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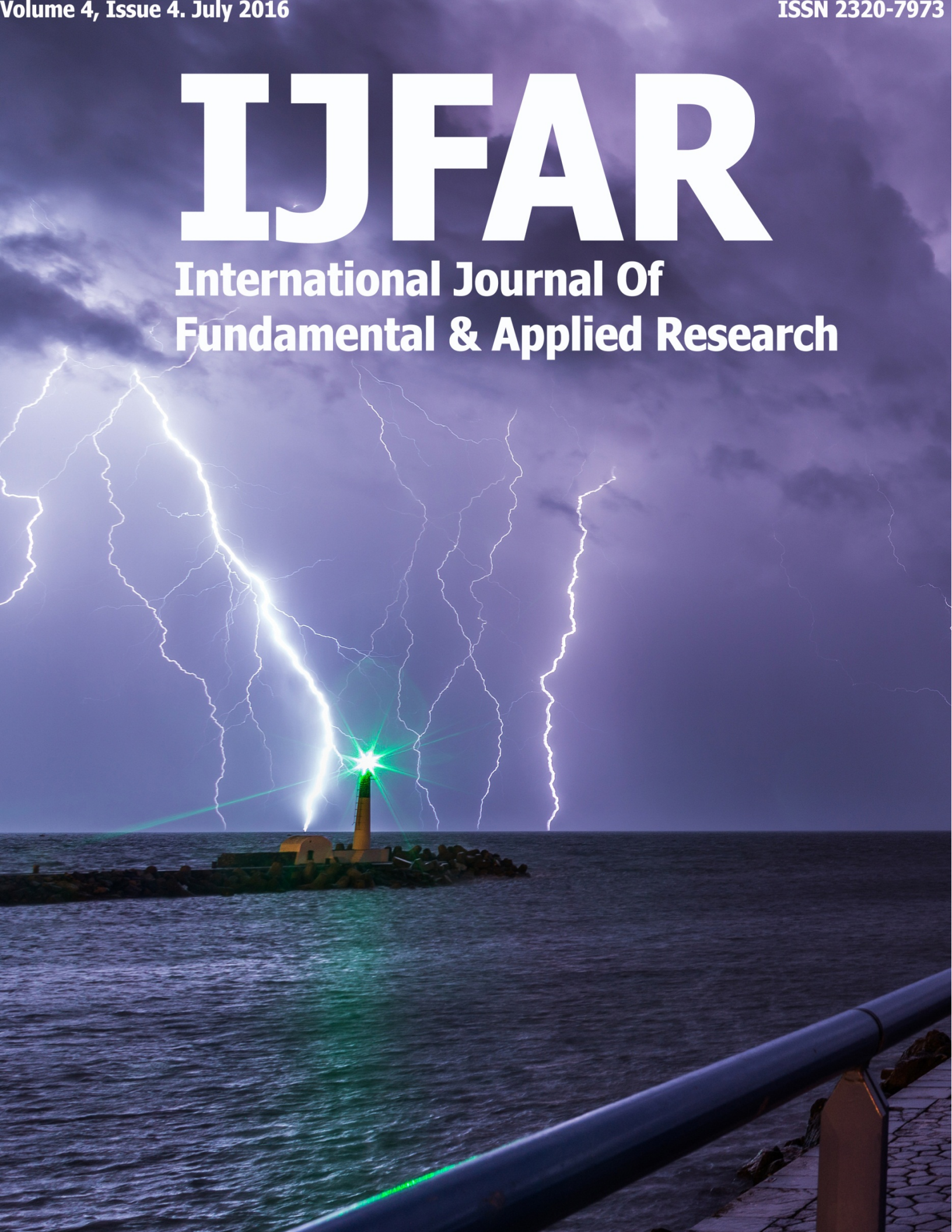

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Content

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Degradation of Toxic Chemicals by Zero-Valent Metal Nanoparticles

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ABSTRACT
Zero-valent iron (ZVI) has been the main focus of zero-valent metal particle which is commonly studied due to its low cost and non-toxicity. So far, iron is the only zero valent particle to be studied for its oxidative degradation properties. The ultimate aim of researchers in the area of decontamination is to develop the perfect decontaminant - a substance that will degrade all contaminants but will leave surfaces and environments unharmed. particular iron, whose size is on the nanoscale, have incorporating nanoscale ZVM particles onto solid supports which may be useful for increasing the lifetime, activity and usability of the particles. The zero-valent metal particles (ZVMs), in the primary application of ZVI-catalyzed degradation that has been looked at its use in permeable reactive barriers to decontaminate water. These are designed to go in-situ into a contaminated water flow, primarily groundwater. Such barriers incorporate mainly granular iron particles. However, the increase in surface area and energy gained by using nanoscale particles increases the decontamination potential of the particles. Another important consideration in the effectiveness of ZVI is the way in which the catalyst particles are incorporated into the system. A variety of solid supports may be used or particles can be incorporated into polymer shells or matrices. . The zerovalent metal (usually granular iron) is the bulk reducing agent as basic chemistry of iron corrosion was also discussed .Degradation via reduction Using different types of metals such as scrap iron of construction grade has been used as a reactive material for permeable reactive barriers for groundwater remediation. In addition to using "typical" scale iron in PRBs, nanoparticles (1-100 nm diameter) containing zerovalent iron (nZVI) may be used. Chloramines pose a threat to aquatic ecosystems that are exposed to discharges of treated wastewater.Between the nanotechnology and the environment actually there is a quite mismatch between claims and realities has illustrated in view of modern era . Finally, possible challenges to developing ZVMs as a decontaminant are discussed.

OBJECTIVES OF THE STUDY

Zero Valent Iron (ZVI), elemental metallic iron, reduces waterborne inorganic ions, releasing soluble Fe(ll) in their place, which oxidizes further into Fe(III). Coal mining drainage is an example where ZVI has treated contaminated water safely, effectively and economically. In chemical terms, ZVI describes the elemental form of iron, and refers to the zero charge carried by each atom—a result of the outer valence level being filled. These characteristics allow ZVI to convert oxidized elements—which may be toxic and soluble in water into immobile solid forms. ZVI chemistry allows for effective, reliable reduction of waterborne contaminants that works for industry as well as the environment. Nanotechnology is one of the fastest growing sectors of the high-tech economy, with more than 800 consumer products using nanomaterials with personal, commercial, medical, and military uses. The term *nanoparticle* is generally used to refer to a small particle with all three dimensions less than 100 nanometers (nm). Its small size and large surface area per unit mass

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impart characteristics that can be useful in hazardous waste site remediation and contaminant reduction. Decontamination is an important aspect of operations in a chemically or biologically contaminated environment. Development of such a 'perfect decontaminant' is the ultimate aim of decontamination practitioners, that is, to develop a decontaminant that can be used for all applications and situations. To achieve this aim there are certain criteria that must be kept in mind when developing a decontaminant. It is necessary for a decontaminant to achieve complete destruction of the contaminant as fast as possible. Logistical considerations further emphasize the need for a highly reactive decontaminant. A conflicting requirement is for the decontaminant to be non-destructive to surfaces/substrates such as paints and rubbers. This leads to the difficult situation of developing a decontaminant that iron wall remediation. Nanoscale zero-valent iron (NZVI) particles are typically 5–40 nm sized Fe^0/Fe oxide particles that rapidly transform many environmental contaminants to benign products and are a promising *in situ* remediation agent. Due to their small size and increased reactivity, these manufactured nanoparticles have the potential to be more effective than the microscale ZVI that is already in use for contaminant remediation in soil and groundwater aquifers. However, little is known about the environmental fate of these nanomaterials once they have undergone biological and non-biological processes within a contaminated aquifer. For this reason, it is important to find out what the possible impacts of these nanomaterials are once they enter the environment and how they could potentially affect human health or the environment. Despite these concerns, NZVI technology and its application are a very promising, efficient and cost-effective method for remediating contaminated soil and groundwater aquifer sites.This technology uses ZVIs to form a permeable reactive barrier (PRB) which filters out contaminants in groundwater, leaving only decontaminated ground water and dissolved iron on the other side of the PRB is selective to all contaminants but nothing else. **Zerovalent iron** and zerovalent metals (ZVI and ZVM, respectively) have a variety of applications ranging from filters to electrodes to trenches.

Historical background

Zero-valent iron has been used successfully in the past to remediate groundwater by construction of a permeable reactive barrier (PRB) of zero-valent iron to intercept and dechlorinate chlorinated hydrocarbons such as trichloroethylene (TCE) in groundwater plumes. Currently, zero-valent iron in both the micro and macro-scale is used in PRBs for the purposes of remediation at contaminated sites.The massive surface area and unique properties of nanoparticles have led to much research on their application to environmental remediation. Across the broad array of environmental concerns, research ranges from the use of TiO2 nanoparticles for photo catalytic treatment of nitrous oxides in plant emissions, to the use of naturally occurring metal oxide nanoparticles for the treatment of organic contaminants in groundwater.The closest example to a commercial technology is the use of iron nanoparticles as a reductant for the remediation of chlorinated organics in water; this is a direct modification of the use of iron filings or microscale iron powder for the remediation of chlorinated organics in water.

The development of granular iron PRB technology was reliant on two advances: that metallic irons breaks down chlorinated organic compounds, and that reactions can proceed *in situ* under normal groundwater conditions.**[1]**Metals have been used as catalysts since the 20th century, with more literature available concerning the corrosion of metal shipping and storage containers**.** Because this literature concerned pure solvents rather than aqueous solutions and the processes often occurred at high temperatures and pressures, it was not looked at by the environmental community. In 1972, zerovalent metals were found to be effective in breaking down pesticides and other chlorinated organic compounds in aqueous solution.**[2]**However, this finding was also overlooked, perhaps because it was only recorded in patents and it preceded awareness of chlorinated solvents in groundwater as an environmental problem. In the 1980s, a student at the University of

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Waterloo examined the possibility of sample bias caused by sorption of contaminants to well casings and other materials used in groundwater sampling.[1] While contaminants were lost from solution as a result of diffusion into polymers, contaminant losses were also observed when solutions came into contact with certain metals, and these losses were not consistent with a diffusion process. Reductive dechlorination was considered the most likely cause.**[2]** This was confirmed by tests that showed several transitional metals had the ability to degrade many chlorinated aliphatic compounds.[1] In general, nanoiron particles can treat the following contaminates in a range of geological settings:

Figure 3: Permeable Reaction Barriers.

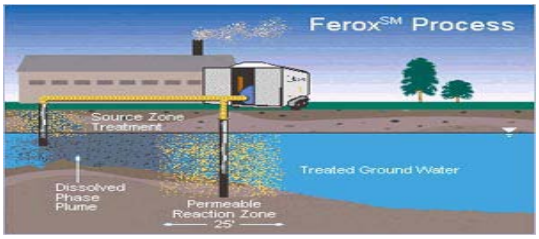

Figure 4: **NZVI Dispersion Via Injection.**

Contaminants:

o Halogenated aliphatics (PCE, TCE, 1,1,1-TCA, 1,1,2,2-TeCA)
o Halogenated aromatics
o PCB
o Halogenated herbicides and pesticides
o Nitroaromatics
o Metals (e.g., Cr6+, As)

Geologic Conditions:

o Sand
o Silt
o Fractured rock
o Landfills
o Fill materials
o Sediments

Permeable reactive barriers

Zero-valent iron has been used successfully in the past to remediate groundwater by construction of a permeable reactive barrier (PRB) of zero-valent iron to intercept and dechlorinate chlorinated hydrocarbons such as trichloroethylene (TCE) in groundwater plumes. Zero-valent iron in both the micro and macro-scale is used in PRBs for the purposes of remediation at contaminated sites. A PRB (Figure 1) most commonly contains granular iron as the reactive medium that degrades chlorinated organics into potentially nontoxic dehalogenated organic compounds and inorganic chloride that precipitates out of the water column and becomes part of the sediment. A PRB, in its simplest form, is a trench built across the flow path of a groundwater plume. The trench is filled with a suitable reactive or adsorptive medium that removes the contamination from the groundwater, thus protecting downgradient water resources or receptors. The use of nanoscale zero-valent iron (NZVI) instead of using micro/macro-scale Fe^0 (zerovalent iron) materials could potentially eliminate the need for using PRBs and be more effective in both cost feasibility and contaminant

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remediation. Several factors play a role in determining a nanoscale iron product's reactivity, including particle size, the amount of reactive surface area, the presence or absence of hydrogenation catalysts (*e.g.,* palladium), the method of manufacture, the morphology of the particle (porosity), the crystalline structure of the particle, impurities.

