD) of sewage is produced, but their treatment is only 11786 MLD. Similarly, the treatment of industrial wastewater originated mainly from large-scale factories is only 60% [3]. In this situation, wastewater treatment has become foremost important. The industries like textile, paper and pulp, dye and dye intermediates, paint, pharmaceutical and tannery etc. discharge the organic contaminants into natural water supplies. Among all industries, textile industry produced more than half of all dye effluents (54%) as shown in Figure 1 [4], [5].

All over the world, approximate 10,000 types of textile dyes are generated based on color index and 7×10^5 tons of dyes are produced. The major countries have a major role in textile industries are China, United States, Pakistan, Brazil, Taiwan, Turkey, Bangladesh including India. Among all countries, India is largest textile producer where different types of raw materials like synthetic fibers, cellulose fibers are used [6]. According to a study, almost 1.6 million liters water is used by textile industries per day for the production of 8000 kg fabric where 16% of that water utilized to dye the clothes and 8% for printing as shown in Figure 2 [5].

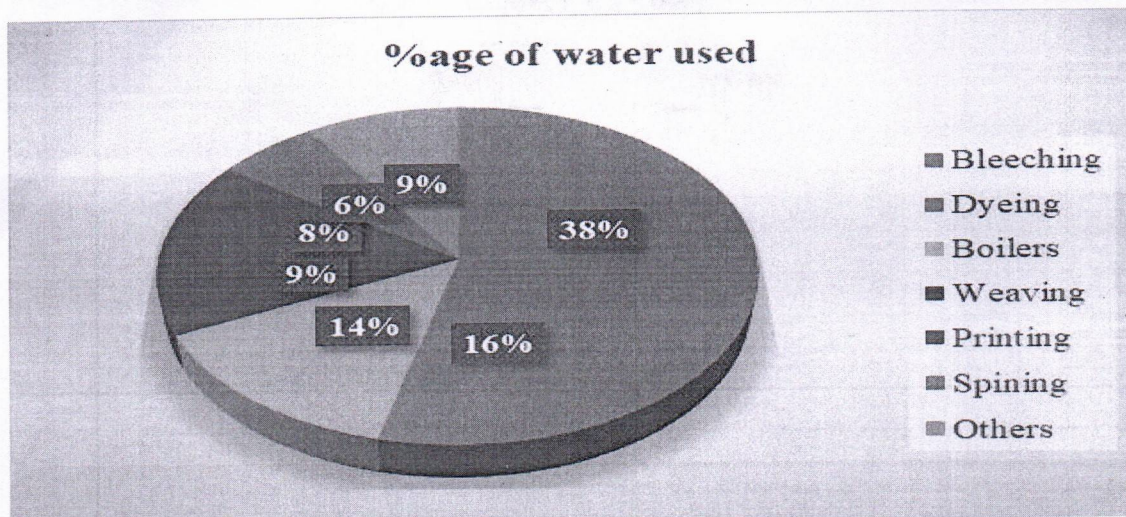


Fig. 1.2 Textile processing consuming water

The chemical processes in textile industries includes bleaching and dyeing which generates a large quantity of effluent containing a large volume of substantial contaminants such as higher chemical oxygen demand (COD), biological oxygen demand (BOD), dispersant, levelling agents, nitrogen, carriers, salts, heavy metals traces, dispersants, acids, alkali, and different types of synthetic dyes [7].

2. INDUSTRIAL DYE MATERIALS

A very common classification of the dyestuff used in textile industries is based on the source from which it is made. The most classification of dyes is done on the basis of their source from where they are originated: natural and synthetic. The synthetic dyes are further categorized into two categories: water insoluble and water-soluble dyes [8].

The most common dyes used in textile industries are acidic and basic dyes due to their bright colour, high solubility in water, low cost, and being simpler to apply to fabrics. As a result, discharge of contaminants spreads toxicity, degrades water quality and have a serious impact on photosynthesis process. Furthermore, due to low light penetration and inadequate oxygen intake, it has a major effect on the aquatic environment. The studies also revealed about genotoxicity and carcinogenic nature of dyes. They can cause various kinds of diseases like bladder cancer, dermatitis, kidney disorder after entering into skin through inhalation, ingestion or skin pores.

Therefore, effluents must be properly treated before being discharged results in enhancement of alternative of water reusability. By 2030, the United Nations has set a goal to enhance "water quality by removing pollutants, eliminating disposal, and reducing the discharge of toxic chemicals and products, percentage of contaminated water results in significantly improving recycling and reuse of water". The environmental technology market of India is also booming, with plenty of business prospects for pollution-reduction technology developments [1].

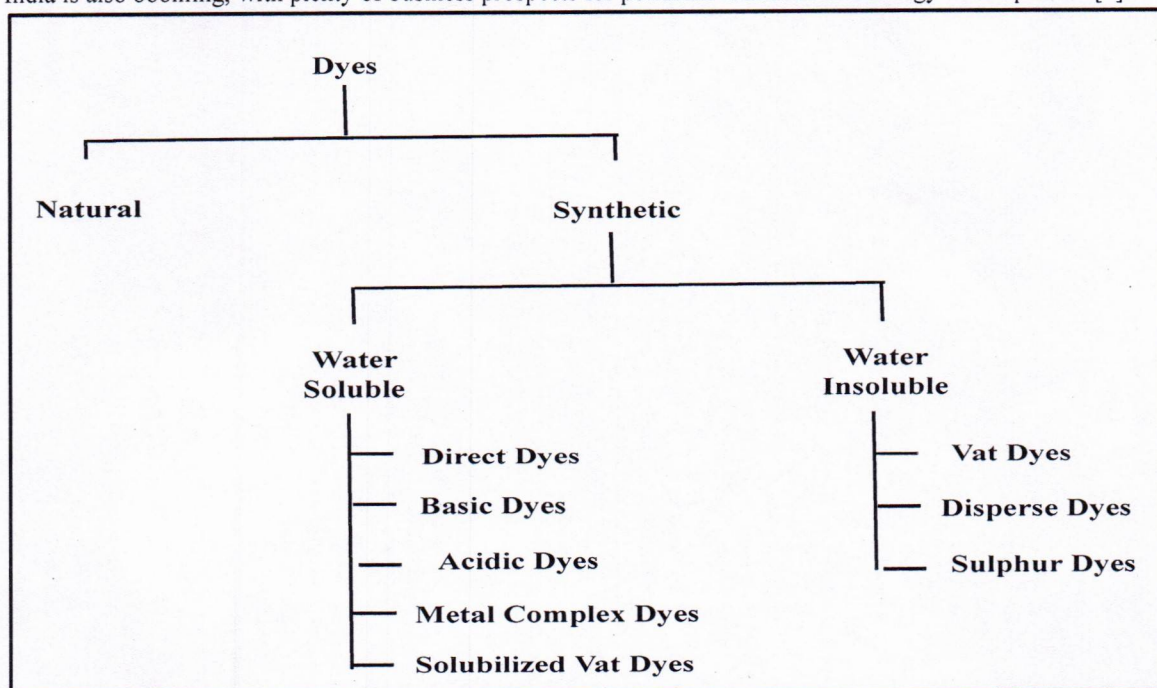


Fig. 2.1 Classification of dyes

3. TECHNIQUES USED FOR REMOVING DYES FROM WATER BODIES

From past few decades, different techniques such as ion exchange, membrane separation, coagulation/flocculation, photodegradation, charcoal filtration, reverse osmosis, ultra-filtration and some biological methods are used for removal of dyes on a large scale. There are some drawbacks of these methods like consumption of high energy, complex design and extended operation times due to which these methods can not be afforded by textile industries especially in developing countries like India [9].

Therefore, one of the most suitable and effective method for eliminating of the dyes from discarded water is adsorption as it is cost-effective with flexible design, more availability, and high energy efficient. Generally, adsorption is a surface process in which the pollutants adhered onto adsorbent's surface [10].

Adsorption is a unit procedure used to separate contaminants from industrial wastewater. Adsorbents used for elimination of dyes are zeolite, charcoal, naturally occurring clay minerals, fly ash, chitosan, fruit waste, rice husk, scrap tyres, petroleum waste, metal nanoparticles, graphene oxides etc [11].

Among all the adsorbents, graphene oxide is known as promising adsorbent to adsorb dyes effluents from water bodies. As graphene has high theoretical specific surface area, high negative charge density, it is largely used for removal of contaminants. The surface of graphene oxide is hydrophobic due to the delocalized π -electron system which provide stability to graphite over other adsorbents. They are also easily synthesized using exfoliation/chemical oxidation method on large scale from abundant natural graphite [12].

The purpose of the review is to study current state of graphene oxide and their composites to remove the dyes from water bodies. The review also focusses on adsorption efficiency of graphene-based composites and mechanisms for removing the dyes with their regeneration.

4. DYES REMOVAL USING DIFFERENT FORMS OF GRAPHENE OXIDE

Different types of dyes present in water bodies are harmful not only for aquatic life but for human being and environment also results in raising the global concern. Graphene oxides and its composites are known as one of the most effective adsorbents to remove the dye effluents like methylene blue, crystal violet, rhodamine-G, indigo carmine etc. with much higher adsorption capacities than other adsorbents.

Methyl orange and basic red 12 were removed by applying graphene oxide from wastewater. 6.83 mg/g of methyl orange and 63.69 mg/g for basic red 12 dye adsorb onto graphene oxide within 100 minutes of contact time at pH 3 of the media. The adsorption efficiency of graphene oxide was more for basic red 12 due to electrostatic interaction between them whereas repulsion was observed between methyl orange and graphene oxide due to having same negative charge. The endothermic nature of the adsorption process was revealed by the effect of temperature [13].

Sharma et al. (2013) employed graphene oxide efficiency to remove methyl green (MG) from aqueous media. 5.496 mmol/g uptake of dye was recorded at pH 5 which is further confirmed from Langmuir adsorption isotherm. Furthermore, enhancement in the adsorption of dye onto graphene oxide was observed with increase in temperature [14].

Magnetic graphene oxide functionalized with Xanthate groups ($\text{Fe}_3\text{O}_4\text{-xGO}$) were synthesized by Cui et al. (2015) where xanthate groups are linked to graphene magnetic material ($\text{Fe}_3\text{O}_4\text{-GS}$). The synthesized composite showed adsorption efficiency for Hg^{2+} 118.55 mg/g within 180 minutes of contact time at pH 7 and 526.32 mg/g for methylene blue within 120 minutes at pH 5.5 respectively. The adsorption process was endothermic and spontaneous as confirmed from the thermodynamic studies ($\Delta G < 0$, $\Delta H > 0$, $\Delta S > 0$) [15].

Polydopamine functionalized GO was synthesized by self – polymerization process to remove several dyes like methylene blue (MB), methyl orange (MO), methyl violet (MV), basic fuchsin (BF), Coomassie brilliant blue (CBB), rhodamine B (RHB), malachite green oxalate (MGO) and neutral red (NR) and toxic ions like Pb(II), Cu(II), Cd(II) and Hg(II). According to Langmuir adsorption isotherm, maximum removal efficiency of PDA functionalized graphene oxide (15% polydopamine –GO) was 2.181 mg/g for methylene blue dye which was ten times higher as compared to individual polydopamine or GO [16].

The hydrogel of graphene oxide and chitosan (GO-CS) were synthesized using graphene oxide suspension with Chitosan solution and used for elimination of both methylene blue, a cationic dye and Eosin Y, anionic dye from aqueous media. The efficiency to adsorb both cationic and anionic dyes (>300 mg/g) was higher for both hydrogels due to their porous structure. The adsorption efficiency varies with change in the composition of hydrogels. As the concentration of GO increased, methylene blue dye adsorption was more and on increasing the concentration of chitosan, Eosin Y adsorption was high which is due to the electrostatic interaction as GO shows negative charge on its surface and chitosan have positive charge respectively for different cationic and anionic dyes [17].

A simple sol gel method developed for synthesis of graphene oxide/ cellulose beads composites to remove cationic dye, Malachite green from water bodies. The results showed over 96% dye removal (Zhang et al, 2015). Dye adsorption increased on increasing amount of composite beads. These composites beads can be reused for five time more through simple filtration process [18].

Sheng et al. (2016) synthesized a novel adsorbent based on graphene oxide using chitosan, fly ash and graphene oxide where cross-linking of fly ash was with both GO and chitosan takes place. The synthesized adsorbent used for removal of both cationic (Acid Red R) (38.87 mg/g) and anionic dye (Red X-5GN) (64.50 mg/g) [19].

Rong et al, (2015) revealed the adsorption efficiencies of NiO/graphene nanosheets against Congo red, an acidic dye. The nanosheets which are fabricated through hydrothermal method showed 99.56% uptake of dye in 180 minutes using 1.0% adsorbent dose of dye concentration e at room temperature. Further, they explained the

HIDDEN POTENTIAL OF CANNA INDICA- ANAMAZING ORNAMENTAL HERB

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Abstract- *Canna indica* L. (family Cannaceae), an ornamental herb, possesses innumerable phytochemicals comprising of polyphenolic secondary metabolites flavonoids, isoprene polymers terpenoids, basic nitrogen containing organic molecules alkaloids, proteins, steroids, glycosides, oils, triterpene glycosides saponins, tannins, carbohydrates and pigment etc. in good proportions. Traditionally, it has been used as home remedy for different ailments. Studies conducted to explore the potential of this plant reveal that it demonstrates bactericidal, antiviral, anthelmintic, molluscicidal, anesthetic, immunomodulatory, cytotoxic, hemostatic, antihepatotoxic properties. It also reduces inflammation, controls diarrhea and serves as antioxidant. This article offers details of chemical constituents which are responsible for pharmacological, non-pharmacological properties of *Canna indica* which may serve as a base to explore its pharmacognostic & pharmacological characteristics that can further be exploited for medicinal and non-medicinal purposes.

1. INTRODUCTION

Since time immemorial human beings are using medicinal/aromatic plants for curing different types of ailments. The connection between human and plants is like the two sides of the same coin. Both of them are dependent on each other for their existence. Man and his eagerness to search natural sources for his requirements are not new. Humans possess enough knowledge from their past experiences to utilize herbal plants as medicines. The latest science advancements in new materials, methods and machines have resulted into multifarious enhancement in exploring, recognizing and identifying new medicinal plants which finally results in isolating many vital and essential molecules for humankind [1]. *Canna indica* L. is also identified as Indian shot or cane or reed as per Greek origin. Genus *Canna* belongs to family Cannaceae which is having nineteen species of other flowering plants. *Canna indica* L. is an ornamental plant of medium height which originated in tropical regions of America. In a short span of time it spread in other parts of world [2]. It is an excellent source of natural starch and various phytochemicals [3].

2. PLANT PROFILE

2.1 Botanical Classification

Canna indica belongs to kingdom-Plantae and subkingdom -Tracheobiont which falls in superdivision - Spermatophyta and division -Magnoliophyta. It has been put up in class -Liliopsida; subclass-Zingiberidae; order - Zingiberales which belongs to family-Cannaceae.

2.2 Vernacular Names

Several names have been apportioned in different languages. In English it is named as African arrowroot, *Canna lily* and Wild *canna*. French and Spanish people call it Balisier comestible and Chupaflor respectively. In different parts of India it is identified by different names such as Sarvajaya, SakaSiri, Devkali (Hindi); Kardal (Marathi); Vankelee, Devakuli (Sanskrit); Krishna Tamara (Telugu); Puvalaikalvalai (Tamil); Laphoorit (Manipuri); Sarbajaya, Kalaboti (Bengali) and Kalahu (Kannada).

2.3 Habitat and Geographical Distribution

The *Canna* can grow in hot and humid environment in South America, Northern Argentina & Philippines, In India in waste places & near water settlements, river sides [6,7]. The plant tolerate acidic, neutral & alkaline soils as well as sandy, loamy & clayey soils but they prefer well-drained and moist soil [8,9]. *Canna indica* develops fully in good sunshine to partial shade but in hot climates some shade at midday time is required. These plants are not very hard and can easily be uprooted. It can be easily promulgated by seeds or root cuttings [6].

2.4 Varieties of *Canna* species

Different varieties of *Canna* are *Canna amabiss*, *Canna bangi*, *Canna coccinea*, *Canna compacta*, *Canna discolour*, *Canna flaccid*, *Canna glauca*, *Canna indica*, *Canna iridiflora*, *Canna jaegeriana*, *Canna tuerckheimii*, *Canna liliiflora*, *Canna paniculata*, *Canna patens*, *Canna pedunculata*, *Canna plurituberosa*, *Canna stenantha*, *Canna speciosa* & *Canna jacobiniiflora*.

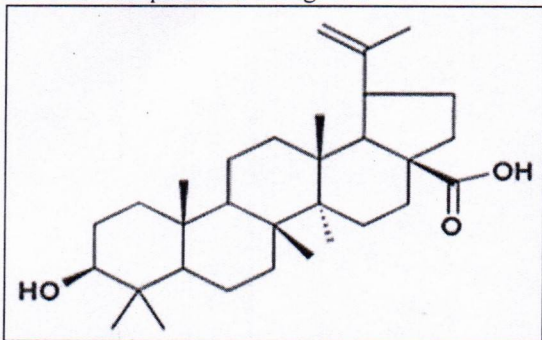
3. Traditional use

Canna indica has been utilized for the cure of malaria, stomach problem, dysentery, cuts, urine disorder, fever and dropsy [10,11]. The root extract has been reported for the management of fever, dropsy, and dyspepsia. Oily residue of seeds has been recommended to relieve earaches. The flowers were used as medication for eye related diseases

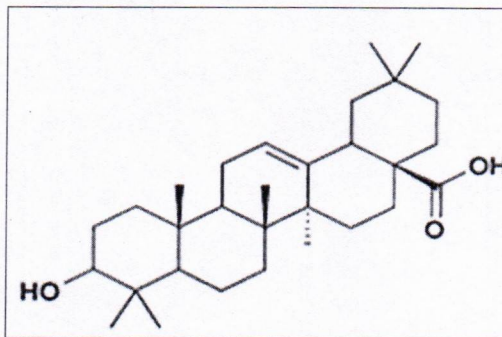
[12,13]. The root contains palatable natural starch and can be used for meal [14]. The powder of dried roots was used to enhance the thickness of sauces and improve the texture of foods [15].

4. PHYTOCONSTITUENTS OF CANNA INDICA

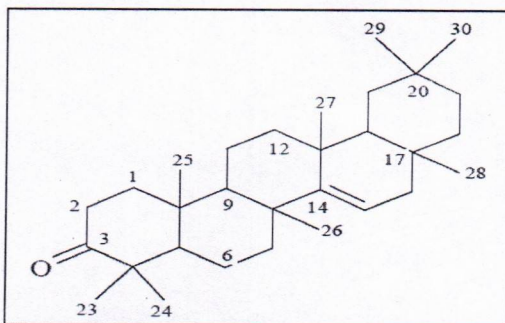
Major chemicals which are present in the plant are represented in Table 1, given below. Structure of some of the chemicals are presented in Fig. 4.1.



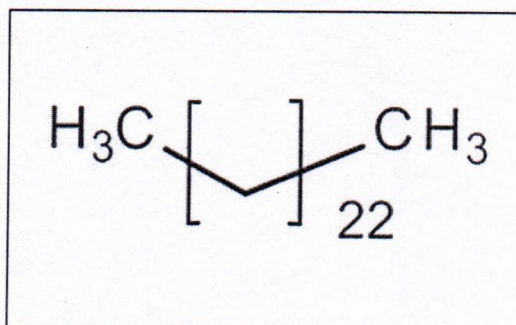
Betulinic acid, (M.P. 295-297°C)



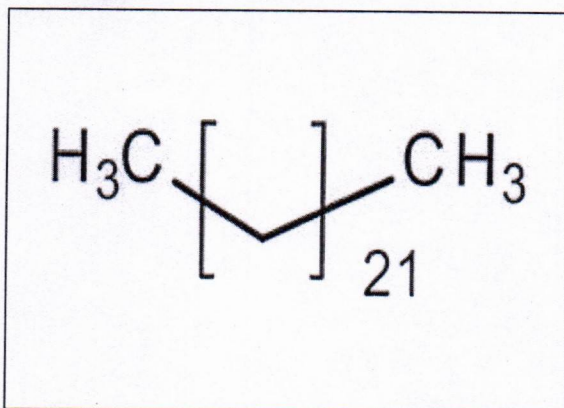
Oleanolic acid, (M.P. 305-306°C)



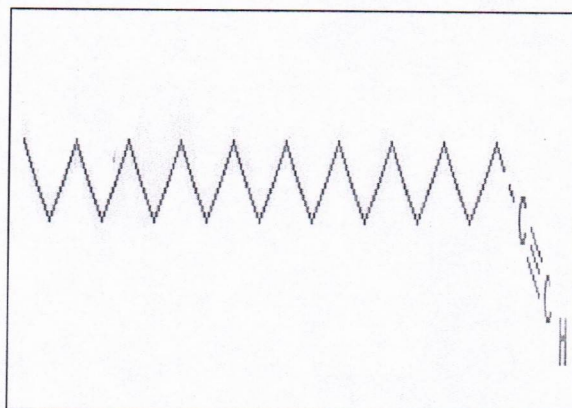
Taraxer-14-en-3-one, (M.P. 150-151°C)



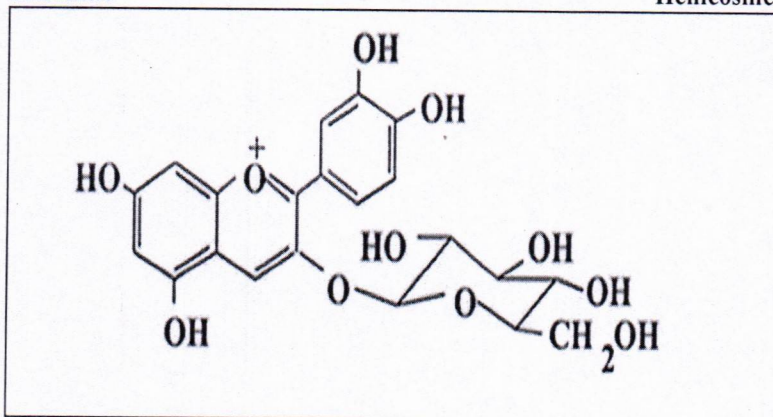
Tetracosane



Tricosane



Henicosine



Cyanidin-3-O-β-glucopyranoside

Fig. 4.1 Structure of major chemical constituents [24]
Table-4.1 Nutritional and Anti-Nutritional Composition [25]

S. No.	Parameter	Percentage
1	Moisture	89.01 %
2	Crude Protein	6.34 %
3	Crude Lipid	4.31 %
4	Crude Fiber	5.78 %
5	Ash	3.14 %
6	Nitrogen Free Extractive	80.73%
7	Calorific Value	1644.54 KJ/ 100 gm

5. PHARMACOLOGICAL UTILIZATION

5.1 AIDS/HIV1-RT inhibition

Canna indica has been identified as curative herb which have been utilized for treatment of AIDS and has been checked for inhibition of reverse transcriptase enzyme encoded with human immunodeficiency virus type 1 (HIV-1 RT). *Canna indica* rhizomes were extracted in water and 80% ethanol and have shown HIV-1 RT inhibition quotient more than 90%. Two proteins isolated from the plant show significant results on HIV-1 RT inhibition [26]. Aputative plastocyanin protein of molecular weight 10 kDa sequestered from the leaves of *Canna indica*, exhibit anti-HIV-1 RT inhibitory activity[27].

5.2 Antibacterial

Canna indica leaves and flowers were extracted in methanol solvent and extract obtained enumerated bactericidal activity against *Bacillus subtilis*. Flowers and stems/bark extract in ethyl acetate showed positive response against *Bacillus subtilis*, whereas, extracts of *Canna indica* leaves, flowers, and stems in hexane and water solvents did not demonstrate any bactericidal effect [28].

The yellowish-brown oil obtained by root of *Canna indica* show substantial bactericidal action towards *Staphylococcus aureus* and slight action is observed for *Bacillus subtilis* [6].

5.3 Cytotoxicity

Stigmasterol and 6-beta-hydroxy stigmasta-4, 22-diene-3-one obtained from hexane extract of rhizomes of *Canna indica* L showed cytotoxicity against P388 leukemia cells [29]. The extracts of the leaves of *Canna indica* in dichloromethane and ethanol also displayed anticancer properties[30].

5.4 Antidiarrheal

Antidiarrheal activity of *Canna indica* was studied by Josphine et. al.,2013. Leaves of this plant were extracted by using methanol by soxhlet extraction method and they have been found to exhibit antidiarrheal property as compared to atropine and loperamide. Even in small amount (10 mg/ml) it was effective in decreasing the fluid production, gastrointestinal motility and acetylcholine prompted shriveling [31].

5.5 Anti-inflammatory

Ethanol extract of *Canna indica* was observed to impede the creation of inflammatory mediators including nitric oxide, prostaglandin E2, and interleukin-1 β in lipopolysaccharide -induced RAW 264.7 macrophages. [32].

5.6 Antinociceptive and anthelmintic

The aerial parts of *Canna indica* were dried, coarsely powdered and extracted with different organic solvents of having polarity i.e. benzene and methanol and were intraperitoneally evaluated for peripheral analgesic action in hot plate method and acetic acid-induced writhing test, respectively, at the dose of 50 mg/kg-1. It was experimentally observed that methanol extract displayed the maximum upsurge in response time in hot plate method. On the other hand benzene extract presented the greater inhibition on writhing induced by acetic acid. Anthelmintic behavior of solvent excerpts was assessed on Earthworm. Outcomes revealed that rhizomes extract prepared in methanol took lesser time to bring about immobility of worms [33].

5.7 Antioxidant

Aerial parts of the plant was extracted in methanol and antioxidant behavior was studied by using 1, 1-diphenyl-2-picryl hydrazyl [DPPH] radical scavenging assay, NO scavenging assay, hydrogen peroxide assay, and hydroxyl radical scavenging method under variable concentrations ranging from 10–100 μ g/ml. It was observed that at a concentration of about 100 μ g/ml, DPPH showed inhibition of 76.70 %, hydroxyl radical scavenging assay of 74.36 %, hydrogen peroxide assay of 61.37 %, and NO assay presented inhibition of 62.84%, [34]. It has also been reported *Canna indica* seed's methanolic extract exhibit antioxidant property[35].

The four anthocyanins extracted from red flowers of *Canna indica* have been separated and named as Cyanidin-3-O-(6''-O- α - rhamnopyranosyl)- β -glucopyranoside; Cyanidin -3-O-(6''O- α -rhamnopyranosyl)- β -galactopyranoside; Cyanidin-3O- β -glucopyranoside;Cyanidin-O- β -galactopyranosidewhich showed good antioxidant activity[22,24].

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A COMPREHENSIVE REVIEW ON WATER TREATMENT TECHNIQUES

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Abstract-With the growing population across the world, there is a call for the availability of freshwater to meet our necessities. There is an increase in water scarcity from 14% of the global population in the 1900s to 58% in the 2000s. Though we have nearly 70 percent of the earth's surface covered with water, still only 0.5 percent of total water is available for human consumption because almost 97% of water is sea water which requires desalination and water purification to make it apt for drinking purposes. Over many years our researchers have been working on various techniques such as Multistage distillation, Reverse Osmosis (RO), Membrane Distillation (MD), Electrodialysis (ED), Nanofiltration (NF), Ultrafiltration (UF), Forward Osmosis (FO), Solar desalination, etc. This paper reviews the various processes (advantages & disadvantages) and their commercialization.

1. INTRODUCTION

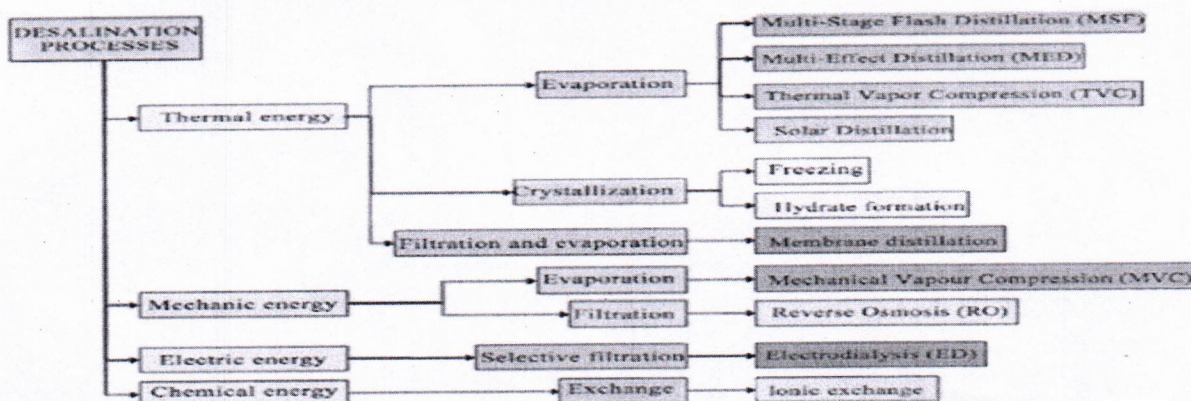
It is a challenge for human life, plant kingdom, and animal life to meet the demand for freshwater which is only 2.5% available on the earth's surface because the rest of available water is in the form of ice caps, groundwater & glaciers only which leads to a very very small percentage of surface freshwater [1] Almost 1/3rd of world's population is bearing the stress of water scarcity and with the increasing industrialization and growing population, it is expected an increase in this percentage [2]. Mainly we call it a water shortage, if the water capital (water level per year per person) falls below 1000m³ [3]. As 97% of water available is from the sea only so the best technique is to desalinate the seawater with various techniques. This is also called Desalination (a process of removing dissolved salts and minerals from the saline water). It depends on TDS (Total dissolved solids) whether the saline water is brackish or it is a seawater. For brackish water (TDS ~10,000ppm) and for seawater (TDS ~45,000ppm) [4]. But the allowed limit of salinity in potable water is of range 500 to 1000ppm [5]. With the depleting fossil fuels it is an alarming situation to find out other sources which are available i.e. renewable sources on earth and make them useful for the desalination process. This review paper also helps researchers to compare various techniques and choose the best one for the desalinating process.

Mid 1600s	•First desalination process on ship	1949	•First Reverse Osmosis membrane
1869	•First desalination on land.	Mid - 1950s	•Produced fresh water by RO membrane.
1928	•First desalination process to supply fresh water for people.	1959	•Introduced Forward Osmosis process
1960	•First MSF plant •Introduction of CDI (Capacitive deionization)	1981	•Interfacial polymerization method for RO membranes.
1963	•Introduction of MD (Membrane Distillation) process	2009	•First PRO pilot-plant.
1965	•First RO plant	2018	•SWRO/MD/PRO hybrid pilot plant.

2. VARIOUS ADVANCED WATER PURIFICATION TECHNIQUES

The two distillation technologies mainly used for world desalination are based on thermal energy and membrane technology. Most of the Middle East countries make use of processes such as MSF, MED, etc. which are based on thermal energy and while the developed countries such as the USA are commercially using membrane-based processes such as RO (Reverse Osmosis), MD (Membrane Distillation), ED (Electrodialysis), etc. [6]

DIFFERENT TYPES OF PURIFICATION PROCESSES



3. MULTISTAGE FLASH DISTILLATION

It is a process that sends the saline feed water through various chambers where the water is heated and compressed to high pressure and temperature. While passing through these chambers, there is a reduction in pressure due to which water starts boiling rapidly and thus the vapour formed which is freshwater is then condensed and collected [6]. It's around the beginning of the 21st century when the MSF (Multistage Flash Desalination) technique was able to hold more than 50% of the market of desalination industry. Though it has many advantages such as good production, ease to operate and construct but still, there was a need to reduce its production cost. For this, the modified (MSF-M) has been proposed which involves the addition of a mixing tank for feed stream and the removal heat rejection section. The analysis of this modified (MSF-M) process shows a remarkable increase in the thermal performance ratio by a factor of 2-3 over conventional MSF [7].

4. THERMAL VAPOUR COMPRESSION

This method refers to the evaporation of sea or saline water which is obtained by delivering heat of compressed vapour. Besides fresh water, desalination also produces brine (high greenhouse gasses). To solve both issues, a study proposed a solar multi-effect distillation/thermal vapour compression (SEMD-TVC) hybrid system. The basic aim is to desalinate brine, to recover freshwater of high purity. The evaluation of this hybrid process has been done by the techno-economic model which discuss this process in two cases: There is an increase in freshwater production capacity (from 10 cubic metres per day to 50 cubic metres per day). Plant lifetime increases from 20 to 35 years [8]. Performance Evaluation of small size TVC desalination plant has also been done which consist of two TVC units each of 375 cubic metre/d capacity. Few problems have been observed which were affecting the problems of plant such as the steam boiler and fouling in the condenser, also the imbalance steam flow leading to imbalance temperature of the boiler. But even after all these limitations, the plant proves to work satisfactorily through 15 months. Overall performance was found to be 70 to 80%. To eradicate operational performance in winters we need a heat exchanger which may be cost-effective also (9). A study of steam parameters on the performance of a TVC-MED (Mutieffect desalination with thermal vapour compressor) plant was developed and model validity was examined. Also for different steam pressures and temperatures the performance was evaluated. For increasing gain output ratio the enhancement of motor pressure is required. Also, energy consumption can be reduced by increasing the suction steam temperature (10).

5. SOLAR DESALINATION

Solar Desalination, as the name suggests utilizes solar energy to desalinate or to remove the impurities found within water. Literature reviews also analyse the need for research into other renewable resources for water desalination. Though Reverse osmosis accounts for 52% of global desalination. But 22% of the desalination processes are thermally driven. Economic studies of thermal and membrane desalination showed that in comparison to reverse osmosis, thermal desalination had a lower average cost [11]. An experimental study of the performance of pyramid-shaped solar still was also carried out which shows a comparison between the free convection solar still with the pyramid-shaped solar and observed that the daily yield was increased up to 25% [12]. The study also showed a solar desalination system that combined solar thermal collectors, heat storage tanks and a spray assisted with low temperature and the system is evaluated for energy efficiency and productivity under conditions of Makkah, Saudi Arabia. Results concluded that the water cost of the proposed desalination system is less than the solar energy driven thermal desalination system. It can provide an

interrupted water supply of 20 kg/day per sq. metre [13]. Over the past 40 years, desalination technology has been extensively developing. The study of hybrid systems such as solar/MSF, solar/RO, solar/MED has been analyzed theoretically. It was concluded theoretically only (no experimental proof as such) that these hybrid systems can be competitive with other existing techniques for small scale desalination up to 10 cubic meters per day to provide drinking water in remote areas which have less accessibility to freshwater [14]. A paper also reports the cost-analysis for various active and passive solar stills. For this basically, two parameters were chosen: present capital cost & annual yield. The conclusion drawn was as follows: Passive solar stills are proved to be better in comparison to active solar stills in terms of present capital cost and the one (passive single effect tubular type) which is made up with local materials shows the minimum cost per litre of 0.0074\$/l whereas the other solar still has CPL of 0.1776\$/l. The passive solar stills are more recommendable due to economic factors [15]. Solar desalination is not an emerging or useful technology in Middle East countries but even in India (tropical country), it is seen to be an appropriate technology as India also receives plenty of sunshine. It receives about 5000 trillion KWh of solar energy in a year. Based on this report it comes to the following conclusions such as:

- Solar energy is pollution-free as well as cost-free
- The areas w/c are away from freshwater sources, the solar stills proved to be a good choice.
- Also concluded that single sloped solar still is better than double solar because the former receive more radiation.
- A 20% higher yield can be observed in the case of double condensing with multiple solar still.
- A combination of greenhouses with solar stills is also feasible

For maximum annual yield, the angle of inclination should be 20 degrees in the flat-plate collector and 15 degrees in still glass cover inclination [16]. The economic & environmental feasibility of solar desalination has also been reported by some researchers. For this a rank scores ($0 < R < 1$) have been calculated for various countries where the solar desalination technique is most applicable. Observations inferred that: For the landlocked countries it comes out with low scores ($R < 0.125$). Also, the score is low for the countries which are near-polar region (eq. Russia, Canada etc.). For the Middle East countries where the solar desalination technique is appropriate the $R > 0.422$, is observed in about 30 nations. For 28 further countries such as China, India, Indonesia, Australia etc. it lies in b/w 0.273 & 0.422 [17].

6. HYBRID ION EXCHANGE METHOD

Though the ion exchange method is not used directly for desalination when it is hybridized with other methods, the results are remarkable. A study conducted a review on the coupling of ion exchange resin with reverse osmosis and ultrafiltration membrane, it was concluded that the efficiency has been improved and operational cost reduces along with the removal of trace pollutants in water. Authors also regarded this hybrid system as a standard boron removal technique [18]. Alharati achieved boron removal to a high level of 0.3 mg /L by combining ion-exchange pre-treatment with nanofiltration while treating natural groundwater [19]. An interesting result claimed by researchers states that the hybrid ion exchange and microfiltration system showed a reduction in surface watercolour to 0.05mg/L on a platinum/cobalt state [20]. A report also exists which consists of two parts. In the first part, there is a one stage electro-dialysis process operating at a constant current mode. While in the second part, the saline water is desalinated by using a multistage electrodialysis program through which the salt concentration of a feeding solution is changing at every stage. The evaluation in terms of energy consumption, water recovery, membrane area is evaluated [21]. To show the improved desalting efficiency of MCDI (Membrane Capacitive deionization) an addition of ion-exchange membranes have been done in front of carbon nanotubes electrodes so that the selectively charged ions pass through the membrane and are absorbed by oppositely charges electrodes which help in improved salt removed efficiency. Results indicate that the CDI without membrane has average salt removal efficiency of about 60% whereas the one with membrane has good efficiency of 97% with initial conductivity of 110 ms/cm and electrical voltage of 1.2V [22]. The first plant in the world using combined technology of Ion-exchange and reverse osmosis was set up in May 2006, Israel. This combination helps in the reduction of overall operating cost as well as capital cost for removal of boron from desalinated seawater. This plant was fed with brackish water and the produced fresh water was consumed for human consumption and irrigation purpose [23].