Description of nanoparticles for site remediation

Nanoscale zero-valent iron particles, with primary particle size less than 100nm, are made by a variety of vendors and shipped as highly concentrated slurries, for use as a reagent to destroy organic contaminants and immobilize inorganic contaminants in groundwater. Several studies have shown that NZVI is very effective for the degradation of halogenated solvents such as chlorinated methanes, brominated methanes, trihalomethanes, chlorinated ethenes, chlorinated benzenes and other polychlorinated hydrocarbons in groundwater (EU paper, 2009). NZVI was also shown to be effective against some pesticides, heavy metals, and dyes. NZVI can be distributed into the subsurface using a variety of carrying fluids. Among the most common are water, nitrogen gas, and vegetable oil. Slurries of water and NZVI powder can be injected into the contaminated zone using nitrogen gas as a carrier. This helps the iron powder disperse in the subsurface and create contact between the contaminants and the iron. Alternatively, NZVI can be mixed with vegetable oil and water to create an emulsion, which is then injected into the contaminant zone (ESTCP, 2006). Researchers hypothesized that chlorinated solvents preferentially diffuse through the vegetable oil and react with the iron inside the emulsion droplet. NZVI will typically be received as stabilized aqueous slurry.

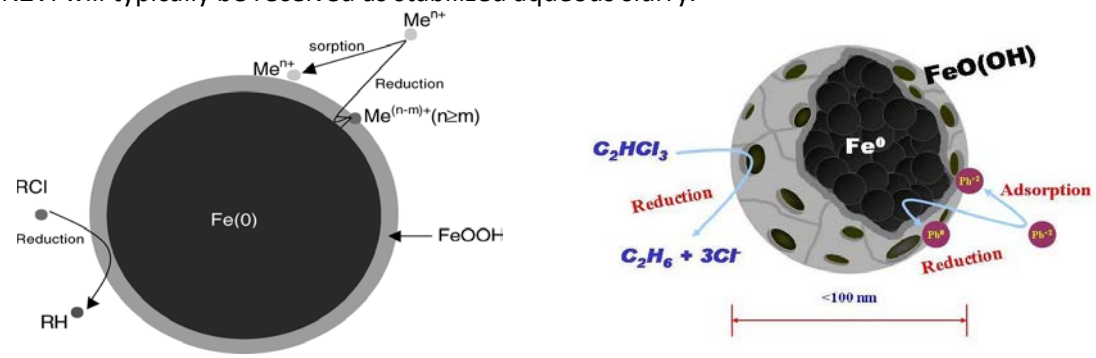

Figure 1: The Core-Shell Model of Zero-Valent Iron Nanoparticles.

The core consists of mainly zero-valent iron and provides the reducing power for reactions with environmental contaminants. The shell is largely iron oxides/hydroxides formed from the oxidation of zero-valent iron. The shell provides sites for chemical complex formation (*e.g*., chemosorption).

Figure 1a: A More Three-Dimensional View of a Zero-Valent Iron Nanoparticle. This figure also shows the porosity of the nanoparticle, which is also an important factor in physicochemical reactivity. Zero-valent nanoiron can also be coupled with trace metals (*ex*. Pt, Pd, Ag), showing significantly enhanced reaction. Nanoiron is potentially benign to the environment and, ultimately, is mainly transformed into Fe_3O_4 and Fe_2O_3, which are abundant on earth.

Besides toxic chlorinated compounds such as TCE, NZVI has been shown to able to degrade other compounds found at contaminated sites such as the organic contaminant trinitrotoluene (TNT), pesticides (DDT), heavy metals (Hg, Ni, Cd, etc.), organic dyes (chrysoidin), and inorganic anions**.**

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A potential remedial scheme using ZVI nanoparticles is shown in Figure 2.

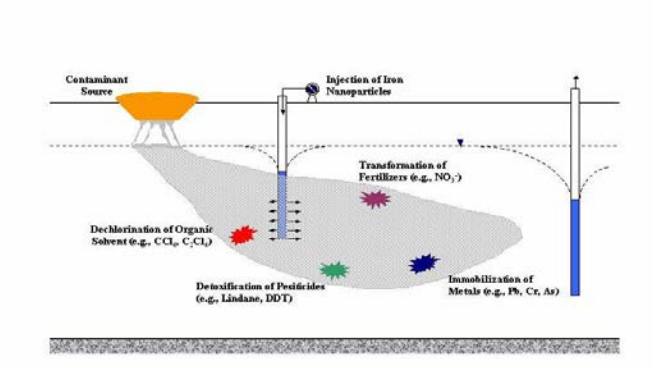

Figure 2

Summary of Environmental Potential

ZVI nanoparticles are the first field application of free-released nanoparticles for environmental remediation. The use of macro-scale ZVI in subsurface PRBs is a well established technology for the reduction of both chlorinated hydrocarbons and toxic metals in contaminated ground water; ZVI nanoparticles use exactly the same chemistry, but take advantage of the increased surface area and the rheological ability of nanoparticles to flow in the subsurface and permeate crevices where contaminants may reside. The technology is potentially applicable in most circumstances where macro-scale ZVI would be employed. Where mixed contaminants, such as chlorinated organics and higher valency toxic metals, are present, ZVI nanoparticles may be able to accomplish the remediation of both types of material. The demonstrated ability of ZVI to encapsulate a heavy metal contaminant (chromium) through a combination of adsorption and reduction processes, and the ability of ZVI to act as a reducing agent offers significant potential for the remediation of radioactive species such as uranium or plutonium where the reduced form of the metal is of much lower solubility and can be effectively removed from solution. Risk issues are not expected to be significant since data, to date, show that the iron nanoparticles do not travel extensively, and nanoparticles of iron oxides (into which nanoparticulate iron will eventually transform) are ubiquitous in groundwater.

These types of passive treatment technologies are designed to be placed on the down-gradient side of a plume to intercept groundwater flow prior to its migration off-site. As the dissolved phase contamination flows through the permeable reaction wall, reduction of the hydrocarbons and heavy metals occurs. Though these types of passive treatment systems are simple to apply at shallow depths and for low concentration levels of chlorinated organics, their applicability and cost-effectiveness are greatly limited at deeper depths and higher concentrations.

An open borehole or direct-push injector assembly casing is used to position the downhole apparatus into the subsurface. Once in place, zero-valent iron powder is injected into the formation as a slurry or as a dry material. Nitrogen gas or compressed air is used as the carrier fluid.

Basic chemistry of iron corrosion

The corrosion reaction involving water is slow, whereas the corrosion of Fe^0 with dissolved oxygen is fast, presuming there is O_2 present. These are the reactive processes:

Anaerobic corrosion: $Fe^0 + 2H_2O \rightarrow Fe^{2+} + H_2 + 2OH^-$

Aerobic corrosion: $2Fe^0 + O_2 + 2H_2O \rightarrow 2Fe^{2+} + 4OH^-$

The presence of a reducible contaminant can produce another reaction which can then contribute to the overall corrosion rate.[3]

$2Fe0(s) + 4H+(aq) + O_2(aq) \rightarrow 2Fe_2+(aq) + 2H_2O(l)$

$Fe0(s) + 2H_2O(l) \rightarrow Fe_2+(aq) + H_2(g) + 2OH-(aq)$

$4Fe_2+(aq) + 4H+(aq) + O_2(aq) \rightarrow 4Fe_3+(aq) + 2H_2O(l)$

$2Fe_2+(aq) + 2H_2O(l) \rightarrow 2Fe_3+(aq) + H_2(g) + 2OH-(aq)$

The second proposed model

The zerovalent metal (usually granular iron) is the bulk reducing agent in these systems. However, corrosion of iron metal yields Fe^{2+} and hydrogen, both of which are possible reducing agents for contaminants such as chlorinated solvents. A heuristic model consisting of three possible mechanisms has proven very useful. Pathway A represents direct electron transfer (ET) for Fe^0 to the adsorbed halocarbon (RX) at the metal/water point of contact, resulting in dechlorination and production of Fe^{2+}. Pathway B shows that Fe^{2+} (resulting from corrosion of Fe^0) may also

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dechlorinate RX, producing Fe^{3+}. Pathway C shows that H_2 from the an aerobic corrosion of Fe^{2+} might react with RX if a catalyst is present. Hydrogenation also plays a minor role in most systems and iron surfaces will be covered with precipitates of oxides (or carbonates and sulfides) under most environmental conditions. Concern stemming from how the oxide layer mediates transfer of electrons from Fe^0 to adsorbed RX led to the formulation of another heuristic model, again consisting of three mechanisms.

In the second model, pathway I shows essentially direct ET from Fe^0 to RX in a corrosion pit, or similar defect in the oxide film. Pathway II shows the oxide film mediating ET from Fe^0 to RX by acting as a semiconductor.

Sequestration

Sequestration of a contaminant refers to a removal process which does not involve contaminant degradation. Sequestration by Fe^0 typically occurs via adsorption, reduction, and coprecipitation. Often, adsorption is only a prelude to other processes which do transform the contaminant in order to assure that the process cannot be reversed. However, there are cases where adsorption is the sequestration process of primary importance, especially with metals that occur as soluble cations which cannot be reduced to insoluble forms by Fe^0. It also can be true in heavy metals, such as Cd, Cu, Hg, etc., which exist predominantly as soluble cations but could be reduced to insoluble species by Fe^0**[3]**

Degradation via reduction Using different types of metals

Cast iron, **[4]** consisting of scrap iron of construction grade, has been used as a reactive material for permeable reactive barriers for groundwater remediation. Reactions are generally believed to occur on the Fe (oxide) surface; however, graphite inclusions have been shown can also serve as a reaction site for 2,4-Dinitrotoluene (DNT)**[5]** ,High purity iron indicates commercial, granular iron for powder metallurgy, etc. Zinc has showed much higher reactivity toward pentachlorophenol than iron. This indicates that zinc may be used as a replacement for ZVI in dechlorinating chlorinated phenols. Chlorinated phenols are sequentially dechlorinated and thus less chlorinated phenols have been identified as a reduction product.**[6]**

Bimetallic combinations

Polychlorinated biphenyls (PCBs) are decontaminated using a treatment system including catalytic ZVM particles and an organic hydrogen donating solvent. The solvent includes water and an alcohol. The treatment system can contain a 2nd solvent, such as d-limonene, toluene, or hexane. The treatment system can contain a thickener, such as calcium stearate orstarch. The treatment system can contain a stabilizer, such as glycerin,mineral oil, or vegetable oil. The catalyst consists of zerovalent metal particles, esp. magnesium or iron, coated with a catalytic metal, such aspalladium, nickel, or zinc. The treatment system provides a paste-like system that is preferably applied to natural media and ex-situ structures.**[7]**