7. ELECTRODIALYSIS

It is a membrane separation technique in which the ions pass through an ion-exchange membrane driven by an externally applied electric field. A.H. Galama et al. studied the desalination of seawater with the help of electrodialysis and also analyses the importance of quantification of energy losses. They presented a hybrid system of ED (Electrodialysis) & SWRO (Seawater Reverse Osmosis) as an alternative method for desalination. Experiments have been performed with a recycling electrodialysis. From this, they concluded that the major loss of energy is caused by the stacking of membranes. It was observed that with the low current density, this hybrid system of ED with SWRO does not lower energy consumption. Also at low applied current density, the cost of operation of ED is less than SWRO [24]. The bipolar membrane (BPM) electrodialysis process has also been investigated for its efficiency using TDS and conductivity changes in the acid and base compartments [25]. Reports also discussed the laboratory set-up of ED. The study was done on the analysis of Taguchi data which analysis the effect of various concentrations such as 10000, 20000, 40000 ppm also for different temperatures such as 25°C, 40°C and 55°C and with different flow rates such as 0.07, 0.13, 0.22 m/s for different voltages 5, 7, 9 V for the evaluation of this ED setup was done. Results conclude that High Voltage and Temp. with less

IMMUNITY BOOSTERS AT ALIMENTARY AND PHYSICAL LEVELS IN RELEVANCE TO COVID-19

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Abstract-Nature has its own power to cure each and every living being, we the humans are continuously not acknowledging these natural medicines and therapies which are already mentioned in our culture or olden times. The most fundamental definition of immunity is the ability of the organism to resist the attack of microorganisms and harmful substances. Many herbs, fruits, vegetables, dry fruits, spices, Vitamins, Minerals etc. may act as immunity booster for humans. The intensity of "Yoga", to cure and avoid diseases or as immunity boosting capacity is a well known fact. Considering the facts of COVID 19, this review is an amalgamation of alimentary and physical components which helps to boost the immunity in humans.

Keywords: immunity, booster, herbs, fruits, spices, Yoga.

1. INTRODUCTION

Immune system is always associated with white blood corpuscles present in the blood. Such cells are efficient to deal with strange organism and have the ability to destroy the same. By this feedback blood plasma generates antibodies in blood, which attack on particular organism in future. This process is known as natural immunity. This allows the human body to remember the antibodies produced and also prepares the body for a new infection [1].

Year 2019 to 2021 will always remembered by the generations due to pandemic of COVID-19. COVID-19 or Corona virus is a group of viruses which belong to the family of Coronaviridae. These groups cause a lot of illnesses such as common cold and can also evolve into deadlier forms such as SARS (Severe Acute Respiratory Syndrome) and MERS (Middle East respiratory syndrome) viruses. It is also important to know the composition of these viruses; they consist of enveloped particles called Virions. The outer ring of these virions is made up of such capsules; each capsule also called the 'nucleocapsid' contains the viral nucleic acids. A collection of these viruses forms a group also known as the genome which consists of a single strand of positive infectious RNA (ribonucleic acid) [2].

Basically, the corona virus is a respiratory virus, which means that it spreads through respiratory droplets i.e., cough or sneeze droplets. The corona virus is a shell which consists of genetic material and proteins. In order to replicate, it requires a living host. Now according to the Centre for Disease control and Prevention, this virus also spreads majorly through person-to-person contact. For example, imagine you are seated in a bus or in a meeting next to someone who is infected with SARS-CoV-2 (SARS COVID-19 virus). Perhaps when you meet that someone, they may have touched their nose or mouth and you shake their hand which is infected. This causes the transmission of some particles of the virus onto your hand. Remember that the virus can also be present on their skin or cloths and can also be transmitted upon touch. If you touch your own nose or mouth, then this will be the virus an entry into your own body, thus, you will become an infected person. It is important to know that even if you do not show any symptoms must maintain distance from non-infected people [3]. It is reported that the elder people are more targeted by this virus because of less immunity [4].

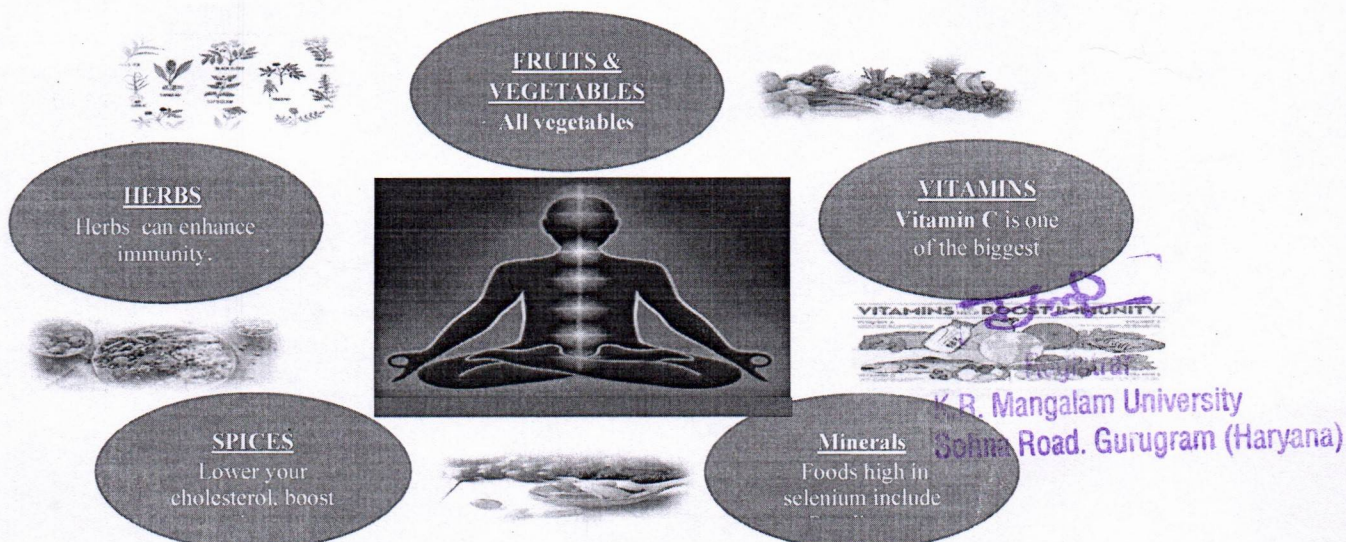


Fig. 1.1 Nutritional and physical factors as immunity booster in humans

According to the research aging is also a factor related to immunity proper nutrition is always required at each step of life. Nutrient plays a vital role to develop immunity as it affects the metabolism. One nutrient can alter the metabolism of other nutrient [5]. It is well-known that deprived people with malnutrition status have higher risk of infection [6-8].

Apart from biological processes, variety of nutritional components may be used as immunity boosters in humans, which inhibits the infections through viruses. It is recommended to follow a healthy and nutritious diet to boost one's immunity. As per researches it was reported that variety of fruits, vegetables, dry fruits, herbs, spices, Vitamins and some elements etc. help to boost immunity of human being [9-10]. Figure 1 reflects the role of immunity boosters to provide a healthy body. Immune boosting system gives a frame to destruct viruses. According to studies people should work on their immunity. The immune system relates to inflammatory functions, modulating cell-mediated immunity, altering and promoting the antigen-presenting cellular functions between the innate and adaptive immune responses. Moderate exercise, good sleep, stress less life, having nutrient rich food and keep hydrating the body, are always develop immunity in a natural way [11].

This review is a study of different immunity boosters (Figure 1) which can heal the body or prevent the body from any disease.

2. FRUITS AND VEGETABLES AS IMMUNITY BOOSTER

Fruits and vegetable are those raw immunity boosters which we can arrange from anywhere. These are very effective nutrition [12]. It was reported that to eat fresh vegetables and salads at every meal, as well as fresh fruits to increase the efficiency of the immune system, especially for the patient of the digestive system and to clean the body [13]. Cabbage, broccoli, cauliflower, beetroot, carrots, pepper, radish, watercress, parsley, celery, red onion, garlic, pumpkin, eggplant, tomatoes, green beans, potatoes, spinach, artichoke, turnip [14-15]. Among fruits Pomegranate, grapefruit, orange, strawberry, avocado, bananas, grapes, apples, pears, melons, berries, cantaloupe, cherries, kiwi, persimmons, pineapples, apricots, lemons, peaches, dates [16-18]. If we consider juices then Beet juice, celery juice, fresh cabbage juice, asparagus juice, black grape juice, carrot juice, fresh apple juice, fresh lemon juice, orange juice, pineapple juice, pomegranate juice, cranberry juice, raspberry juice, apricot juice, peach juice, pear juice, strawberry juice, cucumber with lemon juice and grapefruit with lemon juice [19-20]. Juices extracted from the organic wheat plant and small organic barley leaf extract, organic oats grasses extract, spirulina, chlorella, organic green dandelion, green broccoli, organic spinach, organic kale, organic parsley, organic cauliflower, seakelp, sea pulse, marine Green Algae, and Marine Vegetables [21-22]. Perhaps the most important elements that maintain our immune system is a healthy balanced diet, which contains all the nutrients of proteins, carbohydrates, fats, vitamins and minerals in a balanced proportions with the adoption of healthy eating habits, such as the increasing of eating vegetables and fresh fruits of all kinds because they contain many useful nutrients [23-24]. As per the researches flavanoids are present in fruits and vegetables which enhance immune system specially in older people, who are more prone to any infection [25].

Fruit and vegetables contain nutrients as antioxidants, Vitamins, anti-inflammatory and many other components which help to maintain immune system [26-27]. In a randomized controlled trail test specific supplements used, which recorded that such supplements increased natural killer cell (NKC) cytotoxicity and lymphocyte proliferation [28-30].

Maturing has been aligned with physiologic, social, and monetary changes that can prompt an undermined healthful status [31-32], and more seasoned populaces have low foods grown from the ground admissions [33-34]. Maturing is additionally connected with liberation of the invulnerable framework [35], and more seasoned individuals are at high danger of disease [36], which will likewise adversely affect dietary status. An expansion in foods grown from the ground admission may possibly profit more established populaces in view of their at first low admission of FVs and their adjusted insusceptible status. A thorough appraisal of the impacts of diet on insusceptible framework status and capacity is methodologically unpredictable, and both the counter acting agent reaction to immunization, which addresses a practical trial of the safe framework, by implication testing inborn and versatile invulnerability, and NKC cytotoxicity have been suggested [37].

As instances of COVID ceaselessly expanding, taking day by day security like washing your hands, social removing, practicing and getting sufficient rest is critical to bringing down hazard of contamination. However, keeping a sound and adjusted eating routine to help support your invulnerable framework may likewise give you support. Note that no exploration has been done on food varieties that help battle against COVID-19 explicitly. Nonetheless, past investigations have discovered that eating certain food varieties can improve your wellbeing and reinforce your body's capacity to battle other intrusive infections. Following are some significant vegetables and organic products [38-39], which goes about as invulnerability supporters:

2.1 Red bell peppers

Red ringer peppers rule with regards to leafy foods high in nutrient C. According to U.S. Branch of Agriculture, one cup of slashed red ringer peppers contains of nutrient C. which is around twice than the orange.

A recent report distributed in the National Institutes of Health found that nutrient C adds to safe guard by supporting an assortment of cell works and can bring down the danger of respiratory contaminations. It can likewise help the development and fix of tissues in your body. "Every day admission of nutrient C is fundamental for acceptable wellbeing on the grounds that our bodies don't create it normally," Dr. Seema Sarin, an inside medication doctor at EHE Health, revealed to CNBC Make It.

2.2 Broccoli

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Broccoli is likewise plentiful in nutrient C. Simply a large portion of a cup contains 43% of your day by day worth of nutrient C, as indicated by the National Institute of Health. Broccoli is loaded with phytochemicals and cell reinforcements [40] that help our insusceptible framework. It likewise contains nutrient E, a cell reinforcement that can assist battle with offing microbes and infections.

2.3 Strawberries

Strawberries contain nutrient C. Nutrient C is incredible for reinforcing your insusceptible framework since it can help shield cells from harm brought about by free revolutionaries that we're frequently presented to in the climate.

2.4 Mushrooms

While sun openness is the best wellspring of nutrient D, it can likewise be given by certain food varieties, including mushrooms. A 2018 audit of mushrooms as a nutrient D source [41] tracked down that the "daylight nutrient" can help upgrade the assimilation of calcium, which is useful for bone wellbeing, and may likewise secure against certain tumors and respiratory illnesses. Mushrooms are extraordinary as a side dish or hors d'oeuvre.

New vegetables and organic products are unique to some other wellspring of insusceptibility promoters, however dry natural products likewise have their own significance. Dry natural products are continually being an inborn piece of Indian and different foods. These are known as invulnerability supporters [43]. Dried natural products give a wide scope of phytochemicals, like phenolic acids, flavonoids, phytoestrogens, and carotenoids. Dried natural products are incredible wellsprings of carbs and sugars, for example, glucose and fructose [44-45]. Dried organic products are huge for human wellbeing in furnishing extraordinary sustenance with medical advantages. More examination ought to be done to decide the total profiles of dried organic products according to their cancer prevention agent exercises or other bioactivities [46]. Almonds are celebrated for its sound skin benefits, Vitamin E, found in almonds, is another cancer prevention agent [47] that has been appeared to help the safe framework as well as hindering the maturing cycle. It goes about as a better than different nutrients, shielding them from oxidation and, in this manner, permitting them to manage their job. According to consider Pistachio has capacity to diminish oxidative pressure after actual exercise [48]. Pecan is additionally an resistance sponsor. In an examination The Changbai Mountain pecan (*Juglans mandshurica Maxim.*) utilized, which is a rich wellspring of fundamental amino acids. The impact of three kinds of pecan protein hydrolyzates—egg whites, globin, glutelin was analyzed over mice. When contrasted with the ordinary control mice, those treated with various portions of pecan proteins showed improved resistant records [49]. Cashew nut is additionally in the class to upgrade insusceptibility. According to contemplates, as well as containing high measures of copper, cashews are an extraordinary wellspring of Zinc [50]. Lack of zinc bargains your invulnerable framework working, since this mineral is significant for the improvement of insusceptible framework cells, creation of cancer prevention agent chemicals and action of safe framework controllers. In numerous investigations, boosting zinc consumption has been related with a better invulnerable reaction, implying that cashews could help you fend off your next cold [51].

3. VITAMINS AS IMMUNITY BOOSTERS

With the detonation in corona virus cases all over the world, scaring the world into talks of an epidemic. Because COVID-19 comes with cold and flu-like symptoms, Vitamins B, C and D, may be helpful in boosting your immune system and fighting the illness in the same way they can help you get over a cold or flu.

Food supplements provide nutrients to those who have inadequate and in the need of it. It can be vitamins, minerals, amino acids, fatty acids, and other substances in the form of pills, tablet, capsules and also powders added to water [53]. In the European Union, it is regulated as foods and not as drugs. There should be sources of nutrients to it with a nutritional, immunologic and physiological effect and not just only by adding another ingredient. Furthermore, it is also shown that food supplements are entirely used by millions of people around the world to meet their health needs. Likewise, immunity Booster is one of the food supplements for keeping our immune system healthy.

Immunity Booster is a food supplement that helps your body to lift up the health of the immune system. Based on the Academy of Nutrition and Dietetics, there are top five essential nutrients needed to boost and strengthen the immunity of the body, it includes Vitamin B, D, C, E, and Zinc [53]. Moreover, the human immune system is also an interface across which many climate changes sensitive exposures can affect health outcomes [54]. An important determinant of climate change from various illnesses caused by pathogens and parasites in human populations, diarrhea, enteric diseases and certain waterborne diseases as stated by the World Health Organization. Therefore, low immunity is a significant threat to human life's that may lead to death.

Antiviral medications can restrict viruses from replication there is no primary way to get rid of a virus and prevent viral infection besides having a strong and healthy immune system. Immune system can detect the infected cells and dispose them before the virus begins to replicate and escape [55].

3.1 Vitamin B

Vitamin B is very necessary to be consumed every day and they are water soluble compounds. B community vitamins are coenzymes in some important metabolic pathways, they are essential to maintain many functions in the body, for proper brain functioning, and for the daily the optimal conversion of food to energy. There are

eight B vitamins (including B1, B2, B3, B5, B6, B7, B9, B12), and it is essential to get a multivitamin that includes all of them or take an additional B-complex [56].

3.2 Vitamin C

By and large, nutrient C can help you battle a cold quicker or facilitate your chilly indications on the off chance that you were taking it preceding becoming ill. As a cancer prevention agent, nutrient C can help lessen irritation—and lung aggravation is an extreme side effect of COVID-19, which can prompt respiratory trouble or even demise. So in case you're as yet solid, it doesn't damage to begin taking nutrient C now [57]. This is a decent procedure, as there has been a lot of proof gathered since a century ago about the remedial advantages of nutrient C. Nutrient C is associated with a few fundamental cycles like energy digestion and quality record, just as in guideline of hormonal and epigenetic pathways. It has antimicrobial properties, which decrease the danger of diseases, and has immuno-modulatory capacities, especially in high fixations. Nutrient C has additionally been appeared to have against viral, hostile to contagious and hostile to parasitic impacts. Nutrient C is water-solvent and effectively killed by the stomach related framework so there is no danger of excess. It is prescribed to take your dosages up sufficiently high to actuate free stool while fighting microorganisms. Studies have shown that as lymphocytes and regular executioner cells of the insusceptible framework take up more nutrient C, they become more harmful against microbes [57]. Vitamin C is also involved with iron absorption; it is because pathogens compete with vitamin C for iron resources, as it is essential in aerobic metabolism. If pathogens take too much of your iron, they can starve you of energy by starving your cells of oxygen. They produce excessive amounts of free radicals and acidic by-products which can overwhelm the immune system if there is not enough antioxidant defenses available [58].

3.3 Vitamin D

The essential capacity of nutrient D is to assist your body with keeping up ideal blood levels of calcium and phosphorous, which you can get past openness to the sun's bright beams, or through supplements and the food sources you eat. Getting sufficient nutrient D can likewise shield you from respiratory disease. Nutrient D supplementation fundamentally diminishes the opportunity of respiratory parcel contamination [59]. Nutrient D is fundamental for the resistant framework. At the point when skin is presented to daylight it makes nutrient D [60]. The skin likewise needs cholesterol (from fats), just as magnesium, to work with this cycle. People who live in arctic regions with weak sunlight have survived well by compensating with foods high in vitamin D – such as fatty fish and offal meats [61]. Fish and seaweeds also contain a good amount of magnesium.

4. SPICES AS IMMUNITY BOOSTER

The old Greek doctor, Hippocrates, regularly alluded to as the dad of Western medication, when said, "Let food be thy medication, and medication be thy food," Spices are great in light of the fact that, in contrast to drugs, you don't have to "take" them. All things being equal, you can add them to your number one dishes for a kick of flavor and expanded insusceptibility [62].

4.1 Ginger

This flexible flavor is recuperated from the foundation of the plant, and an assortment of noteworthy phytochemicals have been disconnected from ginger and found to have antibacterial, mitigating, fever-diminishing, and torment alleviating properties. Traditional Indian Ayurvedic medication uses ginger root as a stomach related guide for youthful newborn children with colic and for grown-ups with heartburn. Ginger is a characteristic solution for queasiness and regurgitating because of nausea and morning affliction of pregnancy [63].

4.2 Clove

The oil from this warm, fragrant zest is endorsed in Germany as an effective pain relieving and germicide. Not exclusively do compounds in this flavor present antibacterial and antifungal advantages they likewise help battle the maturing interaction. The high measures of phenols found in cloves are related with the capacity to obstruct the development of cutting edge glycation final results (AGEs) AGEs are non-working mixtures that are related with many age-related conditions like wrinkling of our skin or waterfalls [64].

4.3 Turmeric

Curries and other South Asian and Middle Eastern delights ordinarily incorporate the flavor turmeric. The dynamic fixing in turmeric is curcumin, and logical help including curcumin incorporates against malignant growth and mitigating properties [65].

4.4 Dark pepper

Dark pepper is something other than a table zest. It contains calming, cancer prevention agent and antibacterial activities, yet in addition insusceptible framework upgrading benefits. In South India, it isn't phenomenal for some to their day with some dark espresso with a touch of dark pepper powder [66].

4.5 Cinnamon

Cinnamon comes from the dried bark of an exotic types of Cinnamomum, an evergreen tree filled in Asia. Its dynamic fixing, cinnamaldehyde, is especially powerful at bringing down hazard factors for pre-diabetes, as it stops spikes in glucose after a dinner [67].

4.6 Apiaceae

It is also known as ajwain, it is a calming specialist, a stomach related guide and a gentle diuretic. Because of calming properties and the capacity to increment mucosal release, ajwain is a generally excellent invulnerability promoter and assists with combatting a cold, affirms Pasricha. "Ajwain can be handily added to imbue, tadkas or batters for level or prepared bread. It adds both flavor and crunch." The catalysts in ajwain work with the arrival of gastric juices, in this way improving the stomach related capacities [68].

5. HERBS AS IMMUNITY BOOSTER

In light of COVID-19 spices may assume significant part to improve resistance. Various investigations have tracked down that this plant may assist your insusceptible framework with combatting contaminations and infections, which could assist you with recuperating ailment. Following are the couple of instances of spices which goes about as shelter of numerous viral diseases:

5.1 Tulsi

Ayurveda framework tulsi is regularly alluded to as an "Solution of Life" for its mending powers and has been known to treat various basic ailments. Tulsi is utilized in treatment of epilepsy, asthma or dyspnea, hiccups, hack, skin and hematological sicknesses, parasitic contaminations, neuralgia, cerebral pain, wounds, and irritation [69] and oral conditions [70]. The roots and stems were additionally generally used to treat mosquito and snake chomps and for intestinal sickness [71].

Present day research has uncovered that tulsi has hostile to bacterial; against viral and hostile to contagious action [72] that incorporates movement against numerous microorganisms answerable for human diseases. Tulsi has likewise been appeared to help protections against infective dangers by upgrading insusceptible reactions in no pushed and focused on creatures [73-78] and solid people [79].

5.2 Echinacea (Coneflower)

It is a blooming plant that fills in the U.S. also, Canada, and it's been utilized as medication for quite a long time. A portion of its normal names are the purple coneflower or dark peered toward Susan. All pieces of this plant are utilized to make supplements, fluid concentrates, and teas. Concentrates of Echinacea affect the resistant framework through safeguard against germs. According to investigates it builds the quantity of white platelets, which battle contaminations [80]. It is perhaps the most famous natural prescriptions with an expected 1-4% of everybody utilizing the spice in a given year. It has been mostly utilized in chemo-preventive and chemotherapy for irresistible infections in both upper and lower respiratory frameworks [81]. It was likewise detailed that Echinacea purpurea (Asteraceae) is an enduring restorative spice with significant safe stimulatory and mitigating properties, particularly the lightening of cold side effects. The plant additionally stood out for scientists to evaluate different parts of its advantageous impacts. For example, against uneasiness, hostile to discouragement, cytotoxicity, and antimutagenicity as incited by the plant have been uncovered in different investigations [82].

5.3 Andrographis Peniculata (Green chiretta)

Andrographis Peniculata by and large known as "lord of sharp flavoring," is a herbaceous plant in the family Acanthaceae. In India, A. paniculata is known as "Kalmegh". Concentrates of this plant and angrapholide display pharmacological exercises, for example, those that are immunostimulatory, antiviral and antibacterial. As significant dynamic constituent andrographolide display a wide scope of natural antibiotic, diabetic, antimalarial and hepatoprotective [83-84]. In Asian nations, A. paniculata has been broadly utilized for its antipyretic, pain relieving, protozoacidal, antihepatotoxic, against HIV, immunostimulant, anticancer impacts [85]. According to the investigations it was proposed that the normal item andrographolide are available in this spice and summed up different exploratory and clinical pharmacological exercises of andrographolide, like cancer prevention agent, calming, anticancer, antimicrobial and parasitic, hepatoprotective, antihyperglycemic, and antihypoglycemic. Confirmation from clinical investigations proposes that andrographolide lessens HIV manifestations, simple upper respiratory parcel diseases, including sinusitis and the normal cold, and rheumatoid joint pain [86].

5.4 Rosemary

The leaves of the spice rosemary are utilized new just as dried in conventional Mediterranean dishes to bestow fragrant smells of evergreen. Rosemary has solid cell reinforcement properties, and examination shows that rosemary extricate has both antibacterial [87]. New rosemary leaves is a common remedial portion for boosting insusceptibility during cold weather months.

5.5 Garlic

This amazing culinary spice has a wide cluster of medical advantages going from cardiovascular insurance to resistant incitement. The science of garlic is intricate, with more than 100 unique substances that add to its belongings. The main element is garlic's high grouping of sulfur compounds, which are answerable for both the smell of garlic and its adequacy against microscopic organisms, infections and growths [88].

5.6 Ashwagandha

Aswagandha holds the most noticeable spot. It is known as "satvic Kapha Rasayana" [89]. Ayurveda, the

Clays, especially montmorillonite and bentonite are environmentally benign, recyclable, and economical when used as a catalyst. Heteropoly catalysts are also used in a wide variety and high potential, because of their higher catalytic activity and acidic strength than the mineral acids. By the modification of clays with a variety of HPAs, we can achieve the benefits of using both clay and HPAs. We can use various HPAs such as Silicotungstic acid (STA), Phosphotungstic acid (PTA), Silicomolybdic acid (SMA), Phosphomolybdic acid (PMA) for the modification of clay and may be obtained a series of HPA modified clays. HPA modified clays have proved to be a prominent catalyst for different acid-catalyzed organic reactions. This book represents the basic properties of clays and heteropoly acids and the modification techniques of clays with HPAs. These modified clays further characterized by using analytical, thermal, and spectral techniques and find applications as catalysts in organic reactions.



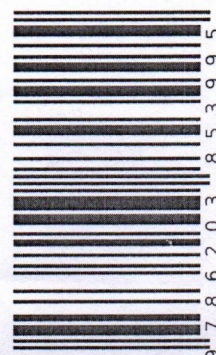
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Advances in Heteropoly Acid Modified Clays as Acid Catalysts

Synthesis and Characterization of Heteropoly Acid
Modified Montmorillonite and Bentonite Clays as
Solid Acid Catalysts


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Recent Advances in Multidisciplinary Research

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Clays, especially montmorillonite and bentonite are environmentally benign, recyclable, and economical when used as a catalyst. Heteropoly catalysts are also used in a wide variety and high potential, because of their higher catalytic activity and acidic strength than the mineral acids. By the modification of clays with a variety of HPAs, we can achieve the benefits of using both clay and HPAs. We can use various HPAs such as Silicotungstic acid (STA), Phosphotungstic acid (PTA), Silicomolybdic acid (SMA), Phosphomolybdic acid (PMA) for the modification of clay and may be obtained a series of HPA modified clays. HPA modified clays have proved to be a prominent catalyst for different acid-catalyzed organic reactions. This book represents the basic properties of clays and heteropoly acids and the modification techniques of clays with HPAs. These modified clays further characterized by using analytical, thermal, and spectral techniques and find applications as catalysts in organic reactions.



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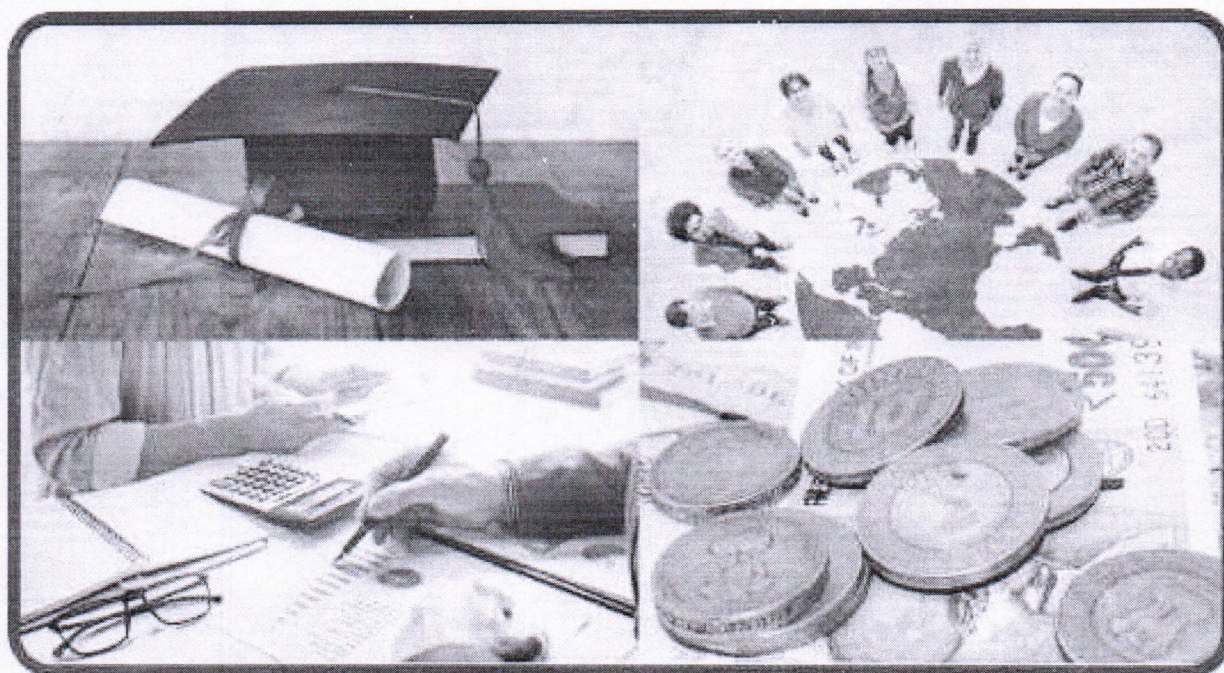
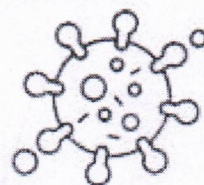
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Volume 3

Impact of COVID-19 on Economy, Business, Education and Social Life



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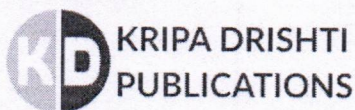
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17. How India Tackles with an Epidemic: Covid-19

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Abstract:

Around 100 years ago in the year 1918, world faced the first pandemic situation caused by virus named Influenza, which was not even destroying the public health but also put a strong effect on the economy as well. Now in 20th century human antiquity is observing a very astonishing time by fighting with an invisible enemy known as novel COVID-19 coronavirus epidemic condition caused by a novel SARS-CoV-2 virus, identified in the year 2019 in China. Initially, it was observed in the local food market of Wuhan city, China and soon spreading across the World. COVID-19 virus having more than 80 % similarity to previously identified virus in 2002 named SARS (Severe Acute Respiratory Syndrome). COVID-19 having a very high transmission rate, which make it more deadly as compared to SARS and MERS, due to which it spreads very soon in every continent on earth, forcing us to live with this virus for perhaps a long time. As per the International Health Regulations (IHR) 2005, WHO declared a Public Health Emergency of International Concern (PHEIC) in order to alert all countries regarding COVID-19. However, now we are more equipped, but as on 27 April 2020, around 2.97 M confirmed cases with 206 K deaths and 863 K recovered cases have been reported which affects the social and economic values globally. This article aims to review the potential preventive measures taken by large populated Asian countries (India) that could reduce the viral transmission among the community in the present context of time.

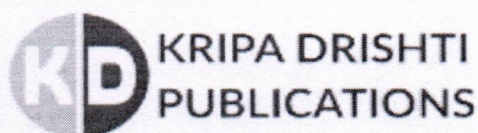
Key words: SARS, COVID 19, Worldwide Scenario, Asian countries, Preventive measures, MERS

17.1 Introduction:

Around four centuries ago, humanity firstly encountered with a novel strain of virus named Influenza, caused widespread illness, deaths, and disruption globally. Word Influenza derived from latin words "Influentia", and it belongs to family Orthomyxoviridae, having eight genomic segments together make around ten proteins and based on their strains it is classified into types A, B, and C [1,2]. Strain A, is the only pandemic and zoonotic in nature, having aquatic birds and swine are the reservoirs and responsible for the majority of morbidity and

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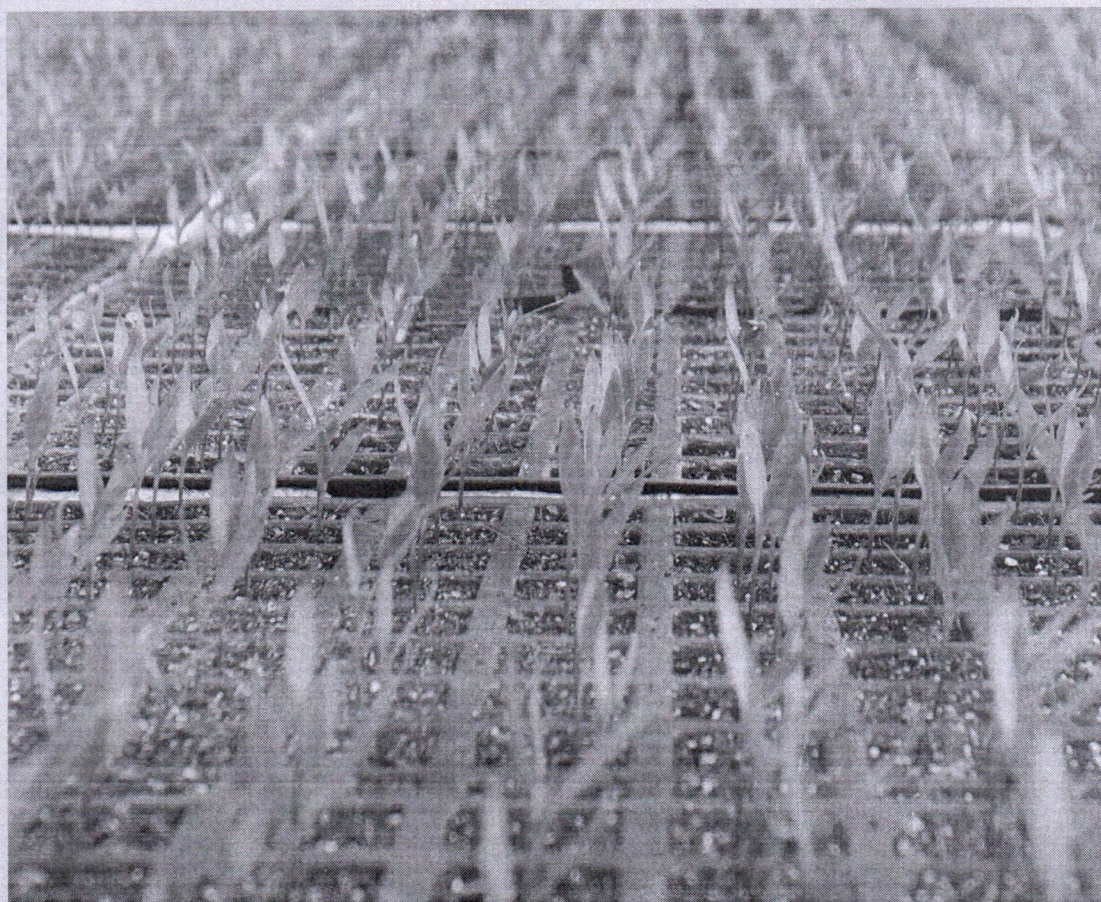
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Seed Production Technology



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CHAPTER 5:

SEED PRODUCTION TECHNOLOGY OF RAPESEED &

MUSTARD

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1. Introduction:

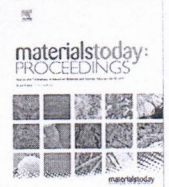
The oleiferous Brassica species are generally recognized as rapeseed-mustard. In India, Rapeseed-mustard are third most important oilseed crop after soybean and groundnut. It possesses second place in eatworthy oilseed crops after groundnut in India and third most after oil palm and soybean in world scenario. Rapeseed-mustard is considered as cash crop. Seeds of rapeseed are brownish black coloured and large sized nut seeds of Indian mustard are medium sized, round and dark brown or black in colour. Rapeseed-mustard is group of eight different species namely *Brassica nigra* (black mustard), *Brassica juncea* (Indian mustard), *Brassica rapa* var. brown sarson (brown sarson), *Brassica carinata* (karan rai or Ethiopian mustard), *Brassica rapa* var. toria (toria), *Brassica napus* var. napus (gobhi sarson), *Eruca sativa* (taramira) and *Brassica rapa* var. yellow sarson (yellow sarson). Rapeseed-mustard belongs to family Brassicaceae or Cruciferae and is a Rabi season crop mostly cultivated under irrigated area (more than 75%) in different states of India.

Differences between rapeseed and mustard:

Factors	Rapeseed (<i>Brassica campestris</i>)	Mustard (<i>Brassica juncea</i>)
Common name	Toria	Rai/Raya/Laha
Plant height	Comparatively shorter (45-150 cm)	Comparatively shorter (90-200 cm)
Roots	Near to surface and lateral spread	Long and tapering roots
Leaves	Sessile and hairy	Stalked and broad
Seed colour	Brownish black or yellow	Brown or dark brown or black
Seed coat	Smooth	Rough
Fruit size	Comparatively thick	Comparatively slim


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Replacing E-waste with coarse aggregate in architectural engineering and construction industry

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Compressive strength

ABSTRACT

The goal of this article is to investigate the possibilities of substituting certified recycled electronic trash for coarse aggregates in construction. Electronic waste is a general word that refers to electronic items that are no longer valuable to their owners, are no longer functional, or have exceeded their useful life. In today's information technology age, consumption of electronic equipment such as mobile phones, laptops, and LED lights has expanded tremendously, resulting in vast amounts of outmoded products, or e-waste. Direct e-waste disposal has been shown to have a negative impact on the environment. Numerous earlier research investigations revealed that e-waste might be utilized in place of coarse aggregate in stiff pavements. This study compared the compressive strength of M20 grade concrete for grinded PCB (Printed Circuit Board), plastic, CRT LCD Monitor, and other e-waste to that of conventional concrete by partially replacing coarse aggregates at four levels, namely 7 percent, 12 percent, 17 percent, and 22 percent with a constant interval of 5 percent. The findings of the study conclude that the strength of concrete increase upto the level of 7 percent coarse aggregate is replaced by e-waste. Further till the 12 percent addition it started decreasing but the decline in strength is within the M20 range of compressive strength. This study concludes that the e-waste shall be used and utilized as a replacement of coarse aggregate in the range of 7–10% without impacting the compressive strength of the concrete.