Nanoscale particles

In addition to using "typical" scale iron in PRBs, nanoparticles (1-100 nm diameter) containing zerovalent iron (nZVI) may be used. There are uncertainties regarding the features of this technology which have made it difficult to engineer applications for optimal performance or to assess the risk to human or ecological health. However, several key facts have been identified related to nZVIs which, if ignored, may lead to misconceptions of the technology. These are as follows: 1) nZVIs used ingroundwater remediation are larger than particles that exhibit "true" nano-size effects 2) the high reactivity of nZVI is mainly due to its high specific surface area and 3) the mobility of the nZVI particles will, in almost all relevant scenarios, be less than a few meters (one implication of this limited mobility is that human exposure due to remediationapplications of nZVI is likely to be minimal). However, there are still many characteristics of this technology about which very little is known: e.g., how quickly nZVI will be transformed and to what products, whether this residue will be detectable in the environment, and how surface modifications of nZVI will alter its long-term environmental fate and effectiveness for remediation.[4]

Sources of nanoparticles

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The top-down approach for manufacturing nano-ZVMs starts with a large metal particle (granular or microscale) and breaks it down. To do this, either mechanical or chemical means may be used which include but are not limited to milling, etching, and machining.**[8]** The bottom up approach involves "growing" nanoparticles via chemical synthesis, self-assembling, positional assembling, etc.**[8]**

Type of contaminanated Inorganics Metals already treated

Chromate is a significant component of many radioactive contaminant plumes. One removal technique involves the addition o scrap metal iron. The reactive surface of ZVI in alkaline waters is a ferrous coating such as green rust.**[9]** In the case of treating arsenic-contaminated water, materials with a high potential for anion \adsorption and coprecipita **ac** desirable. It is also beneficial to have a high potential to reduce the contaminant to an insoluble solid. For the removal of arsenic, the following is the chemical process involved:

$FeCl_3 + 3H_2O + [As] \rightarrow [As]Fe(OH)_3 + 3H^+ + Cl^-$

Technetium, a radioactive material, is of great concern due to its long half-life and abundance in commercial nuclear waste. Technetium in lower valency states has a lower solubility and sorbs more strongly to soils than does Te^{7+}. ZVI has the potential to remove technetium in groundwater.**[10]** To remediate groundwater contaminated by uranium a treatment has been developed to minimize the mobility of uranyl by transferring it to a stable phase. Because the exact mechanism of the decontamination process is unknown, numerous forms of ZVI-materials have been synthesized, including carbon steel, low alloy steel, cast iron, and all other iron-containing alloys.**[11]**

Non-metals

Chloramines pose a threat to aquatic ecosystems that are exposed to discharges of treated wastewater. Dechlorination with sulfite reduces the most refractory organic chloramines too slowly to produce wastewater effluents that meet current ecosystem protection criteria in the United States. The aqueous-phase reducing agents that offer speed advantages over sulfite alone include dithionite, thiosulfate, and iodide-mediated sulfite. Ascorbic acid was even more reactive but was found to be slow relative to sulfite. The potential biological oxygen demand might constrain the choice of aqueous reductants. Metallic iron is shown to reduce inorganic and organic chloramines effectively.**[12]**

Nitrate

Rapid nitrate reduction by iron powder is observed only at pH≤4. pH control with sulfuric acid prolongs nitrate reduction and increases the amount removed.**[13]** Ammonia is the end product of nitrate reduction and accounts for all nitrate transformed under certain experimental conditions.**[13]**However, by using nanoscale iron N_2 gas is the product instead.**[14]** Ferrousspecies, Fe^{2+} and $Fe(OH)_2$ are probably not involved in the reaction.**[**14]

Pesticides

It has been shown to be successful at dechlorinating DDT, DDD, andDDE. The rates of dechlorination was independent of the amount of iron; however, the rates with a surfactant (Triton X-114) present were much higher. The rate of dechlorination is limited by the rate of dissolution into the aqueous phase.**[15]**

Viruses

Viruses are especially problematic in the environment because they are more mobile and more resistant to chlorination and filtration than are bacteria. Removal of viruses from groundwater involve several different forms of iron, including Fe^0, Fe^{2+}, and magnetite. Additionally, viruses can interact with iron in different ways, and thus can be deactivated to different extents.**[16]**

Challenges to the Application of ZVI Nanoparticles

Permeable reactive barriers can be less effective at greater depths due to construction matters, as most construction techniques involves excavation of the soil and replacing with reactive media. Soil mixing wall (SMW) technology, which is establishing cut-off walls and mixing cement slurries directly with soils under the ground, has become a new technology in soil remediation. **[17]** During investigations of the potential of ZVI to reductively decontaminate compounds a few challenges to its practical application have arisen. The first is that the reactivity of iron decreases with time possibly due to

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formation of metal hydroxides or carbonates that partially passivate the surface. Secondly the iron surface loses reactivity on exposure to air as it is oxidised by atmospheric oxygen. This oxidation is exaggerated when nanoscale particles are used .Another limitation, in terms of chlorinated hydrocarbons, is that the iron reactivity decreases with the degree of halogenation resulting in an accumulation of these compounds, eg vinyl chloride, which have toxicological implications.**[18, 19]** .Various methods have been used to try and overcome these challenges**.[18]** These include ultrasound **[20]** bimetallic species and use of external voltage.

Conclusions and Recommendations

The NZVI technology can be a suitable remedy for eliminating or mitigating a contaminant source zone. Although the NZVI injection technology itself is fairly young, the use of zero-valent iron to treat chlorinated contaminants is well-established and accepted. In some cases, ZVI at the macro and micro size scale is more cost-effective and more efficient than NZVI in terms of reduction of contaminant concentrations and longevity. NZVI can also potentially remediate contaminated groundwater sites in a faster period of time than using larger sized ZVI materials in PRBs. This will also contribute in making utilization of NZVI technology and materials at contaminated sites more feasible than protocols using larger scale ZVI materials. This *in situ* technology is technically highly feasible and can potentially save millions of dollars in remediation costs. Given the current and future impacts of chlorinated organic contaminants on the economy and human health, the successful implementation of this low-cost cutting-edge technology could save millions of dollars for the United States. Further and more consolidated studies need to take place in order to assess the potential impacts of these particular nanoparticles on human health, their environmental fate, and full-scale ecosystem-wide impacts over time. Using balanced and well thought out approaches will maximize benefits of the use of NZVI technology while minimizing the risks for the purposes of groundwater contaminant remediation.

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Heavy Metal Pollution: Source and Impact on Environment Human Health

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ABSTRACT
Although some heavy metals are essential trace elements, most of the can be toxic to all forms of like at high concentrations due to formation of complex compounds within the cell. Unlike Organic pollutants, heavy metals once introduce into the environment cannot be biodegraded. They persist indefinitely and cause pollution of air, water and soil. Thus, the main strategies of pollution control are to reduce the bioavailability, Mobility and toxicity of metals.

OBJECTIVES OF THE STUDY

The term heavy metals refers to any metallic element that has a relative high density and is toxic or poisonous even at low concentration. pollution of food by heavy metals is worldwide phenomenon. In recent years there has been an increasing consumption of vegetables among the human community. Heavy metals are considered as one of the major sources of soil pollution. Some heavy metals (Like Fe, Zn, Ca and Mg) reported to be of bio-importance to human and their daily medicinal and dietary allowance & had been recommended. But some heavy metal (Like As, Cd, Pb, Ni, Cu, Cr and Methylated forms of Hg) have been reported to have no known bio importance in human biochemistry and physiology and consumption even at very low concentration can be toxic. Heavy metal contamination in vegetables drinking water and air may pose a direct threat to human health. Industrialization has spoiled the environment by putting more and more concentrations of several metal.

Source of Heavy metal in Environment –

Today water and soil resources have been the most exploited natural system since man strode the earth. Heavy metal is occur naturally in the soil environment from the pedogenetic processes of weathering of parent materials at levels that are regarded as trace (<1000mg kg^{-1}) and rarely toxic. Heavy metals above defined background value high enough to cause risks to human health, plants, animals and ecosystems.

Pollution of water bodies is increasing tremendously due to rapid population growth, industrial proliferation, urbanisation, increasing standard and widespread of human activity. Water polluted are received heavy flux of sewage, Industrial effluents, domestic and agricultural wastes which consist of substances varying from simple nutrient to highly toxic hazardous chemicals. There all various type of pollutant are described as under:

Fertilizers –

Historically, agricultural practices rely heavily on artificial fertilizers, which generally contain one or more of the plant nutrient I,e. N, P and K. Critical pollution problems arise mainly from their excessive application rates. The compounds used to supply these elements contain trace amounts of heavy metals (e,g. Cd and Pb) as impurities, which, after continuous use of Fertilizer. Application, may significantly increase their content in the soil. Metals, such as Cd and Pb, have no known physiological activity. Application of certain phosphatic fertilizers inadvertently adds Cd and other potentially toxic elements to the soil, including F, Hg and Pb.

Pesticides – Different kinds of pesticides are used to control pests which cause a stress in the natural environment. Among pesticides the most important

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are the chlorinated hydrocarbons, eg. DDT, BHC, aldrin, endrin, heptachlor and argano phosphates , dimethoate and phosdrin etc. These pesticides may get absorb by soil particles, which may contaminate root crops grown in soils. Unfor tunately these pesticide residues coexist within biological system with others forms of life. The elimination of pests in the soil must inevitably produce changes in balanced natural cycles and food chains within natural ecosystem.

Municipal Garbage - The Major technical problem of garbage disposal are toxic chemical, pesticides, Irritating solvent, leaching of garbage soluble by water, volatilization of solvents and harmful gases formed by anaerobic decomposition of organic wastes.The raw sewage harbours a variety of intestinal parasitic protozoa , ascariseggs , cysts, pathogenic bacteria and viruses that result in severe soil pollution.

Mining activities-The metal concentrations in waste water effluents are usually relatively low, Long term irrigation of land with such, can eventually result in heavy metal accumulation in soil. Mining can lead to loss of grazing and fertile land , soil erosion ,sedimentation or siltation, danger to a aquatic life .

Potential risks of heavy metal on environment and human health

Industrial waste water- (i) Industrial effluents when discharge through sewage system will poison the biological purification mechanism of sewage treatment causing several soil and water born diseases. Most of these pathogens are insuceptible to degradation and are injurious to health. Metallic contaminants [e.g. Hg , Pb, Zn, As, Cd, Cu etc]destroy bacteria and beneficial microorganism in the soil. Heavy metal tend to precipitate phosphatic compound and catalyse their decomposition .These metal are considered to be indestructible poisons and their accumulation in soil for a long period may be highly fatal to living organism.

ii) Today water resources have been the most exploited natural system since man strode the earth. Pollution of water bodies are increasing tremendously due to rapid population growth, industrial proliferation, urbanization, increasing living standard and wide sphere of human activities. Rivers recived heavy flux of sewage, industrial effulent ,domestic and agriculture wastes which consist of substances varying from simple nutrient to highly toxic hazardous chemical. The deterioration of the aesthetic and supporting qualities of natural lakes and estuaries is caused by excessive fertilization, due to effluents rich in N, P, K. Thus water contaion several dissolved gases [N_2,CO_2 ,Cl_2,SO_2,H_2S] dissolve mineral salts [Na, Ca , Mg, K , Fe, Mn, Co]suspended matters and microbes. Also some of dumped chemicals that were safely flushed away [e.g. Hg , Cd, As, Pb, etc] are now coming to haunt us .Now pollution of water bodies has become universal phenomenon in the present day world.