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1. Introduction

China, India and USA generate around 50% percent of all e-waste, followed by Japan, Brazil, and Russia (Fig. 1). E-waste generation is most prevalent in rapidly developing and industrialising regions. Despite the fact that China and India have equal populations, China generates three times more e-waste than India [1]. India is currently producing e-waste at a pace of 21% per year. E-waste is defined as electrical or electronic devices that have been discarded because they are no longer functional, are obsolete, or have been broken. Rapid technological advancements and declining device prices have resulted in an ever-growing global surplus of electronic waste. E-waste is defined as used electronics that

are destined for recovery, resale, salvage, recycling, or destruction. Electronic waste is becoming a bigger problem, posing serious contamination risks to humans and the environment. Lead, nickel, antimony, mercury, cobalt, thallium, cadmium, selenium, beryllium, polyvinyl chloride (PVC), brominated flame retardants, cathode ray tubes, printed circuit boards, plastic casing, copper wires, and other heavy metals and toxic substances found in e-waste can pose serious environmental and health risks if not properly treated. E-waste also contains valuable materials such as gold, silver, copper, rhodium, palladium, and other metals, which can be economically valuable if properly recycled. Because of the presence of harmful compounds and heavy metals, e-waste disposal and recycling is difficult and poses an environmental risk. E-waste handling legislation and management laws have been adopted in some developed countries. Due to a lack of awareness, poor recycling facilities, and weak law enforcement, many countries did not fully

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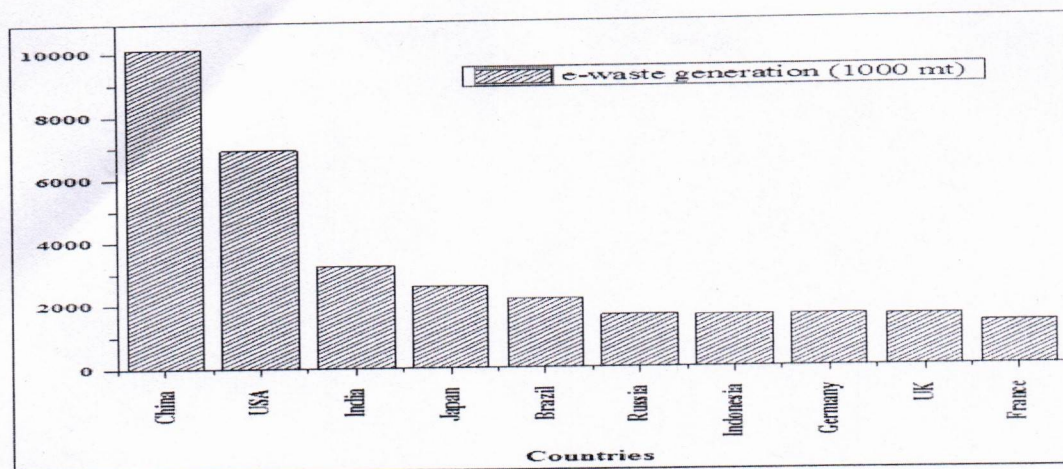


Fig. 1. Country that is generating E- Waste.

comply with the e-waste regulations. As a result, e-waste is improperly disposed of as general waste, posing a major threat to the ecosystem. The increased use of concrete as a construction material has raised concerns about the supply of raw materials. As a result, new substitute materials must be discovered. Each year, a few tonnes of e-waste should be disposed of. Traditional landfilling is not an environmentally beneficial way of disposal, and it is extremely difficult to comply with EPA standards. Reusing non-disposable electronic waste has increased in popularity as a subject of study. Lead, cadmium, chromium, mercury, polyvinyl chlorides (PVC), brominated flame retardants, beryllium, antimony, and phthalates are all hazardous metals and chemicals that can have a detrimental effect on the neurological, kidney, and bone systems, as well as the reproductive and endocrine systems, when prolonged exposure to high quantities of radiation [1]. The Fig. 1 is showing the different levels of generating e waste in different countries and it can analyse from the fig. that the highest waste management is being done in china and lowest in France. And India is the 3rd highest country who is generating E- Waste, and the Fig. 2 is showing to give the estimate generation of E-Waste Data for different years that from how much difference it is rising year by year and it can clearly see that from 2015 to 2025, it has risen 1000000(metric tonn). As the importance of sustainable development has been emphasised at all global and public gatherings, the time has come to develop substitute materials for non-renewable resources. No development can be imagined in today's

world without the use of concrete. In the construction industry, concrete is the most frequently used structural material. The world is advancing at a breakneck pace these days, and our current state of affairs is constantly changing.

Monitoring the quantities and flows of e-waste is critical for evaluating long-term trends and setting and assessing goals for a sustainable society and circular economy. The estimated generation of E-Waste Data for different years that from how much difference it is rising year by year and it can clearly see that from 2015 to 2025, it has risen 1000000(metric tonn) (Fig. 2). On the basis of sound e-waste data, the development of a recycling infrastructure, sound policies, and legal instruments are more efficiently implemented. The true nature of measure indicates and, in some cases, illegal shipments will be undecipherable without a global picture of e-waste. The below Pie chart is showing the contribution (in %) of different materials in generating E Waste, this can conclude that highest involvement is of Metals in generating E waste i. e 60% (Fig. 3). Further the State highly responsible for generating E Waste in the economy is Maharashtra and the state which is very less responsible for the same is Punjab with the huge gap (Fig. 4). (See Fig. 5)

The modern world moves at a breakneck pace, and our existing state of affairs is continually changing [2–4]. This method considers the environment, the preservation of distinguishing assets, and waste product recycling. Apart from deforestation and petroleum product consumption, manufacturing contributes signifi-

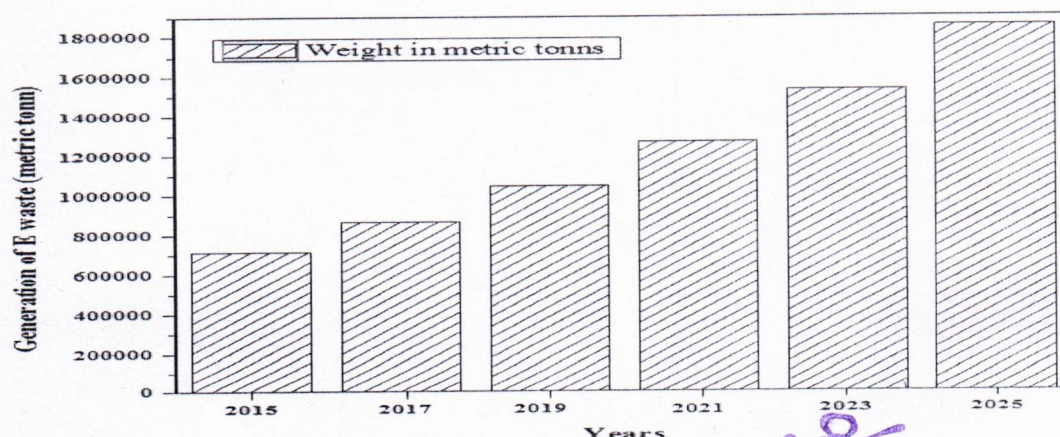





Fig. 2. The above figure is shown to give the estimate generation of E-Waste Data for different years that from how much difference it is rising year by year and we can clearly see that from 2015 to 2025, it has risen 1000000(metric tonn).





Analyze the outcome of waste material as cement replacement agent in basic concrete

Rishabh Arora^a, Kaushal Kumar^a  , Saurav Dixit^b, Lavesh Mishra^b

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Abstract

The use of solid waste in valuable products becomes a worthwhile deal for individuals, organizations and countries themselves. Waste glass powder was also considered one of the world's leading waste materials. This research examines the physico-chemical, thermal and morphological characteristics of waste glass powder, as part of its use for cement replacement. The fine glass powder pozzolanic qualities make it suited for concrete applications. Extensive testing of cement replacement for the age 7 and 28 days in the range of 5 to 15% by waste glass powder has been carried out in terms of the Compressive Strength Test (CST) and Slump Test (ST). Experimental results show the improved economic aspects of concrete with the utilization of waste glass powder. In terms of cost, it was observed that green concrete have approximated 19% economic as compared to ordinary concrete. The study would provide a potential to utilize more concerned wastes like glass powder in green concrete.

Introduction

Presently, material glass has applications in electronic industry by making of different screen based products like LCD, TV, Tabs, etc. Also have applications in food or medical sector particularly from making of surgical equipment to the bottles of beverage industry [1]. As a result, glass industry has different potential approaches throughout the globe. A significant amount of unusable items or defected or broken packaging glass is sent to landfill, basically acquire more useable space or land to more urgent uses [2], [3]. So it is necessary for the consumable countries to prepare a better policy for utilization of these waste glasses. According to report, globally production of waste glass powder is about 130 Mt, in which the EU (European Union) and china produces about 65 Mt while USA produces 20 Mt [4]. Its large production causes environmental impacts and its disposal in landfill became costly. Glass powder has application in different product throughout the world due to its reliability, versatility and durability. Researchers in construction industry still concerning about to avoid any risk and delay for timely completion of projects in India and worldwide [5], [6], [7]

Mainly glass products are the by-product of recycled material and also repeat this recycled process many times without changing their chemical phases or configuration [8]. The recycling of glass starts by melting a mixture containing materials

such as: soda ash, silica, calcium carbonate (CaCO_3), and recycled glass pieces. Glass powder also shows pozzolanic behaviour by reacting with calcium hydroxide and the same enhances with larger surface area for the reactions [8], [9].

Researches point towards the better chemical behaviour of glass rather than other customary materials [10], [11]. Moreover, fine milling glass powder improve the reactions between glass and cement hydrates, can be utilized as additive in cement [9], [10], [11]. Numerous studies are also available to study the pozzolanic activity of fine particles glass powder in concrete [12], [13], [14], [15]. Depending on its fineness, GP would generally exhibit pozzolanic reaction with a deliberate rate compared with the cement hydration. Thus, the replacement of cement by GP might decrease strength at an early age but would increase it at a later age. Numerous efforts have been made to use waste glass in construction industry but studies regarding the utilization of waste material like glass powder are not so common. Also the replacement cement particles in concrete through waste glass powder are very narrow [1], [2].

So, an experimental investigation has been carried out with Waste Glass Powder (WGP) as replacement of ordinary cement up to 15% to produce sustainable concrete. Cube samples were prepared for compressive strength test, slump test and the flexural strength test for the mixes at the curing age of 7 days and 28 days.

Section snippets

Material characterization

In order to study the probability of waste glass powder in construction applications it was necessary to check the physio-chemical characterizations. Primarily, the white transparent bottles were collected and washed properly with clean water. Clean bottles were crushed and finely grinded into powder with the help of roller ball mill up to 1 hr. placed the powder form of waste glass in a separate bucket. This WGP was used as the replacement of cement in the basic concrete. Fig. 1 represented...

Methodology

The existing research focused on replacement of small fraction of port land cement through waste material from glass milling or WGP only. The level of water content was unchanged through this replacement or as it was in common concrete. The main contents of this material were water, ordinary and Portland cement, aggregates and WGP. During this process proper cooling process was also utilized with testing of material to obtained desired strength. Mix design prepared after selection of optimal...

Result and discussions


The samples of the prepared cube were used. Table 3 includes the findings of the compaction factor and slum with a pressure resistance of 7 and 28 days. It has been shown that the value of the slump increases by increasing the amount of WGP. The droop value varies from 50 to 60 mm, and the CF value varies from 0.86 to 0.90 for Mx-0 to Mx3. From the observations it was concluded that the CF value shown directly proportionate relation with the WGP value. The outcomes also reported that the...


Conclusion




- Results obtained from strength tests of the glass powder based green concrete were promising and clearly indicating towards the better economic aspects of glass powder as the replacement of cement....
- Green concrete with promising strength considered as 19% cheaper than ordinary concrete....
- WGP can be used for the increment of strength of concrete. It was found that increasing ratio of glass waste weight affects the compressive strength and hardness of the concrete....





Digitisation of contemporary fabrication processes in the AEC sector


Saurav Dixit^{a 1} , Anna Stefańska^b 

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
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Abstract

Trends in the contemporary architecture sector constantly change the quality of engineering and construction solutions. Broadly understood optimisation processes improve material usage, as well as precision in mass production. Digital fabrication becomes not only a means of aesthetic concepts or architectural models. The central idea of additive technologies becomes the effective use of sources and energy and creating lightweight and easy to produce structural elements. A vital aspect of new technology development is understanding the possibilities and improvements that bring additive fabrication and the need to create a new material range to manufacturing methods simultaneously. The article presents selected examples of how new tools and techniques for assembling and optimising the structural elements engaged in the computational design improve the end-result quality.

 Previous

Next 

Keywords

Additive manufacturing; Digital fabrication; Fabrication; 3D printing; Construction productivity; Sustainable development

1. Introduction

Contemporary architectural design is primarily based on the individualisation of structural solutions and the need to minimise material and energy use. Following the guidelines of sustainable development principles often reveals architects' desire to design curvilinear geometries as a search for aesthetic expression and inspiration from bionic patterns. Their use can take place on many levels, from the search for visual effects only, to an understanding of working systems, such as the mechanics of structural work, to the operation of entire ecosystems. Increased interest in alternative materials.


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Research into the use of biomimetic patterns has noted that optimisation of structures must be carried out in parallel with material optimisation, refinement of their performance, and the search for new conglomerates [1]. Still, the most significant barrier is the simultaneous use in structures of materials with a homogeneous form, formed into complex systems such as, for example, the structure of the magpie skull bone, beetle wing shell, or cuttlefish bone [2]. This review illustrates the fundamentals for recognising specific examples of digitalisation of contemporary fabrication. The paper provides a possible perspective on the challenges of biological and bioinspired structural behaviour and materials and their application in current and future designs.

Biomimicry has contributed to a shift in design, not only following free aesthetic forms, but above all to minimise natural resources and carbon footprint, and therefore sustainable architecture, meeting the "shift from the industrial age to the ecological age "humankind" [1].

Analysing the selected structural and material solutions and fabrications in terms of production speed, material consumption, energy consumption per production is an essential factor in the preliminary design process. Currently, available additive, subtractive and formative techniques have different uses through their characteristics. However, no physical materials with variable properties can carry the force distribution variable in curvilinear structures. After analysing the dynamics of bionic pattern applications in architecture, it seems that the creation of such materials is a matter of the near future. Using mathematical algorithms on the requirements of proportionality, minimum or maximum dimensions, the software creates an individual solution for the indicated boundary conditions. This is particularly interesting from the point of view of prefabrication, which is now more often characterised by the idea of post-Fordism, where the desire for unification does not exclude the creative search for individual solutions.

2. Literature review

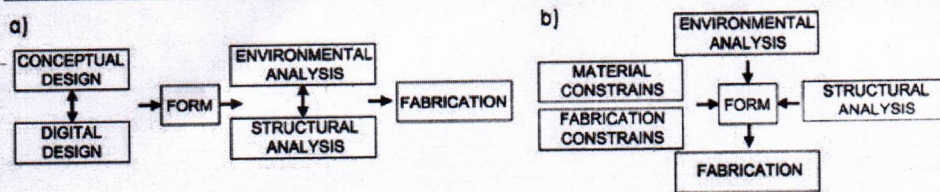
Technology, which is developing at the intersection of many different fields, has become the focus of modern researchers. Until now, 3d printing technologies have been used in prototyping. In the 21st century, additive methods have become an independent technology, combining the optimal material and design method [3]. Because of its poor labour productivity, the AEC sector experience rather stagnation than development over the last years [4]. Additive technologies primarily identified with cloth design, medical implants or vegan meat became in 20's the separate technology branch. Also, using additive technologies to use eatable materials in architectural design is increasingly popular and appealing [5], [6]. However, numerous attempts of houses 3D printing in real-scale have been made in multiple materials, such as concrete, soil, clay [7], and structural elements in such materials as sand-print, steel [8] and, carbon fibre [9], bamboo and wood-based materials [10].

The development of computer-aided design has significantly influenced the selection of bespoke solutions for both design and execution. The engineering-assisted design and form-finding design described above have highlighted the need for more accurate solutions at the architectural scale. A new field of research has risen in the contemporary AEC sector, and the latest digital modelling considers form, material properties, and 3D printing properties [8], [9].

Bio-inspired designing in a sustainable approach transforms science to 'regenerate' and 'enhance'. Current strategies for material optimisation bring new technologies such as Additive Manufacturing, CNC machines and computer-based algorithms for robotic manufacturing. Recent projects refer to robotic fabrication in architecture as craft engaging different materials [9], [10], [11].

Architectural technology strings the more in-depth search for effective fabrication methods thanks to close relation with craft and material-oriented algorithmic design. In material-oriented research, self-assembly material-over-form investigations explore prestressed textiles, and 3D printed rigid elements [11], [12]. 4D printing, i.e. standard 3D printing with the parameter of changing aspects over time, or with materials giving the ability to change according to parameters, is becoming a desirable technology (Fig. 1), allowing modifications regarding form, properties, or functionality [12], [13].


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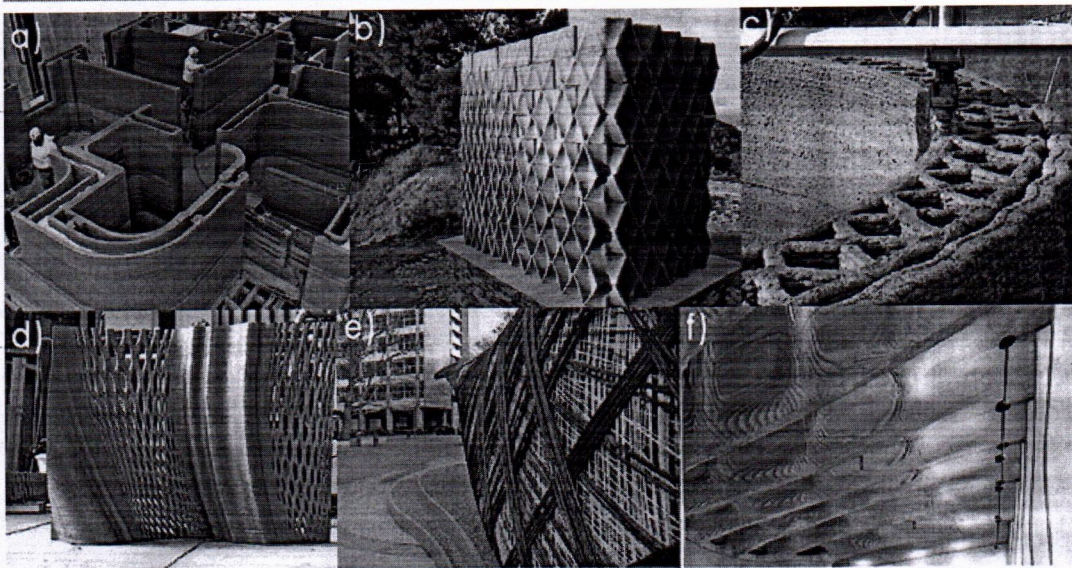


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Fig. 1. a) current designing process, b) material-based design process [26].

The possibility of using high-precision robotic arms has allowed for free handling of additive materials, as well as cutting or multi-axis machining. This changes the way traditional materials such as concrete, steel or wood are used. Additive manufacturing allows using unique features of materials, without limitations of, e.g. shapes, which in the mass production of prefabrication of the last century forced straight walls always designed at an angle of 90 degrees [13]. The use of AM, allows the material consumption to be adjusted and allows for greater freedom of design, a reduction in the proportion of labour involved in the preparation of formwork, and more stringent safety protocols (Fig. 2).



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Fig. 2. Different materials 3D printing in architectural scale (a) concrete house, (b) Clay wall, (c) raw earth house, (d) steel bridge, (e) carbon-fibre pavilion, (f) sand-print slab.