Fertilizers –

i) Excessive use of nitrogenous fertilizers in land leads to accumulation of nitrate in the soil which are transferred to man through plants. Nitrates, being highly soluble, go into drinking ground water and become toxic when this concentration exceeds 90 ppm, causing diarrhea and cyanosis (blue jaundice) in children. In human body these nitrates and nitrites are converted to nitrisoamines and nitroso compounds which are suspected as agents of stomach cancer.

ii) Young infants are more susceptible to fatal disease called methemoglobinemia or blue baby syndrome ,where nitrite interfere with oxygen carrying capacity of blood. Nitrite ions damage respiratory and vascular system causing ultimately death in infants. Normally 0.8% methemoglobin is present in man but in disease its content increases to 10% in blood. Above 20% it causes headache and giddiness. Above 60% it causes unconsciousness and stiffness. Death occurs at 80% of mathemoglobin.

Pesticides –(i) various vegetables, fruits, rice ,grain , wheat and maize are contain significant amount of DDT, BHC, and other organochlorine pesticides. They persist in the soil producing long term effect on vegetative cover. Poly chlorinated biphenyls cause deformities in foetus, nervous disorder, liver and stomach cancer in animals .

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People used vegetables contaminated with 0.5g or more PCBs can suffer from darkened skin, eye damage and severe acne.

(ii) Long lasting effect of pesticides are visible in animal and man, where they affect the tissues and interfere with normal metabolic activites by disturbing the enzymatic functioning in the body.

(iii)People who come in to contact with pesticides ,such as, farmers ,farm workers and agriculturists are much more prone to poisoned by them . Their excess absorption lead to greater accumulation of acetycholine in the body. Chronic absorption damage liver and kidney causing malfunctioning, excess of amino acid in blood and urine, blood abnormalities ,cancer electro –encephalogram deformation of brain tissues.

Methodology –

The proposed study is based on secondary data which are published in the Books, Journals, News paper, Articles, Websites and summary of different souvenirs of this particular topic.

Conclusion -

Pollution prevention also eliminated the transfer of pollutant from one media to another because pollutants are not generated at the place .The raw materials are used more efficiently and also the costs and liabilities of waste disposal and cleanup are avoided .The success of pollution prevention strategies depend upon a multi-disciplinary approach where efficient process control and optimization are achieved by the combined effort of engineers and process analytical chemists. Although heavy metal poisoning could be clinically diagnosed and medically treated , but the best option is to prevent heavy metal pollution.

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GROWTH AND STRUCTURAL CHANGES IN THE ECONOMY OF MADHYA PRADESH SINCE 1991-201

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ABSTRACT
Madhya Pradesh is a major state which appears to be a paradigmatic example of the most disconcerting development of the 1990s in India. There was no increase in different sector employment in the economy of Madhya Pradesh during 1990s. The structural changes of an economy that required the dynamics of primary, secondary and tertiary sector shares are related to each other and economic growth as well. The primary and secondary sector has been stagnant or even declining. By contrast, tertiary sectors have shown statistically significant and high rates of growth over the whole period. But the employment has declined in primary and secondary sector and increasing in tertiary sector in past two decade.

OBJECTIVES OF THE STUDY

Economic development is said to be in variably accompanied by fundamental changes in the structure of an economy (Albert 1986). Economic development and structural changes are highly associated each other. Economic development is defined as process of combining economic growth with changing share of Primary, Secondary and Tertiary sectors in the national product and labour force. Structural changes do not only characterize economic development, these are also necessary for sustaining the economic growth.

The common structural change which takes place due to economic development results into shifts in the shares of Gross Domestic Product and worker force from different sectors i.e. Primary secondary and tertiary sector. (Kuznets 1966) identifies the shift resources from agriculture to industry as the central feature of this transformation. It means economic parameters are interrelated and always subject to transformations reflecting mutual interdependence of economic base and superstructure.

Structural changes in an economy analysed from different sectors which is correlated with various dimension in which structure considered employment and capital investment among others. Due to rise a demand of occupational structure like employment the demand of capital investment increases and after reaching a reasonably high level of capital investment, demand for services increases sharply. It is observed that the growing demand for services has contributed the largest share in Gross Domestic Product from the last two decade and the outcome reflects that economic growth in the country has induced considerable structural changes at the state.

The economy of Madhya Pradesh which is dominated by agrarian activities continues to be backward in the national context. The state despite being rich in human and natural resources and having vast fertile plains has shown growth performance over the years which remained far below the national average. This is corroborated from the fact that state had only 25.59 Percent share in industrial output in 2013-14. The per capita income of the state in 2013-14 was only Rs. 27917. The share of primary sector in the gross domestic product of state had declined from 38.79 percent in 1990-91 to 29.03 percent in 2013-14, while the secondary sector comprising of industries, mining, construction, electricity etc. has gone up. The tertiary sector which includes trade, transport,

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communication and services has registered growth of 40.38 percent in 1990-91and 45.38 percent in 2013-14.

The occupational structure of population has progressively changed in favour of secondary and tertiary sectors. Changes have also taken place in the form of growth of basic and capital goods industries, expansion in social overhead capital progress. The social overhead capital includes transportation facilities, irrigation system, energy production units, educational system and organizational and health facilities.

The paper present a complete analysis of the economic development in Madhya Pradesh which is divided in to two sections including the present introductory one is growth pattern of different sector and occupational structure in the Madhya Pradesh economy, hence in-depth studies on growth and structural changes are needed to be conducted at state levels. While a number of such studies are available for the country as a whole and many other states no serious effort in this direction has been made in the case of Madhya Pradesh economy till date. It is the context that we have selected the economy of Madhya Pradesh for the purpose our study of growth and structural changes.

Review of Literature:-

There is vast amount of growth and structural change among Indian states.

Debnath.et.al. (2012) analysed the trend in sectoral share of the state domestic product and inter sectoral linkages in north eastern India for the period 1981 to 2007. They used causality test utilised simple regression technique and used ordinary list square panel unit root test, Johansson fisher panel cointegration test and ganger causality test for the study. They identified that there is a large degree of inter dependence in sectoral growth. The causality test reveals that there is a directional causality among the sectoral output in north eastern state in the long-run; there is it unidirectional causality from agriculture and industrial sector to the service sector. They identified that the relationship between service and industry and service and agriculture sector are both positive, they found that income generation from service sector and the income growth of service sector depend on growth of agriculture and industries.

Behera. (2012) analysed the trends in sectoral shares in state domestic product and inter-sectoral linkages in Odisha for the period 1980-81 to 2011-12.He implemented Granger causality test for obtained linkages between primary, secondary and tertiary sectors. He identified that there is a weak linkages between primary and secondary sectors in the growth process and do not show linkages with the tertiary as a whole, Then he used long run cointegration which is reflect a strong relationship between secondary and tertiary sector services in the economy on one hand and independent long run relationship with in FIRB. However the linkage is significant between the sectors, but it is not linked with three sector analysis where primary sector is completely missing for a relatively faster adjustment towards long run equilibrium rate of growth.

Singariya. (2014) studied the links between structural changes and economic growth in India for the period of 2004 to 2012. The present paper used statistical method which highlights the growth pattern of different sectors of the economy shows an emergence of the service sector as the major contributor. It indicates that some sector were able to shift their labour force from low productivity agriculture to higher productivity industry and service sectors despite the rapid growth of populations.

Singh.et.al. (2011) examined the connection between measures of structural change and growth in India, for the period of 1951-2007. They find that there is a structural break in the two time series, and this break occurs in 1988. Furthermore, there is a one way causal relationship between structural change and growth, but only for the 1988-2007. Hence, this analysis provides more objective empirical support for previous informal assertions in the literature.

Kuznets. (1981) identified the primary reason for changes in economic structure. He saw income elasticity of demand as the primary reason for changes in the structure of economy but recognized that other factors, technological and

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institutional, also play an important role in accelerating these changes.

Objective of the Study:-

The objectives of this paper are:-

- Analysis of pattern of growth in the state during the given period.
- Study of the sectoral growth performance of the state economy.
- The study of changes in the occupational structure in the state during the period of analysis.

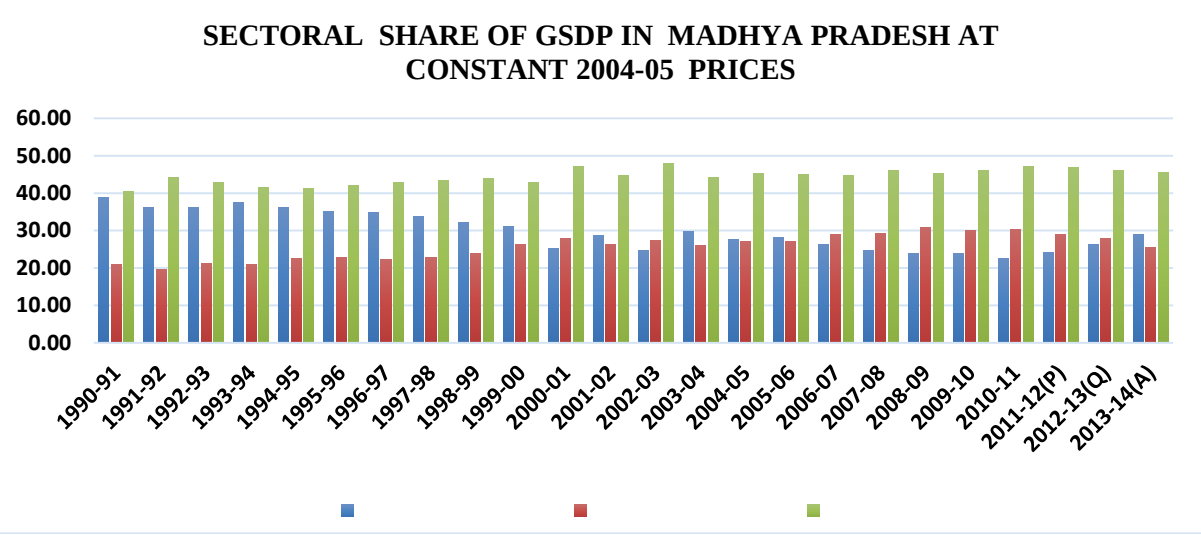
Data Source and Methodology:-

Keeping in view the broad objectives of the study, the secondary data on the Madhya Pradesh economy has been used. For analysis of Growth trend and sector-wise shares in Gross State Domestic Product (GSDP) and employment have been analysed. The required secondary data were collected from Directorate of Statistics and Economics of Madhya Pradesh and Budget at a glance 1991 to 2014, Reserve Bank of India bulletin, Census of India Report and NSSO Round of survey and other publications.

Structural change of sectoral composition of GSDP of Madhya Pradesh:-

Indian economy has undergone a significant structural changes since Independence. This is highlighted by the change in the sector-wise composition of income and workforce over the years. The decade of 1990s witnessed major policy changes in the Indian economy and its State/Union territory economies. Each state of the Indian union is different in terms of its natural, social, political and economic features. Therefore, the pattern of growth of each sub-national unit is unique. Historically, In order to analyse structural changes in the state economies they divided into three major sectors and as per this sectors state has predominantly been an agricultural economy; the percentage share of primary sector in gross domestic product as well as labour force has been the highest. But over the years, there has been a change in the sector-wise distribution of state domestic product. The tertiary sector has become an important sector in terms of its contribution to the state domestic product. However the primary sector still occupies a declined position in terms of its share in the distribution of sectoral workforce.