Nature, not only reduction of human impact on natural resources [14]. The usage of timber in the AEC sector significantly rises, a renewable resource with a negative carbon footprint and low embodied energy [15], [16].

3. Discussion

Changing trends in architecture are continually changing the quality of engineering solutions. A significant influence is exerted by emerging new trends in shaping architectural and structural solutions, an essential aspect of which is shape optimisation through generative design methods. Nowadays, structural detailing is increasingly becoming one of the steps in the interdisciplinary design of an object. Structural detailing has become fused with architectural detailing, and technology has


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Analysis of Predictive Current Control Technique in Wind Energy Conversion System

Vineet Dahiya & G. Leena

Conference paper | First Online: 29 September 2021

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Abstract

In today's world as there is surge in power demand, there is need for alternative energy sources and wind energy generation systems are now gaining popularity as they provide better power quality and active power control. The predictive technique is a propitious substitute to control the operation of matrix converters as it includes extra aspects in the control which makes it simple and flexible. The implementation of this strategy can be useful in renewable energy technologies, grid interconnection, multi-drive systems control, etc. Analysis of predictive control proposition when implemented into different topologies of matrix converters in synchronism with different cascaded systems used in different industrial applications mainly in renewable energy and multi-drive system have been discussed. In this

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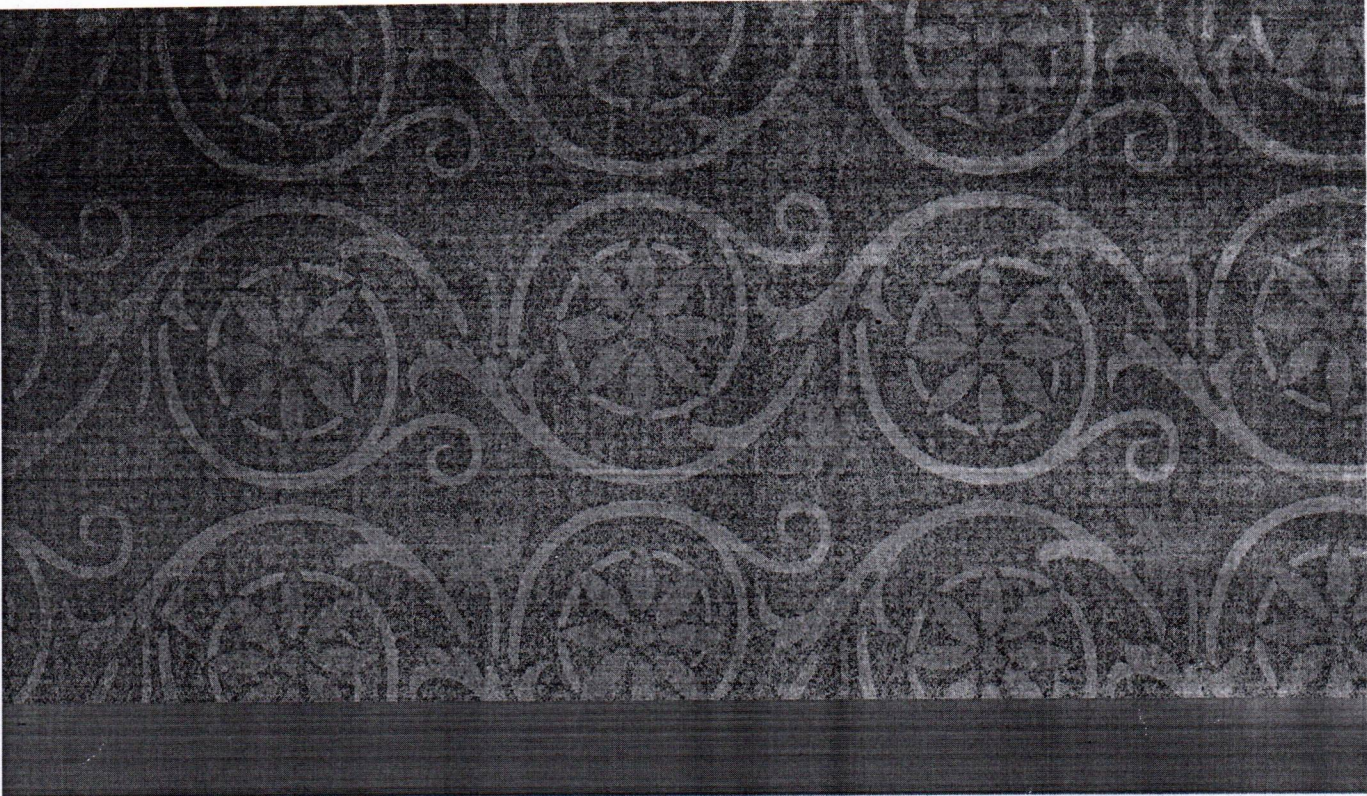
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Abstract

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LITERATURE, LANGUAGE, AND THE CLASSROOM

ESSAYS FOR PROMODINI VARMA

Edited by
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ROUTLEDGE



LITERATURE, LANGUAGE, AND THE CLASSROOM

Essays for Promodini Varma

*Edited by Sonali Jain and
Anubhav Pradhan*


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Comparison of Static and Harmonic Response of Structural Steel and Aluminium Alloy Automotive Shock Absorbers



Abhishek Sharma, Surendra Kumar Yadav, Anshul Yadav,
Virendra Kumar, and Anil Kumar

Abstract In this study, two different materials, i.e. structural steel and aluminium alloy 6061, are used as potential shock absorber materials, and their performance is calculated using FEA analysis. The stresses, deformations, fatigue life and vibrational analysis of both the shock absorbers are compared. It is concluded from this study that the shock absorber made of structural steel shows excellent stress resistance even at heavy loads and the fatigue life of steel is higher than that of shock absorber made of aluminium. However, both the materials show approximately equal vibrations when the loading is applied. The study suggests that both these materials can be used in the shock absorber. However, because of high strength and high fatigue life characteristics, shock absorber made of structural steel should be preferred over shock absorber made of aluminium.

Keywords Finite element method · Shock absorber · Fatigue life · Vibrational analysis

1 Introduction

A shock absorber reduces vibration by dissipating energy, smooths vehicle motion and ensures that vehicle's tires remain in contact with the road. The basic working principle of the shock absorber is energy conversion and dissipation. The energy that causes vibration (kinetic energy) is converted into heat energy, and then this heat is released in atmosphere through heat exchanging mechanism. Both hydraulic and pneumatic shock absorbers are available. Hydraulic shock absorbers use oil as fluid while pneumatic shock absorbers carry air that is heated and exhausted to the outer atmosphere [1]. In the absence of this heat dissipation mechanism, if only spring is used to absorb energy that is induced by bumps or uneven road, the

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Comparative study of erosion wear resistance on SS 430 and SS SD 2507

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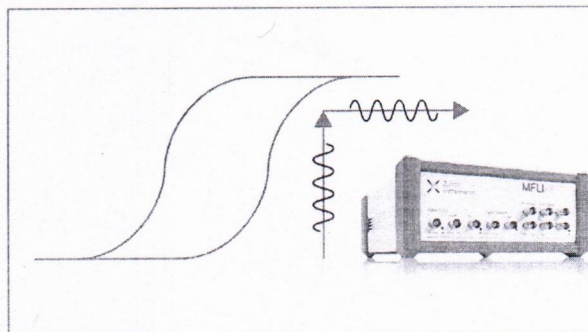
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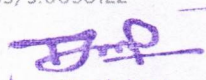
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Comparative Study of Erosion Wear Resistance on SS 430 and SS SD 2507

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Abstract. Transportation of solids through slurry transportation system is very effective and efficient method SS 430 is the preferred material for pump impeller on account of its superior corrosion and erosion wear resistance properties, however its hardness is not as high as the other materials used for making impellers. On account of the paper deals with erosion related wear effects on SS 430 and SS SD 2507 samples has been evaluated by performing experiment on slurry pot tester. Experiment was conducted on two parameters namely, rotational speed and different particle size of the erodent material. Fly ash was taken as the erodent material and experiments were performed for rotational speed of 700, 950, 1200 and 1450 rpm. Particle size of the fly ash varies from 53-75 μ m, 75-110 μ m, 110-150 μ m and 150-180 μ m. Results shows the SS SD 2507 having higher micro hardness as compared to SS 430 and because of this SS SD 2507 shows better erosion wear resistance as compared to SS 430. So use of SS SD 2507 as pump impeller is advised from impeller longevity stand point in comparison to SS 430 impeller.

INTRODUCTION

Disposal of fly ash is critical to the power plants operations and for this many power units use slurry transportation system. Transportation of solids by the slurry transportation system is known to very effective process of solid waste handling. The interaction of solid particles (fly ash) with the material surfaces causes erosion wear [1,2]. Material loss is the effect of the erosion and reason of this is the solid particles repeated impingement on the material surface. Such erosion is highly undesirable phenomena because material loss causes high maintenance cost and also leads to loss in transport efficiency in the process increasing operation cost. Although many researchers have done lot of work on the slurry erosion but still it's not fully discovered because of its complexity and dependency on many factors.

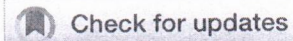
To avoid the erosion wear material selection of the component is very important part and from previous research it was found that stainless steel is very good material for the different parts of the slurry transport system especially for the pump impeller [3,4]. SS 430 is commonly used among engineering material used by many industries because it has very good corrosion resistance but its hardness is lower than the other materials so it has low erosion wear resistance [5]. This work reports the effect of slurry erosion on the SS 430 is compared with the SS SD 2507 because SS SD 2507 has same corrosion resistance but due to its high hardness its erosion wear resistance is higher as compare to SS 430.

Erosion wear rate is depends on the various parameters like rotational speed, particle size of the erodent, concentration of the solids in slurry and exposure time duration but the most important factor is the rotational speed and the particle size of the erodent material [6,7,8]. So in this paper erosion wear is studied on the two parameters which is rotational speed and particle size of the fly ash.

RESEARCH ARTICLE | MAY 13 2021

Effects of activating flux on aluminum 6061 using TIG welding (GTAW)

Deekshant Varshney; Kaushal Kumar ✉

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The purpose of this study is to investigate the effects on the aluminium alloy plate AL 6061 of triggering fluxes and solder parameters and depth to width ratio (DWR). The welding process for argon gas tungsten arc (GTA) was conducted on the 6061 plate aluminium alloy without filling metals. The fluxes were activated by SiO_2 , TiO and Fe_2O_3 . Mixed fluxes were used to analyze the effect on solder penetration. Using the experimental technique of GTA soldering using activated flux, a welding Perl of 10 mm with a single pass soldering aluminium alloy plate has been fully mounted. The study concluded that the TIG soldering of SiO_2 and Fe_2O_3 fluxes led to a substantial increase of welded bead penetration and that 6,061 alloys sold with the highest ratio of depth to width were created by the SiO_2 flux.

Topics

Alloys, Welding

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Synthesis and Stability of Al₂O₃/Water Nanofluids

[Vinay Singh](#), [Ajay Kumar](#), [Kaushal Kumar](#) & [Munish Gupta](#)

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Abstract

The nanofluids may be considered as multifaceted fluids, generally employed to improve the effectiveness of thermal systems, though poor stability due to sedimentation and agglomeration has limited their applications in practical use. In this work, commercial Al₂O₃ nanopowders were dispersed in distilled water using CTAB as surfactant. Stable Al₂O₃ /water nanofluids with weight concentrations ranging from 0.02–0.5 wt% were synthesized using bath and probe ultrasonication.


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Nanopowders were characterized using high-resolution TEM micrography. UV–Vis spectroscopy and zeta potential tests were also conducted to check stability of the nanofluids.

Keywords

- Al₂O₃/water nanofluid
- Characterization
- Aggregate
- UV–Vis
- Zeta potential

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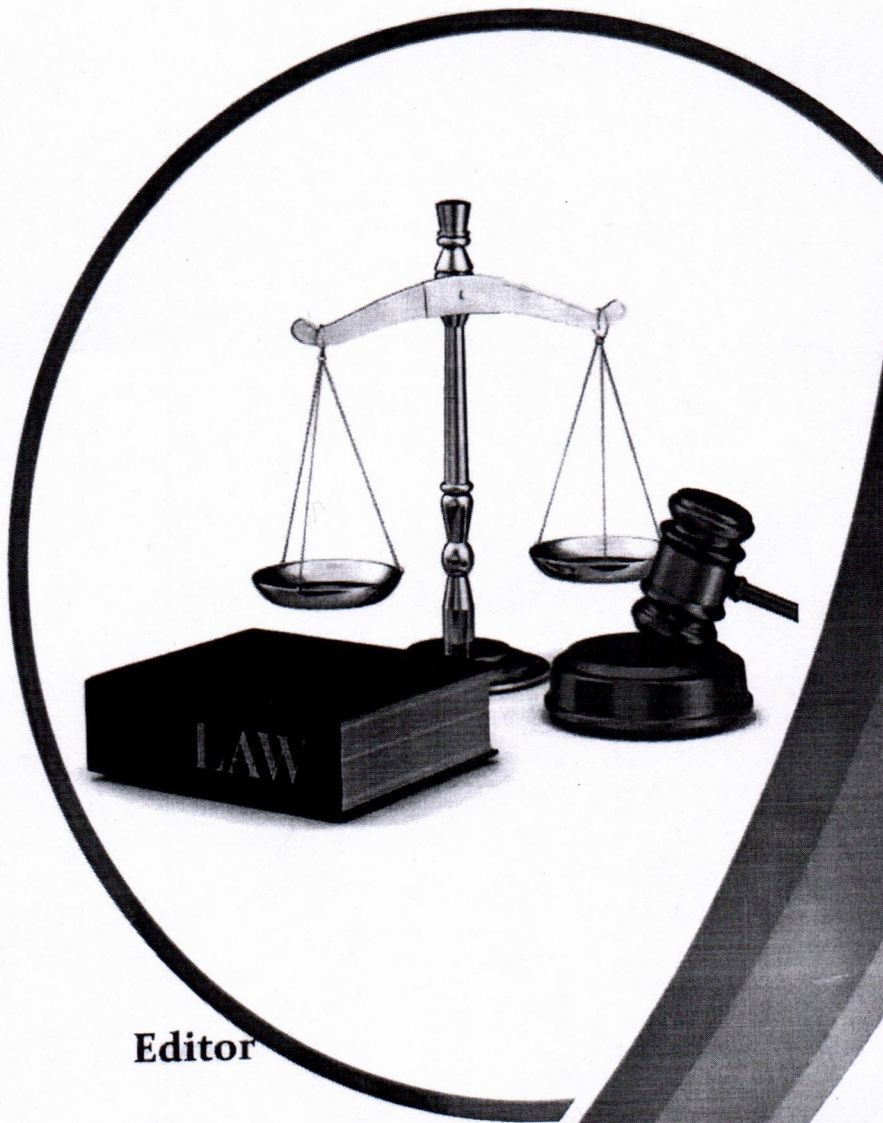
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CRIMINOLOGY, PENOLGOY AND VICTIMOLOGY-AN OVERVIEW

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Dr. Somnath Roy
Dr. Archana Vashisht
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3. Custodial Violence in India- An Obstacle towards Development

Bio Note:

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Abstract:

In general parlance the words, 'torture' or 'abuse' denotes "cruelty," "atrocities," and "injury," all of which refer to the deliberate infliction of thrilling bodily and mental agony in order to punish, to collect evidence, or to compel someone to confess something. The Rule of Law requires a dedicated community of public officials who are both inspired by its noble principles and resolved to preserve the law at all costs. Custodial abuse is not a new wonder. It is witnessed to have occurred in some form or another at various times throughout history. It's just that in recent years, it's become an absolutely important topic. It is a disease and a virus that develops in the body of a sick individual. In a democratic society, it is the role of the police to defend and to ensure safety rather than curtailing liberty and freedoms. Custodial abuse can take various forms, including verbal attack that causes emotional or physical discomfort, forcing a person to stay at a police station for no reason, using third-degree tactics, stripping, molestation, rape, and death.

The job of the police is to create a nonviolent and orderly environment in which these liberties can be practiced. A democratic police force is unconcerned about people's opinions, associates, campaigns, or allegiance to official policies. It will demand that colonial laws, procedures, methods, and arrangements for the care and treatment of those who have been arrested, detained, or imprisoned in some way be thoroughly examined. It would also mean that the victim would have exclusive rights to redress and compensation, in addition to institutions like the Board of Visitors.

Keywords: Custodial; Violence; Abuse; Police Power; Custodial Death.

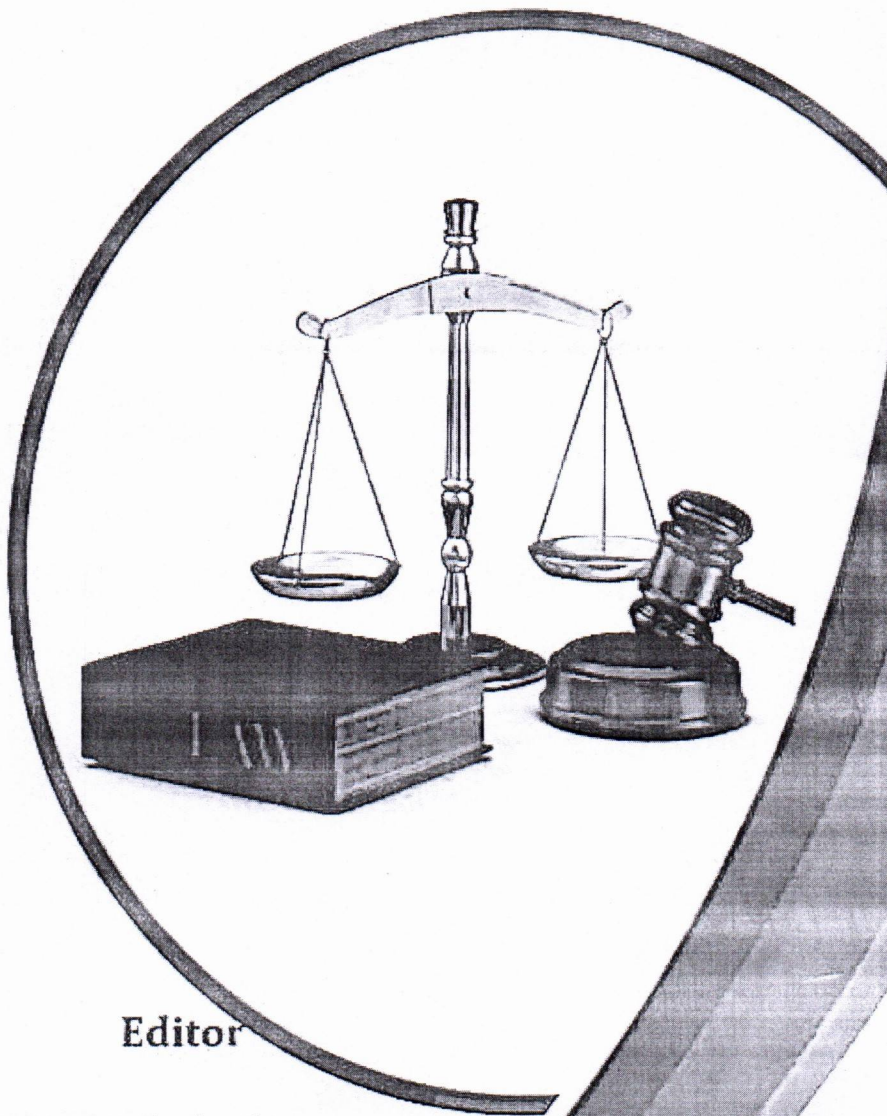
3.1 "Liberty is the most Cherished Possession of Man:"¹

India is a democratic republic that is secular, communist, and independent. The administration of criminal justice guiding principles is made possible by the application of the rule of law.