Hence the sectoral share in primary sector declined from 38.79 percent in 1990-91 to 29.03 percent in the year 2013-14. The steady and significant slow decline in the share of primary sector in total output as a result of its much slower growth has one of the singular features of the process of structural change in state. But the sectoral share of secondary and tertiary sector occupies a dominant position because secondary sector increases from 20.83 percent in 1990-91 to 25.59 percent in the year of 2013-14 and tertiary also increases from 40.38 percent 1990-91 to 45.38 percent 2013-14. However, the change in the sectoral share of these three sectors shows the different phase of growth and structural changes.



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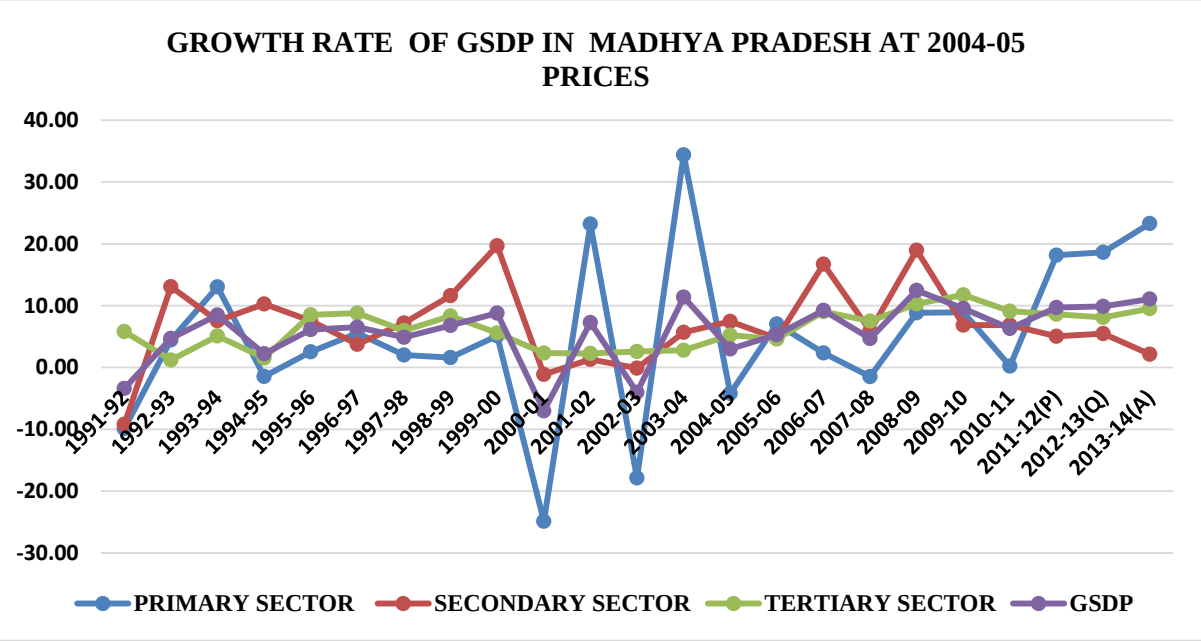
The growth pattern of gross state domestic product provides the most important single indicator of the overall performance of the state economy and its sectors. These estimates over a period of time reveal the extent and direction of changes in the level of economic development. The study of GSDP is, thus, important to study the structural changes in the economy and it sectoral composition of GSDP gives an idea of the relative position of different sectors of the economy. The sectoral composition of GSDP divided in three sectors i.e. primary, secondary and tertiary sector. The growth of these three sectors simultaneously change over the years because the involvement of the these sectors in the growth of state are varying in every year like contribution of primary sector -9.90 percent in the year 1990 with secondary sector -9.19 and tertiary sector 5.82 percent during the same period and simultaneously changes of contribution of these sectors obtained in the year of 2013-14 during whole study.



Structural change of Occupational structure of Madhya Pradesh: -

Employment has always featured as an important subject of discussion both in academic and policy making circles it has become a matter of intense debate in recent years due particularly to a rather disappointing employment performance of the post-reform period there has been a significant changes in occupational structure but as noticed above that changes is out of step with the changes in income derived from different sector. With differential growth of employment among different sectors of the economy there have obviously been change in the structure of employment among the three major sector by broad division of economic activity namely primary, secondary and service sector there has been a decline as expected in the share of agriculture and industrial sector but the increase in the share of services in the total employment. The share of primary sector in total employment has declined slowly from 77.5 percent in 1991 to 71.5 percent in 2001 and further to 69.5 percent in 2011. The employment share of secondary sector also decline from 8.4 per cent in 1991 to 4 per cent in 2001 and further to 3 per cent in 2011 but the employment share of tertiary sector continuously increases from 14.1 percent in 1991 to 24.5 percent in 2001 and further to 27.5 percent in 2011 because there is a weak linkages found between these sectors and investment rate declined in primary and secondary sector. Primary and secondary sector

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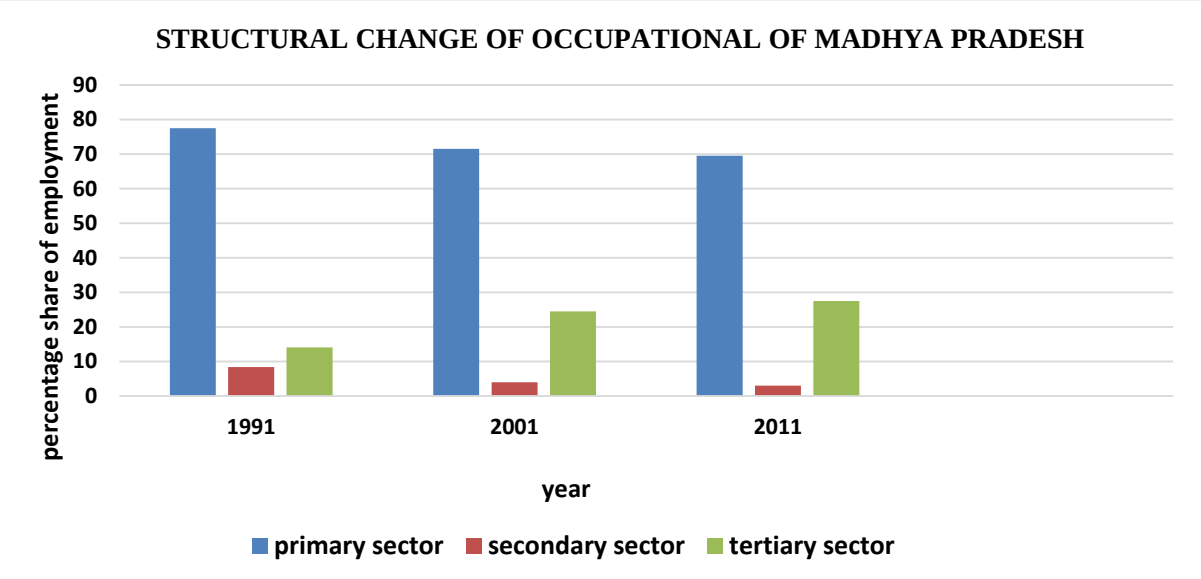
requires more investment for developing infrastructure and generating employment that's why outsider investor not attracted lack of developed infrastructure but tertiary sector increase due to small scale investment which is developed employment in large scale. The story of the service sector is different as far as the sectoral composition of employment is concerned. The employment share of this sector or shows a rising trend over the period with moderate fluctuation in the early 1990s.



Conclusion:-

The broad conclusion that emerges is that structural change analysis of Madhya Pradesh economy is indicative of the fact that the last decade has been characterized by a shift in sector- wise shares in gross state domestic product as well as in workforce Frome primary and secondary sectors to tertiary sectors. It appears from the analyses that Madhya Pradesh economy has undergone a structural shift. A higher rate of growth is observed in the tertiary sector over a period of decades. It indicates that Madhya Pradesh economy was able to shift their labour force from low productivity agriculture to higher productivity industry and service sector and to increase productivity within these sector. It shows that there is an ample scope to improve the economic growth via tertiary sector growth.

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Analysis of Different Types of faults and effects of Voltage Sag on 11 KV Networks

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ABSTRACT

In an electric power system, a fault is any abnormal flow of electric current. For example, a short circuit is a fault in which current flow bypasses the normal load. An open-circuit fault occurs if a circuit is interrupted by some failure. In three-phase systems, a fault may involve one or more phases and ground, or may occur only between phases. In a "ground fault" or "earth fault", current flows into the earth. The prospective short circuit current of a fault can be calculated for power systems. In power systems, protective devices detect fault conditions and operate circuit breakers and other devices to limit the loss of service due to a failure. In a poly-phase system, a fault may affect all phases equally which is a "symmetrical fault". If only some phases are affected, the resulting "asymmetrical fault" becomes more complicated to analyze due to the simplifying assumption of equal current magnitude in all phases being no longer applicable. The analysis of this type of fault is often simplified by using methods such as symmetrical components. There are numerous types of power quality issues and power problems each of which might have varying and diverse causes. To further compound the matter, it is all too common that different power quality problems can occur simultaneously, interchangeably or randomly. Voltage Sags (VS) account for the vast majority of power problems experienced by end users. They can be generated both internally and externally from an end users facility. External causes of sags primarily come from the utility transmission and distribution network. Sags coming from the utility have a variety of cause including lightning, animal and human activity, and normal and abnormal utility equipment operation. Sags generated on the transmission or distribution system can travel hundreds of miles thereby affecting thousands of customers during a single event. Sometimes externally caused sags can be generated by other customers nearby. The starting of large electrical loads or switching off shunt capacitor banks can generate sag large enough to affect a local area. If the end user is already subject to chronic under voltage, then even relatively small amplitude sag can have detrimental effects. Sags caused internally to an end user's facility are typically generated by the starting of large electrical loads such as motors or magnets. The large inrush of current required to starts these types of loads depresses the voltage level available to other equipment that share the same electrical system. As with externally caused sags, ones generated internally will be magnified by chronic under voltage. This paper presents analysis of different types of faults and effect of voltage sag on 11 KV Network. The MATLAB is used as simulation tool and simulation results are discussed.

OBJECTIVES OF THE STUDY

The term voltage sag (VS) as the name suggests, is drop in voltage. VS distorts the voltage profile of the system. Voltage sag is also referred as voltage dip. Voltage dip is the term given by IEC while the term "voltage sag" is used by North American power quality commission. VS creates disturbance in the pure sinusoidal waveform of voltage which in turn

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deteriorates the power quality of the system. VS occurs for very short duration of 0.5 to 30 cycles. It is decrease in RMS voltage of about 90 % to 10 % of nominal voltage. Although VS occurs for very short duration but its effects deteriorates system with time decreases life period of the system. Probability of large VS is less than small VS due to electrical supply configuration . VS is drop in voltage which is being supplied. VS badly affects the voltage stability of the system. To calculate out VS, drop in RMS value of voltage is the main concern. By calculating out RMS voltage drop, percentage VS can be determined.