¹ R. S. Verma, *Law Relating to Custodial Death and Human Rights* 1 (Verma Publications, 2001).

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1. White Collar Crime: A Biggest Menace for Society-A Study to Rectify the Present Snag

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Abstract:

White collar crime are generally a crime which is committed by the people of higher status who is educated and expert in their profession. It can also be called as the economic offense of repudiate and professional elites. Generally, the criminals who are obligating these kinds of crime are expertise in technology and its set ups. The economic loss incurred through white-collar crimes is far higher than that of the conventional type. In this chapter authors have discussed about the meaning, nature of the white collar crime and its inception. The authors further discussed about the differentiation between White collar crime and the Blue-collar crime. The authors has also explicated about the white collar crime in different professions i.e. medical, legal profession, education, engineering and corporate sectors etc. and the collective reasons behind the happening of white collar crime. The legislation and some of the important cases has also been discussed in this chapter along with steps to bring reformation in it.

Keywords: *White collar crime, blue collar crime, mens rea, education, legislation.*

1.1 Introduction:

White collar crimes are the crimes which are related to the crime done by the professional who has the high social status in the society. The activities of fraud, corruption, bribery are the most common form of this type of crime. The people who are indulging in this kind of activity are comparably rich people and have a reputation in the society. Generally the doctors, lawyers, engineers and the businessmen are the people who are doing white collar crime in their profession. White collar crime was first introduced by Sutherland in the year 1939 who stated that these are crimes committed by people who enjoy the high social status, great repute, and respectability in their occupation. Most of the types of white collar crime are fraud, insider trading, Ponzi scheme, identity theft cybercrimes, embezzlement, counterfeiting, money laundering, and espionage etc. The basic reason behind the white collar crime is greed of money. Now a days the one who are rich want to get more money and want to become richer, so for earning more money they are indulging in the illegal activities.


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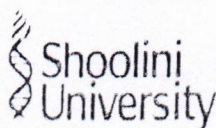
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AN OVERVIEW OF ROLE OF MEDIA IN PROMOTION OF RIGHT TO INFORMATION IN INDIA¹

The pursuit of dominance has always been a driving force in human society. Power can be interpreted in a variety of ways, depending on the context. For example, money is power for an entrepreneur; influence is power for a leader, and so on. When we discuss politics, we are once again dealing with a power struggle. Presently, we survive in a neo-modern era, or as some argue, an Information era, in which information and knowledge are regarded as the most powerful derivative instruments that can even be used to purchase capital. We have a democratic republic government in India, which reflects the will of the people. People must be aware of political goals, the functions of various governmental bodies, welfare programs, legislation, and so on under this type of government. Meaningful democracy should be based on the idea of a well-informed population capable of participating thoughtfully and effectively in the country's governance. Transparency and fair transparency are the two foundations of democratic governance, since it is the basic aim of a democratic government to bring people's will into action and be accountable to them for it. Democracy's "oxygen" is thought to be information. It energizes the environment in which it settles. A democratic government's ability to operate depends on freedom of speech, free dissemination of ideas, and access to information. Since it represents and captures government activities and procedures, information are essential for a healthy democracy and good governance. Availability of information not only allows people to participate actively in the democratic governance process, but it also encourages administration to be free, transparent, and accountable.

The right to information (RTI), which allows anyone to access information held by or under the control of public bodies, may thus be an effective tool for promoting good governance. Data is considered to be democracy's "oxygen." People cannot meaningfully engage in the activities of their country if they are ignorant of what is going on in their society and the actions of those in power are hidden from them. The capacity of a

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UNRESTRAINED BEHAVIOR OF MEDIA IN ERA OF INVIOABLE RULE OF LAW: A THREAT TO RIGHT TO PRIVACY

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MEDIA TRIALS AND ITS EFFECT ON FAIR TRIAL^{1 2}

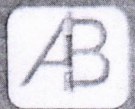
ABSTRACT

"The moment we no longer have a free press, anything can happen. Who makes it possible for a totalitarian or any other dictatorship to rule is that people are not informed"-

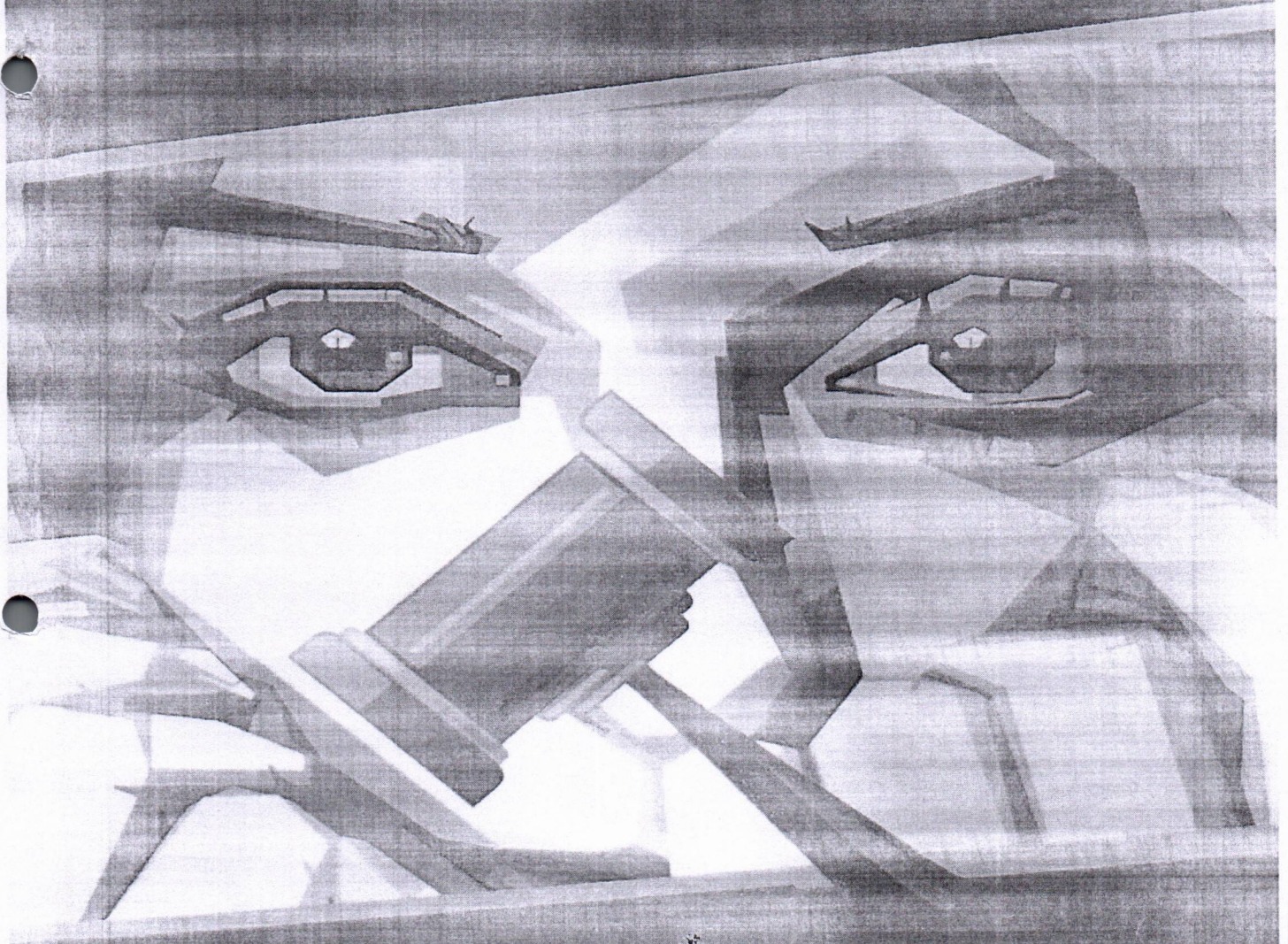
Hannah Arendt

We are living in a democratic country. In a democratic country, participation of each stakeholder is sine qua non. It is not possible until and unless we have the right to freedom of expression. Indian democracy has adopted all best practices to encompass healthy democracy including right to free speech and expression. This very fact can be noticed in the very beginning i.e. preamble of the Indian Constitution as "We, the people of India, having solemnly resolved to constitute India into a Sovereign, Socialist, Secular, Democratic, Republic.....". It gives basic idea of freedom of speech and expression in India. It provides the liberty to every citizen to share his views. However, today the mediums of airing speech and expression are various includes media and social media too. Media is a communication outlet that is usually used for storing and circulating information and data in its various forms like print media, mass media and social media etc. Media is indispensable in modern democracies. It is known as the fourth pillar of democracy and but has its own merits and demerits. Merits include all efforts in providing information and educating people about day to day affairs happening across world. As a demerit, at times it consists of lack of emotional connectivity, inauthentic information circulation, infringement of privacy, and giving more scope to the new generation to indulge themselves in 21st century's crimes like cybercrime. Apart from the other areas of internet, these days media is also imparting justice nowadays. Excess interference of media in the justice delivery system not only infringing the right to privacy of other persons but also creates an illusion in the mind of decision-makers. Through this paper, the researcher tries to critically analyze the right to privacy in the digital era as well as the power of social media in the current scenario. This

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Women Law and Remedies



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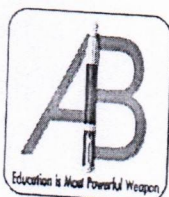
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Women Law and Remedies

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10.

Effect of Mental and Physical Violence on the Life of Women

Dr. Archana Vashishth*

Introduction

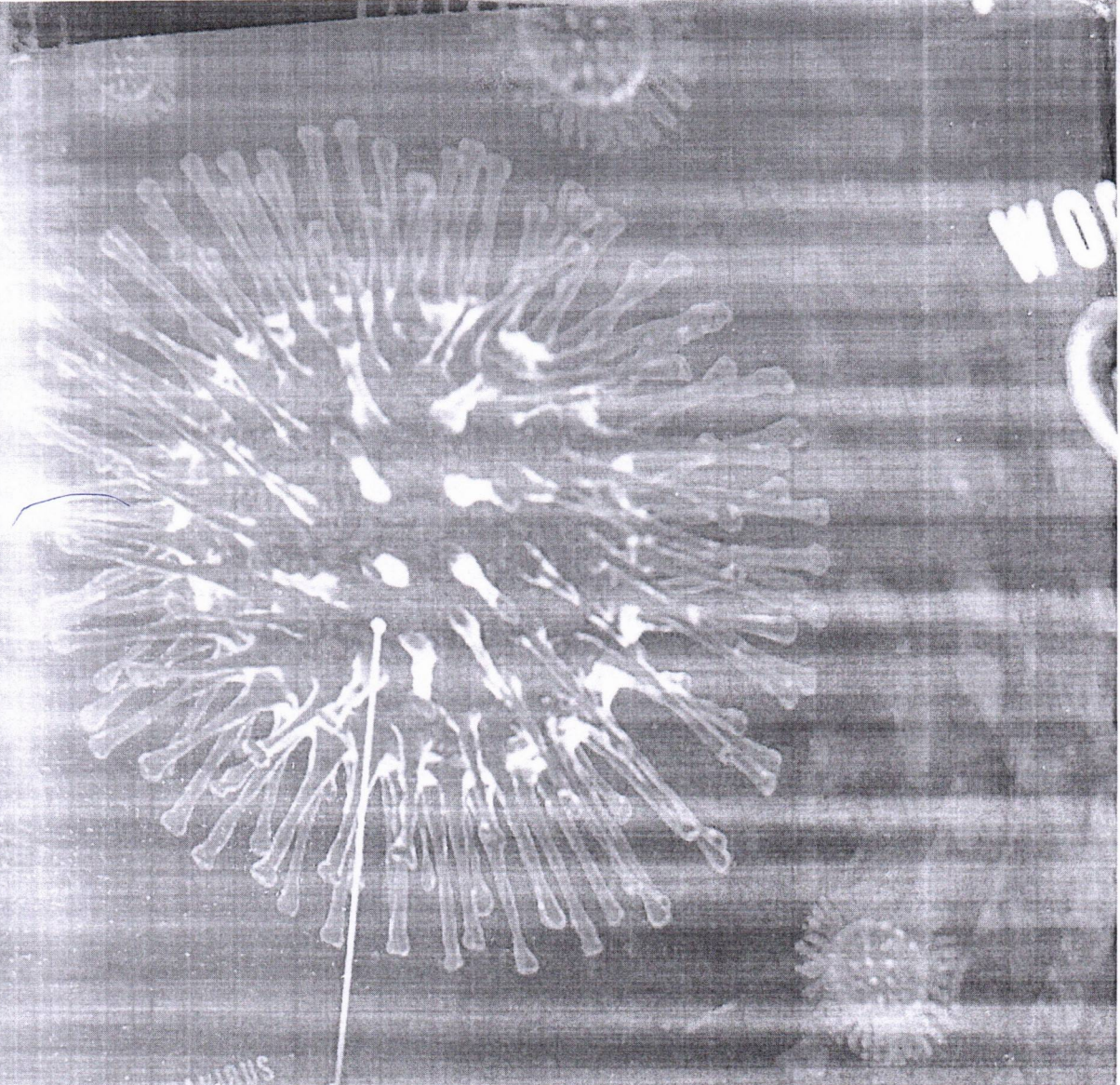
Domestic harassment towards the females in India has identified as a prominent social issue in recent times. A large range of departments, from medical professionals to law management officials, have been monitored. The extent of the health impacts of this issue is uncertain. According to international estimates, at some point in their life, one in three females experiences violent acts in an intimate partnership. This type of abuse may take the form of physical and/or behavioral elements. Physical abuse is characterized as the use of force by the partner to create violence that leads to physical, sexual or psychological damage to some other individual, including hitting, fighting, slapping, punching, firing, dragging, biting, pinching, strangling, psychological aggression and defined as the intentional use of force against some other person, along with the fear of violence that can affect family life.

*Assistant Professor, School of Legal Studies, K.R. Mangalam University, Gurugram.



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BLUES OF COVID-19

TIDING OVER THE PANDEMIC WAVES

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Tiding Over the Pandemic Waves

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Covid-19 India: Corporate and Employment Law Measures Announced by Indian Government

Dr. Archana Vashishtha

Introduction

Corona viruses are a wide family of viruses that can cause animal or human illness. Many corona viruses are known to cause respiratory infections in humans ranging from common cold to more serious illnesses such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The most recent corona virus discovered causes a COVID-19 corona virus outbreak. The first cases of humanity were identified in December 2019, reports Cleveland Clinic. People first started to descend with COVID-19 in central China's Wuhan area, reports the World Health Organization. Wuhan is the capital of the province of Hubei, between the rivers Yangtze and Han. More than 80,000 cases of corona virus were reported in mainland China and more than 3,200 people died the most in the province of Hubei, reports Johns Hopkins University. Like other viruses, the COVID-19 virus possibly spread



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Impact of process variables on surface roughness in negative incremental forming process

Ajay Kumar^a, Vinay Singh^b, Sujata Nayak^c, Amit Kumar^d, Ankit Tyagi^a, Anita Sharma^e

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Abstract

A pivotal development of the obsolescence of conventional methods of sheet forming has enhanced the need of augmenting an agile and novel method of fabricating the tailored components according to the requirements of customers and users. Moreover, businessmen are interested to promote their businesses by manufacturing the tailored and customized parts of intricate and complex geometries at a lower cost and with negligible waste. Single Point Incremental Forming (SPIF), also known as “negative incremental forming”, avoids the direct use of any kind of specific die-sets and produces the user-ready parts. The investigation of the surface quality of the formed specimen is important to study the suitability of this process for industrial applications. This paper explores the effects of the interactions of tool radius and forming angle on the surface roughness of parts formed by the SPIF process. A full factorial approach was taken into account as DOE. The average roughness was found to rise with the rise in forming an angle. On the other hand, the increase in tool diameter resulted in the decrease of Ra value of formed components because the increase in the tool diameter allows the decrease in the waviness on the surface of the specimen. It was observed that the Ra value of formed components was decreased by 83.87% when the experimental condition was changed from the combination of higher levels of wall angle (68°) and lower level of tool diameter (7.52mm) to the combination of lower levels of wall angle (60°) and a higher level of tool diameter (19.50mm).

Introduction

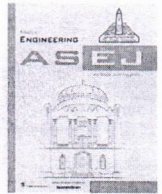
Taking energy and ecosystem issues into consideration, the leading sectors are keen to reduce the emissions generated by various industrial plants. The level of pollution can be reduced up to a significant extent if the need for utilized energy is decreased in the production processes for manufacturing the lightweight of considerable hardness and strength by employing the novel and emerging manufacturing methods. Besides, industrial sectors desire to uplift their businesses by producing customized and tailored products of intricate shapes using some flexible and agile methods of fabrication because of the pivotal progress of obsolescence in the utilization of conventional processes [1], [2]. Furthermore, the sheet metal components are widely used by various sectors that should be fabricated at lower cost and cycle time using suitable forming methods. The sheet metal processing techniques result in a negligible amount of wastage during the operation. However, the involvement of specific tooling and dies during the conventional sheet processing techniques is a great hindrance for implementing the

customized and batch-type production economically. Hence, to accommodate the use of specific tooling and die-sets, bigger size forming machinery is required to perform the forming operations which increases the required cost and energy for producing the components [3], [4], [5]. Furthermore, the need for a flexible and agile approach of forming the customized products economically can open the channel for reducing the emissions by utilizing lower energy and smaller machinery. Incremental Sheet Forming (ISF) is the flexible process of forming the components of sheet materials for different applications including automobile, medical, and aerospace without involving dedicated die-sets. During ISF, various intricate and complex shapes can be fabricated from a range of materials using a single tool that is moved over the surface of specimen layer by layer on any milling machine or industrial robot [6], [7], [8]. The tool is actuated by the numerical instructions that are usually generated by CAM software for the designed CAD model of the desired shape to be produced. The origin of the ISF process was established by Mason's [9] in 1978. However, related work was also reported in two patents [10], [11] issues in 1967. The ISF finds wider application including automobile components, aero-foil and fuselage parts, ankle and knee implants, cranial plate, customized channels, etc. [12], [13]. Single Point Incremental Forming (SPIF) is one of the types of ISF process and also known as "negative incremental forming". The working principle of the negative incremental process is shown in Fig. 1.

The exploration of surface roughness of the sheet parts fabricated by this die-less method can greatly help in increasing the implementation of this process to the mainstream of manufacturing industrial units. Furthermore, the investigation of impact parameters of negative incremental forming on the surface quality of the produced parts has the potential to widen the scope for researchers and engineers to raise the suitability of this die-less method at an industrial scale. Although, researchers have performed some studies to show the influence of input parameters on surface roughness during this process that is not significant.