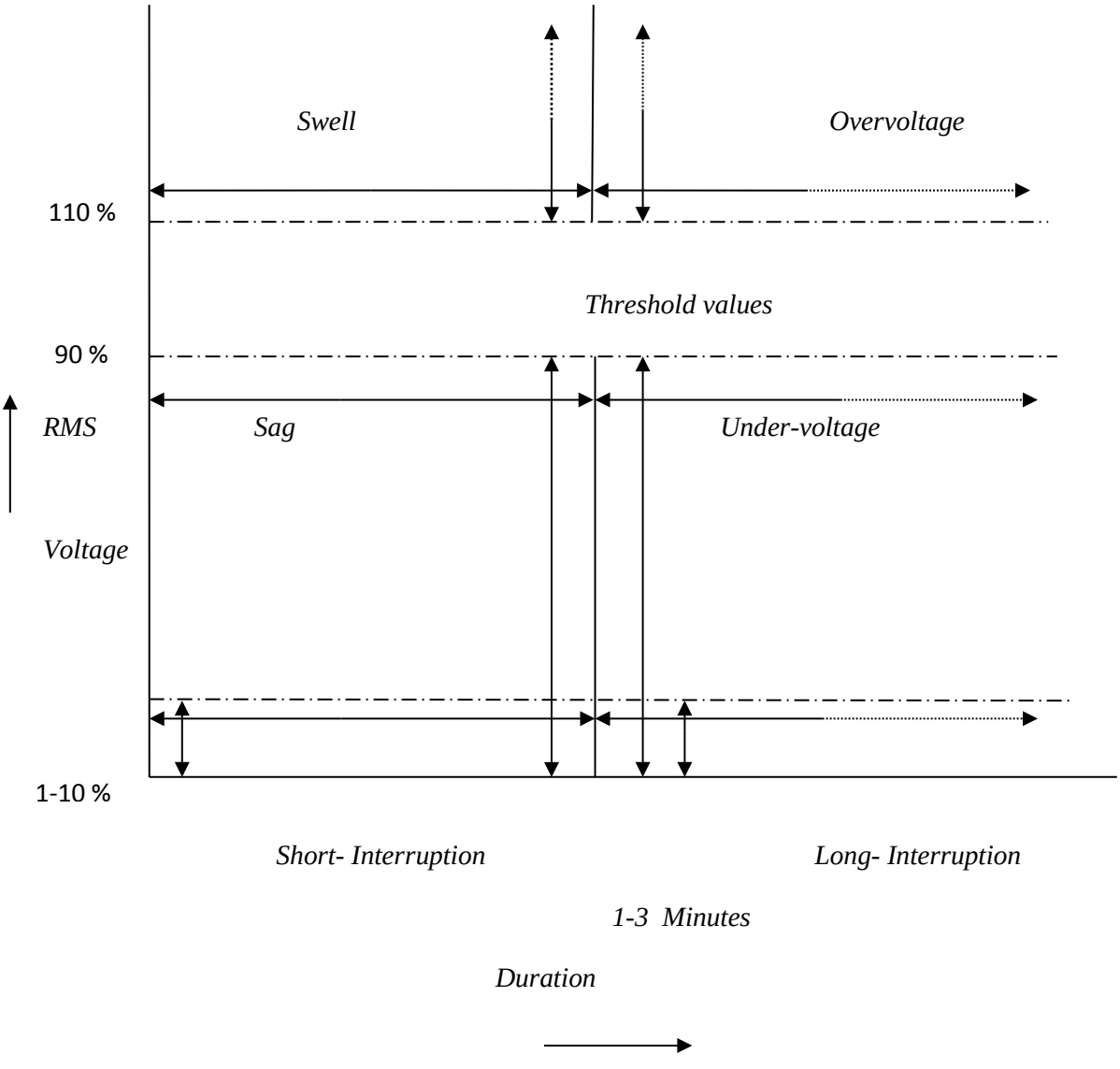

Fig 1 Types Of Voltage Variation Duration Curve

Here, we study the voltage sag relation with different transformer connections. By applying different types of faults, sag in voltage is developed in the system. Voltage sag analysis gives us complete details of system

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behavior when voltage drops from the specified value or threshold value. VS affects both domestic as well as industrial customers but comparatively industrial customers have to face more problems due to VS.

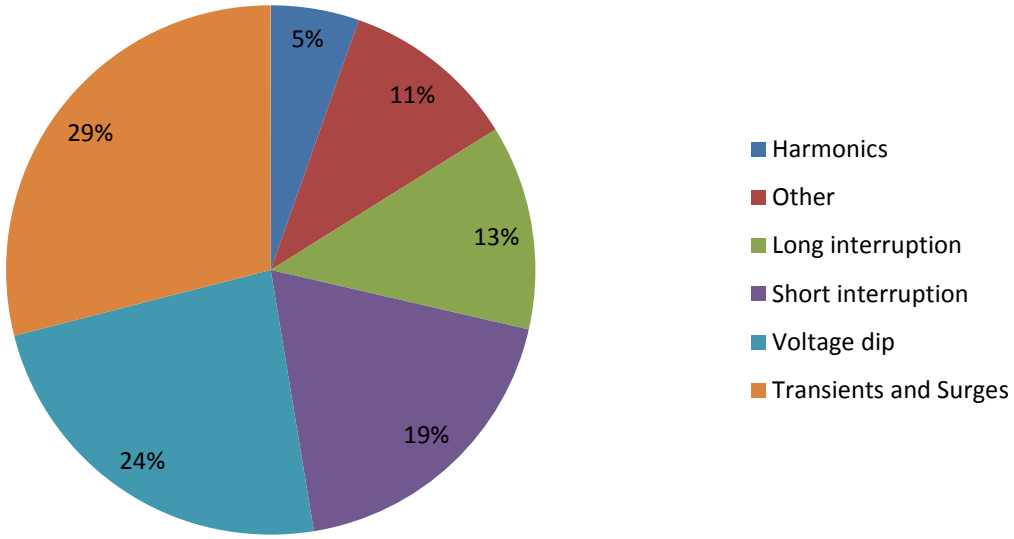

Fig 2 PI-Chart for different types of PQD

Table 1 VS Classification

Type of Sag	*Duration*	*Magnitude*
Instantaneous	*0.5-30 cycles*	*0.1-0.9 pu*
Momentary	*30 cycles-3 sec*	*0.1-0.9 pu*
Temporary	*3 sec-1 min*	*0.1-0.9 pu*

LITERATURE REVIEW : E.Styvaktakis, M.J.H.Bollen presented Automatic classification of power system events using RMS voltage measurements" (2002) IEEE Power Engineering Society Summer Meeting. In this paper PQ monitoring in depth has been discussed. For this a method have been suggested for automatic power system event classification using RMS voltage measurement and results show that this classification can be applied on specific events and its limitations have been discussed. In this events covered are energizing, non-fault interruption, fault interruption, transformer saturation, induction motor starting, step change and faults.

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P.Heine, M.Lehtonen discussed Voltage sag distributions caused by power system faults" IEEE Transaction on Power System. In this paper VS distribution on different voltage level is taken into consideration. Share of different types of faults at each voltage level and sag propagation throughout the power system has been studied. By this it is concluded that origin of sag in urban and rural areas are different. This paper helps during planning of power system to mitigate sag from different parts of power system.

S.Khokhar, A.A Mohd Zin, A.S Mokhtar, NAM Ismail presented MATLAB/ SIMULINK based modeling and simulation of power quality disturbances IEEE (2014) . In this paper, simulation and modeling of PQD due to exploitation of various load types has been discussed. PQD created by using parametric equations as well as power system models in MATLAB/ SIMULINK. PQD of voltage magnitude variation such as sag, swell and interruption are created by different types of faults and heavy loads. PQD of frequency variation type such as harmonics are generated by using converter. PQ waveforms obtain by this are useful in checking the performance of new automatic classification algorithm.

IEEE Recommended practice for monitoring electric power quality 1159-2009. In this, standards of IEEE on monitoring of electrical PQ has been discussed. This is proved to be very helpful in understanding PQD due to VS and equipments ride-through capability compatible with VS.

4.0 Effects of Voltage Sag : VS experienced by low voltage consumer is more as compared to other consumers even though sag is distributed in the whole system (3). This happens only because of network characteristic features, sag in some part is high and at other part , it is low or many a times negligible. VS results in breakdown of plant, increase in maintenance cost, production loss etc. It badly affects sensitive equipments such as adjustable speed drives, diagnostics systems, computer controller equipments etc. Effects of VS seen are as follows -

1. System losses increase.

2. Reactive power requirement increase.

3. Poor power quality.

4. Equipment malfunction and decrease in their life time.

5. System becomes uneconomical.

The economical consequences which an industry has to face due to VS can be calculated by summing up the cost of repairment and the cost of production loss (10). VS is always confused with the term interruption, but there are remarkable differences between the two. Interruptions occur for 1 minute, decrease in RMS voltage to less than 10 % of nominal value. Although VS does not cause severe damage at the time when it occurs but deteriorates the system performance and also decrease its life time.

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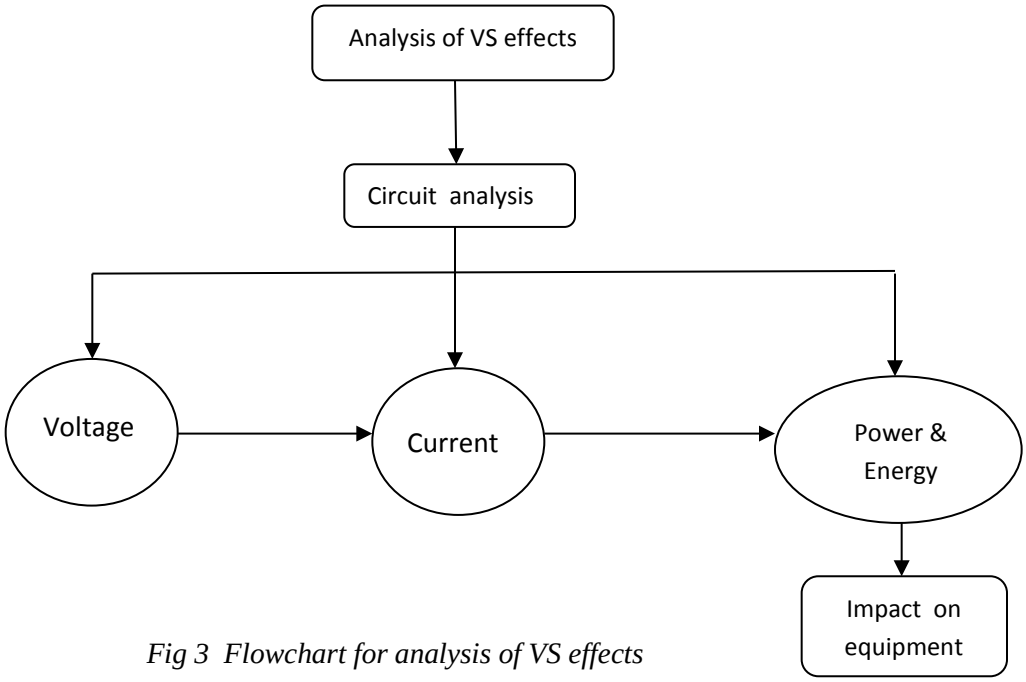

Fig 3 Flowchart for analysis of VS effects

Faults Analysis

Single Line To Ground fault (SLG) , fault take place between the line and the ground. About 65-70 % of faults are SLG fault. It occurs due to short circuit fault, this short circuit arises in between any one phase with the ground. It may be occur due to breaking of line and come in contact to the ground or may be due to insulation failure. VS due to this type of faults give birth to suppressed voltage with high phase angle jump in faulted line. While in other two lines phase angle remain undisturbed. To simulate this type of fault all the three sequence network are used and also current in all these sequences are same in phase angle and magnitude. So, all the sequence network are connected in series. In Double Line (DL) And Double Line To Ground fault (DLG) zero-sequence component of current is not present and relation of positive sequence with negative sequence is such that both have component of current those which are equal in magnitude but opposite in phase. To simulate this fault there is no need of zero sequence but the positive sequence and the negative sequence are connected in opposition. Also, in this positive sequence component of voltage is equal to the negative sequence component of voltage. About 5-10 % of faults are DL fault.In DLG, all the three that is zero, positive and negative sequence network are required to simulate this type of fault. In this negative and zero sequence network are connected in parallel first then in opposite with positive sequence network. Around 15-20 % of faults are DLG fault. In 3-Φ fault as the name suggest fault occur in all the three phases or lines. In this type of fault short circuit occurred in between all the three phases. In this zero and negative sequence current component are absent, only positive sequence current is only present. Positive sequence current is not affected by mutual coupling and is equal to phase current. Flowchart for fault analysis used in this paper shown below-

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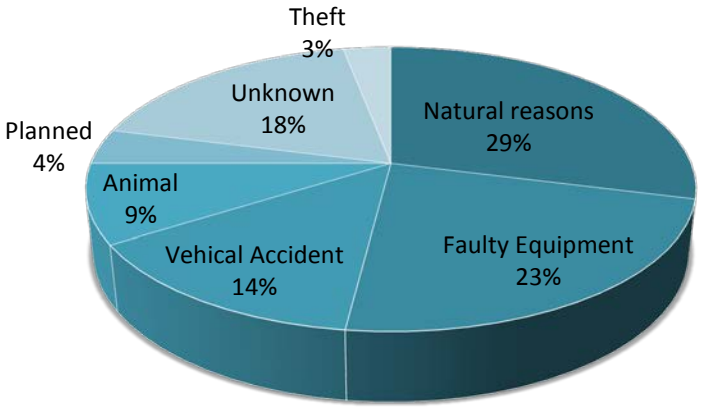

Fig 4 Percentage of different types of fault

Table 2 Fault probability in different type of power system component

Power System Component	***Fault Probability (in %)***
Overhead lines	*50*
Switchgears	*12*
CT,PT, relays, control equipment etc	*12*
Transformers	*10*
Underground cables	*9*
Generators	*7*

Table 3 Percentage of different fault initiators

Fault Initiators	*% of all faults*
Normal deterioration from age	*7*
Exposures to chemicals	*9*
Other mechanical damage	*12*
Exposure to dust	*14.5*
Shorting by tools, rodents etc	*18*
Exposure to moisture	*22.5*

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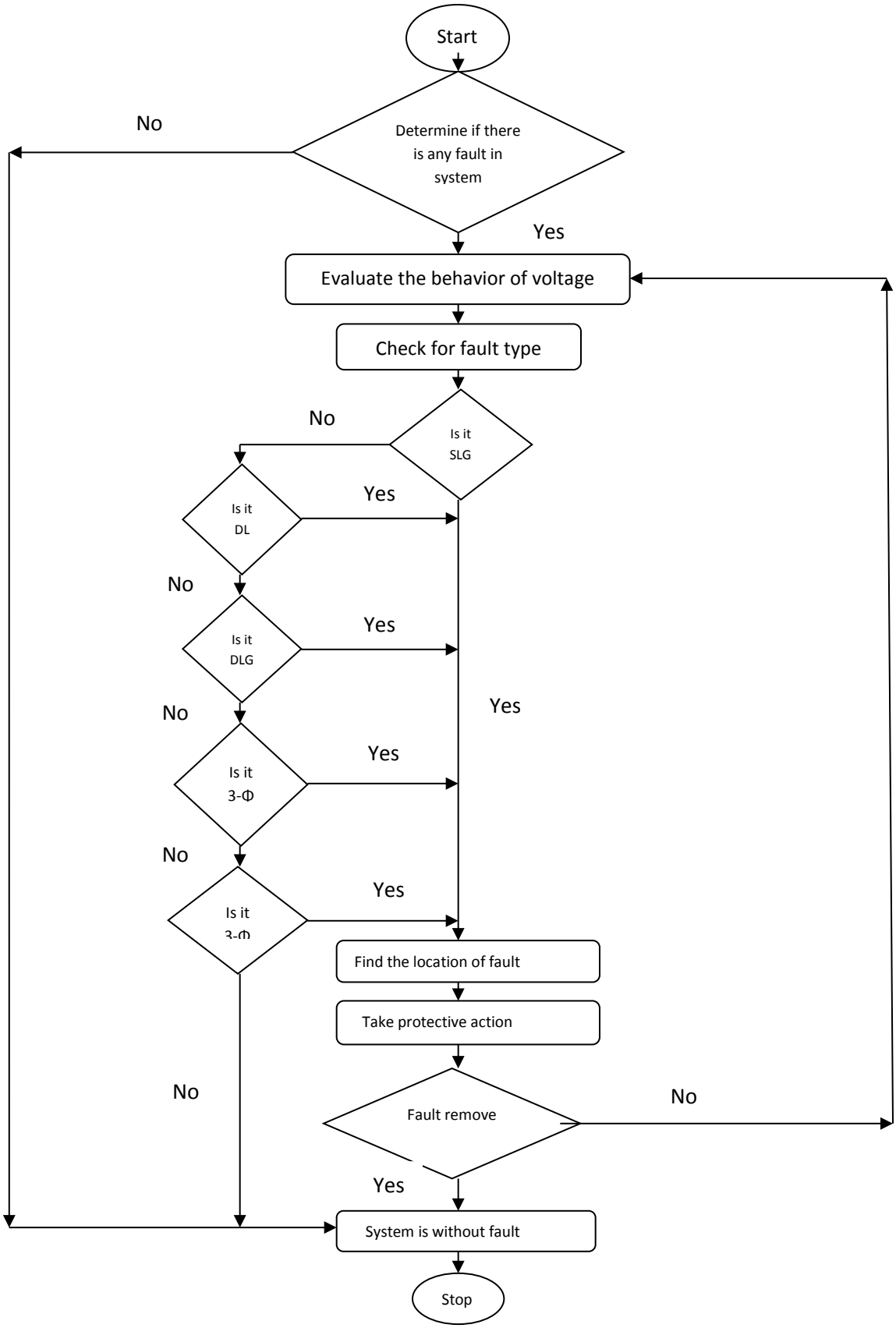

Fig 5 - Flowchart for fault analysis

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6.0 RESULTS

The effect of transformer connection on different types of faults regarding VS graphs has been obtain from MATLAB/SIMULINK. Figure 6 shows Single Line diagram of the feeder for Vijay Nagar Jabalpur M.P. consider under study.

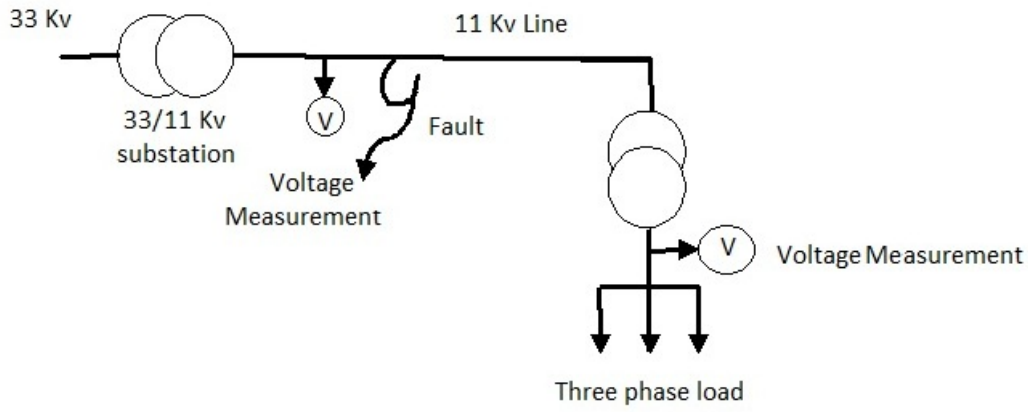

Fig6 Single line diagram

Table shown below gives the details of parametric configuration taken under MATLAB/ SIMULATION

Type of fault	*Pre-fault RMS Voltage*	*Post-fault RMS Voltage*	*% Sag*
Single line to ground	*220*	*34.97*	*84.10*
Double line to ground	*220*	*167.32*	*23.94*
Double line	*220*	*196.16*	*10.83*
Three phase to ground	*220*	*172.48*	*21.60*
Three phase	*220*	*213.24*	*3.07*

.

Table 7 Parameters of MATLAB/SIMULINK model

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COMPONENT	*PARAMETER*
Source	*33/11Kv, X/R= 10*
Transformer	*200KVA, 11/0.4 Kv*
Frequency	*50 Hz*
Load	*140 KW, 10 KVAR*

Table 8 Percentage sag on different fault on Yg-Yg transformer connection

From this study it is concluded that during SLG fault when transformer is Y_g-Y_g connected VS is quite high compare to transformer when Y_g-Y connected. Similarly, in case of 3-Φ fault VS is observable when transformer is Y_g-Y_g connected. When transformer connection is Y_g-Y. DL fault is observable more clearly then in transformer connection Y_g-Δ11.

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A Comparative Study Of Initial Basic Feasible Solution Methods For Transportation Problems By Using A New Method Named Average Transportation Cost Method

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Abstract
In this research paper a new method named Average Transportation Cost Method (ATCM) is proposed for finding an initial basic feasible solution for a balanced transportation model which is optimal or too close to optimal and then compared the result with the existing methods naming Vogel's Approximation Method (VAM), Minimum Transportation Cost Method (MTCM) and Proposed Approximation Method (PAM).Here a numerical illustration is established and the optimality of the result yielded by this method is also checked. The most attractive feature of this method is that it requires very simple arithmetical and logical calculation, that's why it is very easy even for layman to understand and use. Because of the simplicity of this method one can easily adopt it among the existing methods.

1.Materials and Methods

A Transportation problem is one of the earliest and most important applications of linear programming problem. This is a special linear programming problem which arises in many practical applications in other areas of operation including, among others, inventory control, employment scheduling, and personnel assignment [1]. In this problem we determine optimal shipping patterns between origins or sources and destinations. The transportation problem deals with the distribution of goods from the various points of supply, such as factories, often known as **sources**, to a number of points of demand, such as warehouses, often known as **destinations**. Each source is able to supply a fixed number of units of the product, usually called the **capacity** or **availability** and each destination has a fixed demand, usually called the **requirements**. A balanced condition (*i.e.* Total demand is equal to total supply) is assumed. The objective is to schedule shipments from sources to destinations so that the total transportation cost is a minimum.
In 1941 Hitchcock developed the basic transportation problem along with the constructive method of solution and later in 1949 Koopmans discussed the problem in detail. Again in 1951 Dantzig formulated the transportation problem as linear programming problem and also provided the solution method. Now a day's transportation problem has become a standard application for industrial organizations having several manufacturing units, warehouses and distribution centers. Several extensions of transportation model and methods have been subsequently developed. For obtaining an optimal solution for transportation problems it was required to solve the problem into two stages. In first stage the initial basic feasible solution (IBFS) was obtained by applying any of the available methods such as "North West Corner", "Matrix Minima", "Least Cost

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Method", "Row Minima ", "Column Minima" and "Vogel's Approximation Method " etc. In general, the Vogel's approximation method yields the best starting solution and the north-west corner method yields the worst. However, the latter is easier, quick and involves the least computations to get the initial solution [5]. Goyal (1984) improved VAM for the unbalanced transportation problem, while Ramakrishnan (1988) discussed some improvement to Goyal's Modified Vogel's Approximation method for unbalanced transportation problem [6] .Then in the next and last stage MODI (Modified Distribution) method was adopted to get an optimal solution. Charnes and Cooper [1] also developed a method for finding an optimal solution from IBFS named as "Stepping Stone Method". Adlakha and Kowalski (2009) suggested a systematic analysis for allocating loads to obtain an alternate optimal solution [7].
Recently, P.Pandian and Sudhakar proposed two different methods in 2010 and 2012 respectively for finding an optimal solution directly. However, the study on alternate optimal solutions is clearly limited in the literature of transportation with the exception of Sudhakar VJ, Arunnsankar N, Karpagam T (2012) who suggested a new approach for finding an optimal solution for transportation problems [8]. Here in this paper, a much easier heuristic approach is proposed for finding an optimal solution directly with lesser number of iterations and very easy arithmetical computations.