Mulay et al. [14] explored the influence of process factors like the diameter of the tool, the thickness of the sheet, step down, and feed rate on surface roughness using AA5052-H32 Al alloy sheets. It was found that punch radius and step size were the most contributing factor for surface roughness. Kumar and Gulati [15] explored the input variables for average roughness and found that the tool radius, tool geometry, and viscosity of forming oil were the most contributing factors. They also provided the statistical model to predict the average roughness. Vijaya et al. [16] investigated the effects of step size, wall angle, and tool material on the surface roughness of the IS513 Cr3 sheet. It was observed that to obtain a good surface finish, tool diameter was kept at a higher value and step depth was kept at a lower value. Kumar et al. [17] studied the impact of tool rotation and tool radius on surface quality and found that the combination of higher tool rotation and higher tool radius produces good surface quality during SPIF operation. Dabwan et al. [18] also investigated the influence of various parameters on surface profile. It was found that a better surface finish was achieved with lower sheet thickness, the larger diameter of the tool, and minimum step down. Mohanty et al. [19] also studied the effects of various process parameters on surface roughness on Al-1100 alloy sheets. Higher surface roughness was observed for a higher forming angle and feed rate. Kumar et al. [20] studied the impact of tool shape and tool radius on surface quality and found that the combination of flat-end tool and higher wall angle produced poor surface quality. Wang et al. [21] investigated the effect of local temperature in friction stir-assisted ISF on the surface quality of AA2024-T3 alloy sheets. Surface roughness was estimated by two types of scales namely fish scale & cutting scale.

It has been noticed from the literature report that the interactions of wall angle and tool diameter have not been explored significantly during SPIF. Furthermore, the SPIF process has not been implemented in the mainstream manufacturing industries because of a lack of proper guidelines about the influence of impact factors which affect the surface roughness of formed components significantly. The knowledge about the impact of wall angle, tool radius, and their interactions on the surface quality of formed parts during SPIF would open the new window for implementing this technique in manufacturing units. Therefore, it becomes crucial to perform the experimental campaign to explore the significance of crucial input variables on the surface quality of formed parts. Furthermore, AA2024-O is an important alloy that can be widely used in various sectors including aerospace, automobile, medical, and architects because of its favorable characteristics like greater toughness, resistance to corrosion, the ability of damage control, moderate hot hardness, and lightweight [22]. The current study attempts on investigating the impacts of wall angle, tool radius, and their interactions on average roughness on AA2024 sheets. These input variables and their interactions have not been explored on AA2024 alloy sheets for average surface roughness so far.



Game theoretic and non-game theoretic resource allocation approaches for D2D communication

Roopsi Rathⁱ*, Neeraj Gupta

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ABSTRACT

Device to Device communication involves communication between two devices without routing the packet through the cellular network. Ideally, the process involves reutilizations of the ideal resources of the cellular network for communication purpose. This ensures better management of radio spectrum and reduces communication delay. However, resource allocation has also been a major challenge because it contributes to various problems like interference, throughput issues and many other. A lot of work has been carried out in the recent past to address the above issue. The current paper reviews the work done in the area of resource allocation in the context of device to device communication. Among various mathematical tools available it was brought into being that game theory has been extensively used to address the problem. The main contribution of the paper, it provides the insight into the evolution that has been made in the area of resource allocation and highlights various open issues that need to be addressed.

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1. Introduction

Due to a rise in the number of portable devices, there is a need for networks which can support a higher data rate. It is predicted that the data traffic will raise 1000 times within coming next 10 years [1,2]. This extensive need for channel capacity asks for spectral efficiency. Device-to-Device (D2D) communication technology allows the devices to connect with each other with or without the participation of network accessories like a base station or access point [3–5]. The communication between mobile users is initiated by either utilizing ideal cellular licensed spectrum or through dedicated unlicensed spectrum without traversing to the core network [6,7]. The close proximity between the different D2D users improves the reliability of users, offload traffic, system capacity, spectral efficiency, higher throughput, delayed time and energy efficiency within the wireless network which is not possible in traditional cellular communication [8,9]. Fig. 1 describes as a

general scenario for the device to device (D2D) communication, it includes vehicle communication, relaying of data, content distribution in concerts, cellular video streaming. The next-generation communication technology, including 5G guarantees more devices to be associated more efficiently (see Tables 1 and 2).

By the assertion of spectrum sharing, the device to device correspondence can be organized into two types, i.e. in-band and out-band [10,11]. Fig. 2 illustrates the classification of D2D communication based on the spectrum. The in-band D2D recommends using the cellular spectrum for both cellular and D2D devices. The same radio resources of the cellular users can be reused by the D2D users in the underlay in-band D2D communication, due to which the problem of interference mitigation occurs between both D2D and cellular connections. In contrast, in overlay in-band D2D communication, assigns a dedicated portion of cellular resources to D2D devices and the rest of the spectrum resources used by cellular devices. In out-band D2D communication discards the interference problem between cellular and D2D devices by utilizing the unlicensed spectrum like Bluetooth and Wi-Fi direct [12,13]. The out-band D2D is considered as controlled and autonomous. In controlled out-band D2D, the radio interfaces are either handled by the access point or BS, whereas in autonomous out-band, these radio interfaces are handled through the users themselves.

The majority of literature work is contributed towards the underlay in-band D2D communication. D2D communication in

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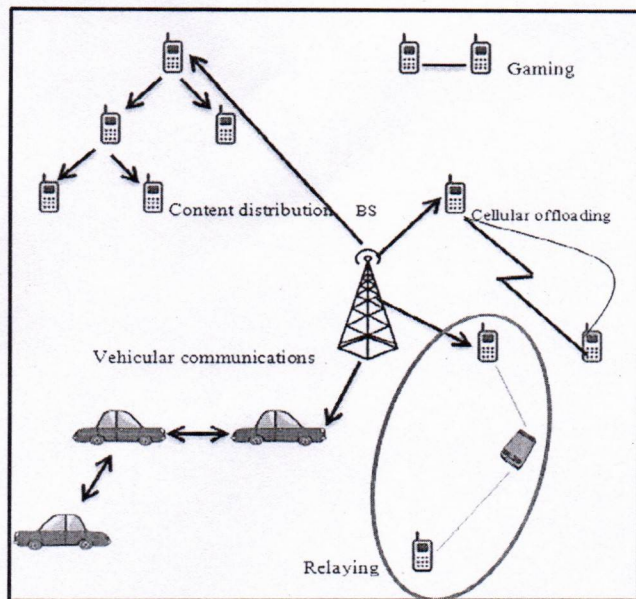


Fig. 1. A general scenario for the device to device (D2D) communication.

Table 2

Represents the comparison of different game theoretic-based resource allocation algorithms for D2D communication.

Reference	Objective	Game theory model	Algorithm
[66,67]	Channel distribution for D2D users by reiterative best response algorithm	Stackelberg game theory (Leader and Follower)	Joint scheduling and resource allocation algorithm
[74,75]	Assigning the channel for D2D users by reiterative bid Algorithm	Auction game theory (Bidder and Auctioneer)	A reverse iterative combinatorial auction (RICA) algorithm
[64]	Power allocation in D2D communication for all users by reiterative bid algorithm	Non-cooperative static Game	Joint power allocation for D2D
[84]	Power and route algorithm using dynamic scheduling	Coalitional graph game	Myopic dynamic algorithm
[39]	Channel assignment and power allocation sub- problem	Nash bargaining game	Optimal resource allocation Algorithm
[70]	Resolve the selfish behaviour of UE/BS and acquired the equilibrium	Nash Equilibrium and game theory	Linear search Algorithm for UQBS System
[33]	Efficient allocation of resources by max-coalition	Coalition formation game approach	Merge and split based Algorithm
[85]	Power allocation and rate enhancement of relationships between device users	Matching Theory social	Utility function maximization (UFM) D2D links redistributive algorithm

has been extensively used to address the problems concerning resource allocation. The main contribution of this article is it gives insight into literature concerning the application of game theory in resource allocation in context to D2D communication. The Section 2 of the paper concerns with the basis of D2D communication

underlay cellular network shares the same radio resources with cellular users to improve the system capacity and throughput. This leads to the problem of resource allocation the same cellular resources to D2D users. In literature various solutions for allocating the resources efficiently has been proposed, including game theory, graph method, column generation method and heuristic optimization. It is observed that among all the mathematical tools game theory is prominently used because as a decision-making tool, it can easily analyze the complex interaction amongst interdependent rational entities/players and predicting their set of approaches [15,16].

The current paper provides a detailed survey concerning the resource allocation in the D2D communications. The Game Theory

Table 1

Represents the comparison of different non-game theory-based resource allocation algorithms used for D2D communication.

Reference	Objective	Algorithm used	Description
[49]	Maximize throughput. Optimal Spectrum utilization. More D2D users get into the communication.	Greedy heuristic Algorithm	Common resource blocks (RBs) are formed as a Base Station assigns the unassigned RBs of CUEs to the DUEs.
[56]	Intra and inter-cluster Interference management. Optimizing the resource allocation and power for all the user and accomplishing Necessary transmission rate.	Power control and Resource allocation Algorithm	Provides required QoS. Cluster based interference and Power management. Minimum energy consumption in high rate services.
[57]	Energy Efficient resource allocation and distribution in D2D communication	Heuristic Algorithm and nonlinear Programming	Optimal allocation of resources. Provides maximum throughput Minimizing the transmitted power of DUEs.
[58]	Maximize DUE to pair with a QoS constraint	CAC scheme	Call admission control works on a first come first serve basis. Maximum D2D pairs and its average transmission power are analyzed with full CSI. Maximum transmit power constraint. DUEs give inclination over CU. For Resource Block allocation.
[47,48,59]	Maximizing the system capability with the presumption of higher DUEs as compared to CUEs.	Colouring algorithm which allocates resource blocks to each CU and DUE	
[55]	Better system performance may be achieved. Minimize CU interference.	Heuristic Optimization resource Allocation (HORA) Algorithm	Guarantees the channel quality to D2D users. The channel quality of DUEs and transmission requirements of CUEs measured in parallel.
[43]	Better spectrum efficiency and throughput. Achievable access pattern for joint power control and RB scheduling.	Column generation approach, branch-bound algorithm	Maximum power constraint. Minimum transmission length of time slots for D2D connections by considering resource block scheduling.
[60]	Maximizing weighted sum throughput for D2D users and minimizing the rate for cellular users.	Iterative resource allocation algorithm	Iterative approach is based on two segments, i.e. power sub channel and bandwidth sub channel assignment.
[28]	Optimization of data sum rate, which considers resource allocation, it also observes energy/ transmit power	Resource sharing in cellular and D2D communication	Data transmission in non-orthogonal, orthogonal, reuse cellular resource modes are developed to achieve maximum data sum rate
[54]	Better fairness and system throughput	Adaptive time division (ATD) scheduling algorithm	By using Proportional fairness scheduler, D2D users reuse cellular resources for a time slot.

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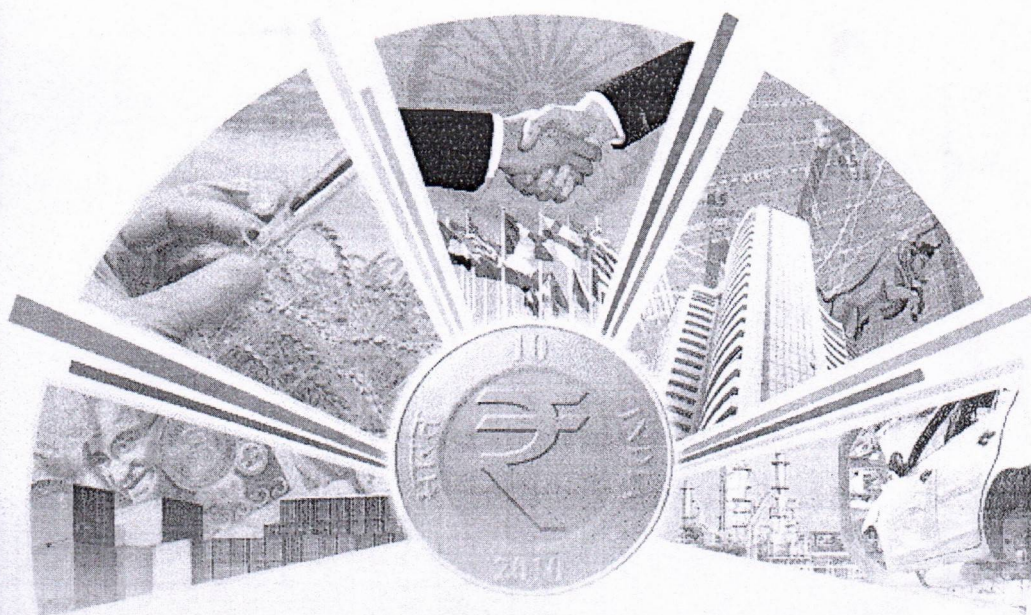
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FUTURE PROSPECTS AND CHALLENGES



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Micro Finance Institutions and Inclusive Growth

Amit Parmar*
Dr. Richa Nangia**

Introduction

For Inclusive growth Micro financial Institutions plays an important role. On the micro economic and macroeconomic levels, an inclusive financial system has virulent repercussions. Financial inclusion, according to Conroy (2006), improves economic efficiency and equity distribution by allowing a large number of people to deposit money and providing fruits of economic growth that can be shared by all. Previously, only a few academic studies on the financial sector's performance in terms of financial inclusion and its impact on economic growth (Agnello 2012, Claessens et al 2007 Ashta,2010) concluded that The financial sector plays a unique role in the promotion of growth in underdeveloped countries.

Microfinance is a type of financial service that gives poor and low-income people small loans and other financial services. It is a financial inclusion tool that enables poor and low-income households to rise out of poverty, boost their income levels, and improve their overall living standards. It can aid in the implementation of national policies aimed at reducing poverty, empowering women, assisting disadvantaged groups, and raising living standards.

Over the last two decades, the Indian microfinance sector has seen tremendous expansion in terms of both the number of institutions providing microfinance and the amount of credit accessible to microfinance users. Microcredit is distributed through a number of institutional channels, including I scheduled commercial banks (SCBs) (including small finance banks (SFBs) and regional rural banks (RRBs)) lending both directly and through business correspondents (BCs) and self-help groups (SHGs), (ii) cooperative banks, (iii) non-banking financial companies (NBFCs), and (iv) microfinance institutions (MFIs) registered as NBFCs, as well. As per RBI there are total 197 lenders in the country which are actively dealing into microfinance with total loan amount outstanding Rs 2,27,942 crore .

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Performance Analysis of Complex Manufacturing System using Petri Nets Modeling Method

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Abstract. The Petri nets modeling method is a powerful tool for the performance analysis of industrial systems. The main factor which makes it more effective among the various popular simulation methods is the ability to deal with the real working conditions. The data obtained from such a manufacturing system is generally full of uncertainties and the Petri nets modeling method deals with this data to reflect the real behavioral pattern of different sub-systems installed in the plant. The Petri nets-based simulation method provides the availability of the sub-systems for a long time period by running the plant in virtual manners. The results obtained through the analysis can be utilized to identify those sub-systems which highly affect the system availability and separate maintenance planning for each sub-system can reduce the production loss due to unavailability of any sub-system for performing its intended task. The proposed methodology has been demonstrated in this paper using a complex repairable manufacturing system.

Keywords: Petri Nets, Performance analysis, Steady-state availability, Manufacturing system.

1. Introduction

The new emerging industrial systems are entirely focused on assuring the maximum output and higher quality of product through the advancement in engineering systems under the concept of performability. The prime objective of utilizing the available resources is also a fundamental need for the satisfaction of higher expectations. The complexity of these industrial systems is even higher, recognizing the demand for automation and large systems, consisting of series-parallel sub-systems of higher configuration is a true challenge for system analysts. Besides this, making the optimum balance between the large initial investments and continually maintaining high standards of the competitive market is another test for the industrialists. Knowing the reality of actual situations, performance analysis of industrial systems is the only way to move ahead toward the predefined targets. The proposed simulation method for different industrial systems has been used to evaluate system performance. Adamyan and He [1] suggested that system reliability and safety depend not only on the failed states but also on the sequence of failures. For this, they have presented a methodology to determine the occurrence of failures using Petri nets. Bahl et al. [2] utilized the Petri nets approach to determine the behavior of distillery plant through the variation in input parameters of various components and suggested the most critical component which highly influences the plant availability. Florin et al. [4] presented a study on the Petri



nets model which includes stochastic behavior of timed transition firing choice and provides an approximate solution for a case example of bus allocation. Garg and Sharma [5, 6] applied the Petri nets and Lambda-Tau methodology for RAM analysis of the complex system of urea manufacturing industry. They have also performed the sensitivity analysis for the system in terms of system availability and reliability against the different combinations of input parameters. Kumar et al. [8] used the Petri nets modeling method for the performance assessment of a milk processing plant. They have also performed the profitability analysis for this system. Kumar et al. [9, 10] used the Markov modeling method to analyze the system performance. They have also used the GA and PSO algorithms for performance optimization. Kumar and Aggarwal [11] developed a Petri nets model for performance evaluation of computer program execution in distributed processing system and suggested the two reliability measures to determine the probability of computer program execution. Haiyue et al. [12] proposed general procedure of modeling for reliability evaluation of a critical system and demonstrated through an example to show the effectiveness of proposed approach. Haverkort and Niemegeers [13] proposed a performability modeling technique especially for the system which can be partially operable. Through this framework, they have suggested a few general rules for performability modeling software tools in terms of their adaptability and output. Holliday and Vernon [14] analyzed the performance of computer system through the Petri nets modeling method and showed the capability of PN model for parallel system to obtain an accurate estimation of system performance. Leveson and Stolzy [15] described the application of Petri nets model in software development process. They explored the possibility for the software reliability analysis for its properties i.e., safety and fault-tolerance to determine the criticality of functions in certain conditions. Lindemann [16] proposed an improved randomization technique for DSPN model to determine the steady-state solution process. This technique is easy to implement and provides comparatively stable numerical solution. Liu and Chiou [17] suggested that in reliability engineering, Petri nets model is more efficient than fault trees for system failure analysis and to describe the relation between events and conditions. Molloy [18] analyzed the system performance using Petri nets and Markov process with the exponential transition rate. They have also suggested that Petri nets model is much simpler for its specification as compared to Markovian analysis. The discrete-time PN model provides improved human interface and better specification mechanism. Sachdeva et al. [19, 20] analyzed the behavior pattern of pulping and screening system in a paper plant for reducing overall operation and repair costs. They proposed the Petri Nets-based methodology to compute the reliability parameters using Monte Carlo simulation of the Petri Nets model and the effect of parameters on system availability have also been discussed.

It is observed in the literature that the researchers have successfully investigated various industrial systems using Petri nets modeling method, the present deals with the performance analysis of a complex manufacturing system using the Petri nets modeling method to reflect the real system behavior using the uncertain data. The obtained results will be highly beneficial in future maintenance planning for the different sub-systems.

2. System description

The dished end (DE) manufacturing system is part of container manufacturing process. The dished ends are manufactured in this system to install on the ends of a shell. This process completes the manufacturing of heavy-duty containers mainly used to store the chemicals. The schematic process flow diagram of the DE manufacturing system is shown in Figure 1 [10].

- *Sub-system A:* It is a gas cutting machine used to cut the circular pieces for the manufacturing of dished ends.
- *Sub-system B:* It is a hydraulic power press used to obtain the required curvature in the dished end.
- *Sub-system C:* These are two submerged arc welding machines installed in parallel and it is used to join the dished end with the shell.

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