Transportation problem and General Computational Procedures

The transportation model of LP can be modeled as follows:

$$\text{Minimize} \quad Z = \sum_{i=1}^{m}\sum_{j=1}^{n} C_{ij}x_{ij} \quad \text{(Total Transportation cost)}$$

$$\text{Subject to} \quad \sum_{j=1}^{n} x_{ij} = a_i \qquad \text{(Supply from sources)}$$

$$\sum_{i=1}^{m} x_{ij} = b_j \qquad \text{(Demand from destinations)}$$

$$x_{ij} \geq 0, \text{ for all i and j;}$$

Where,
Z : Total transportation cost to be minimized.

C_{ij} : Unit transportation cost of the commodity from each source i to destination j.

X_{ij} : Number of units of commodity sent from source i to destination j.

a_i : Level of supply at each source i.

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b_j : Level of demand at each destination j.

NOTE: Transportation model is balanced if Supply ($\sum_{i=1}^{m} a_i$) = Demand ($\sum_{i=1}^{m} b_i$).

Otherwise unbalanced if Supply ($\sum_{i=1}^{m} a_i$) ≠ Demand ($\sum_{i=1}^{m} b_i$).

The total number of variables is mn. The total number of constraints is m+ n, while the total number of allocations (m+n–1) should be in feasible solution. Here the letter m denotes the number of rows and n denotes the number of columns.

Solving Transportation Problems

The basic steps for solving transportation model are:

Step 1 - Determine a starting basic feasible solution. In this paper we use any one method NWCM, LCM, or VAM, to find initial basic feasible solution.

Step 2 - Optimality condition : If solution is optimal then stop the iterations otherwise go to step 3.

Step 3 - Improve the solution**.** We use either optimal method: MODI or Stepping Stone method.

Table 1: Transportation array

Destinations

		D1		D2 …….. …….. Dn				Supply *a* i
SOURCES	S1	C11	x11	C12	x12	…….. C1n	x1n	*a* 1
	S2	C21	x21	C22	x22	…….. C2n	x2n	*a* 2
	.	……..		……..		…….. ……..		……..
	Sm	Cm1	xm1	Cm2	xm2	…….. Cmn	xmn	*a* m
Demand bj		b1		b2		…….. bn		Balanced model $\sum_{i=1}^{m} ai = \sum_{j=1}^{n} bj$

Methodology

The following methods are always used to find initial basic feasible solution for the transportation problems and are available in almost all text books on Operations Research.

The Initial Basic Feasible Solutions Methods are:

(i) Column Minimum Method (CMM)
(ii)Row Minimum Method (RMM)
(iii)North West-Corner Method (NWCM)
(iv)Least Cost Method (LCM)
(v)Vogel's Approximation Method (VAM)

The Optimal Methods are:

(i)Modified Distribution (MODI) Method or u-v Method
(ii)Vogel's Approximation Method (VAM)

There are several other initial basic feasible solution methods and optimal methods for solving transportation problems satisfying supplying and demand.We have used following four methods to find initial basic feasible solution of the balanced transportation problem:

- Vogel's Approximation Method (VAM)
- Proposed Approximation method (PAM)
- Minimum Transportation Cost Method (MTCM)
- Average Transportation Cost Method (ATCM)

For optimal methods we have used either the Modified Distribution (MODI) Method or the Stepping Stone Method.

Vogel's Approximation Method (VAM)

This method provides a better starting solution than the North West Corner rule and Least Cost Method. VAM generally yields an optimum or close to optimum solution.

Note: Penalty means the difference between two smallest numbers or costs in a row or a column.

Proposed Approximation Method (PAM)

This method provides a better starting solution than the other existing methods. The PAM also yields optimum solution or close to optimum solution.

Note: Penalty means the difference between the largest and the smallest numbers or costs in a row or a column.

Minimum Transportation Cost Method (MTCM)

This method also provides a better starting solution than the existing ones. The MTCM generally yields optimum solution or close to optimum solution.

Note: Penalty means the difference between two largest numbers or costs in a row or a column.

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Proposed Method
Average Transportation Cost Method (ATCM)

In this study, we proposed a new solving method for transportation problems by using ATCM. This method provides a better initial basic feasible solution than the above three existing methods which we have used and obtain minimum optimal transportation cost.

Algorithm
Step 1. Make the table balanced. Compute penalty of each row. The penalty will be equal to the average of the costs in the row. Similarly compute penalty for each column.

Step 2. Identify the row or column with the maximum penalty and assign possible value to the variable having smallest shipping cost in that row or column. If two or more rows corresponding equal penalty then select the cell with minimum cost of that maximum penalty row.

Step 3. Cross out the satisfied row or column.

Step 4. Write the reduced table and compute new penalties with same procedure until all the allocations have been made . Determine the total minimum cost of occupied cells satisfying m+n-1allocations.

Note: Penalty means the average of the costs in a row or a column.

Optimal Method: Modified Distribution (MODI) Method

This method always gives the total minimum transportation cost to transport the goods from sources to the destinations.

Algorithm

Step 1. If the problem is unbalanced, balance it. Setup the transportation table.

Step 2. Find a basic feasible solution.

Step 3. Set $u_i = 0$ and determine u_i ' s and v_i's such that $u_i + v_i = c_{ij}$ for all basic variables.

Step 4. If the reduced cost $c_{ij} - u_i - v_j \geq 0$ for all non-basic variables (minimization problem), then the current BFS is optimal. Stop! Else, enter variable with most negative reduced cost and find leaving variable by looping.

Step 5. Using the new BFS, repeat steps 3 and 4.

The Numerical Problem

We have used four methods to find an initial basic feasible solution for the balanced transportation problem .The problem was developed by Hakim [2] . Consider the transportation problem presented in Table 2 where there are 4 sources, 6 destinations; the cost is given in the cells, and the supply and demand given in bottom and right hand end row and column respectively in Table 2.

Table 2: Example problem

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Destinations

Sources	1	2	3	4	5	6	Supply
1	1	2	1	4	5	2	30
2	3	3	2	1	4	3	50
3	4	2	5	9	6	2	75
4	3	1	7	3	4	6	20
Demand	20	40	30	10	50	25	175

Solution

Four methods have been used here to find initial basic feasible solution of the above problem and these are presented in turn.

Vogel's Approximation Method (VAM)

Using VAM the final solution is presented in the Table 3.

Table 3: Solution using VAM

Sources	1	2	3	4	5	6	Supply
1	20		10				30
2			20	10	20		50
3		20			30	25	75
4		20					20
Demand	20	40	30	10	50	25	175

Therefore the total transportation cost determined by the Vogel's Approximation Method is:

Min. Z = (20)(1) + (10)(1) + (20)(2) + (10)(1) + (20)(4) + (20)(2) + (30)(6) + (25)(2) + (20)(1)

=20 + 10 + 40 + 10 + 80 + 40 + 180 + 50 + 20
= Rs. 450

Proposed Approximation Method (PAM)

The final solution completed using PAM is presented in the Table 4.

Table 4: Solution using PAM

Sources	1	2	3	4	5	6	Supply
1			30				30
2				10	40		50
3	20	20			10	25	75
4		20					20
Demand	20	40	30	10	50	25	175

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The total transportation cost by Proposed Approximation Method can be given as:

Minimize Z = (30)(1) + (10)(1) + (40)(4) + (20)(4) + (20)(2) +(10)(6) + (25)(2) +(20)(1)

=30 + 10 + 160 + 80 + 40 + 60 + 50 + 20

=Rs. 450

Minimum Transportation Cost Method (MTCM)

The total transportation cost by Minimum Transportation Cost Method is given in Table 5.

Table 5: Solution by MTCM

Sources	1	2	3	4	5	6	Supply
1	20		10				30
2			20		30		50
3		40			10	25	75
4				10	10		20
Demand	20	40	30	10	50	25	175

The total transportation cost by MTCM is given as:

Min Z = (20)(1) + (10)(1) + (20)(2) + (30)(4) + (40)(2) +(10)(6) + (25)(2) +(10)(3) + (10)(4)

=20 + 10 + 40 + 120 + 80 + 60 + 50 + 30 +40

=Rs. 450

Average Transportation Cost Method (ATCM)

Using ATCM the final solution is presented in the Table 3.

Table 3: Solution using ATCM

Sources	1	2	3	4	5	6	Supply
1	10		20				30
2			10	10	30		50
3	10	40				25	75
4					20		20
Demand	20	40	30	10	50	25	175

Therefore the total transportation cost determined by ATCM is given as:

Min Z = (10)(1) + (20)(1) + (10)(2) + (10)(1) + (30)(4) +(10)(4) + (40)(2) + (25)(2) +(20)(4)

=10 + 20 + 20 + 10 + 120 + 40 + 80 + 50 + 80

= Rs. 430

Modified Distribution (MODI) Method

We have found total minimum transportation cost using MODI method by taking initial basic feasible solution obtained by Average Transportation Cost Method (ATCM). The final solution is shown in Table 6.

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Table 6: Solution using MODI

Sources	1	2	3	4	5	6	Supply
1	20		10				30
2			20	10	20		50
3		40			10	25	75
4					20		20
Demand	20	40	30	10	50	25	175

The total transportation cost by Modified Distribution Method is given as:

Min Z = (20)(1) + (10)(1) + (20)(2) + (10)(1) + (20)(4) + (40)(2) + (10)(6) +(25)(2) + (20) (4)

=20 + 10 + 40 + 10 + 80 + 80 + 60 + 50 +80

=Rs.430

Table 5: A comparison of the methods - VAM, PAM, MTCM and ATCM and MODI

Initial Basic Feasible Methods	Value of the objective Function	Minimum Value (cost)
VAM	450	Same Result
PAM	450	Same Result
MTCM	450	Same Result
ATCM	430	Optimal or minimum cost
MODI Method	430	Optimal or minimum cost

2.Result and Discussion

The cost of transportation shows that the:

(i)Minimum Transportation Cost Method (MTCM), Vogel's approximation method (VAM), and Proposed Approximation Method (PAM) provide the same result, not optimal but close to optimal, but Average Transportation Cost Method (ATCM) provides the minimum optimal transportation cost.

(ii)In VAM, MTCM and PAM, the penalty of each row and column makes the problem lengthy and the calculation time is longer, but while dealing with the average for getting penalties in ATCM makes the problem simple, easy and familier to non- mathematical or statistical persons and takes a short time in calculation.

3.Conclusion

As transportation problem is a special linear programming problem having many practical applications in other areas of operations, including, among others, inventory control, employment scheduling, and personnel assignment as mentioned earlier. Here in our research

work we have used four methods, The Minimum Transportation Cost Method (MTCM), Vogel's Approximation Method (VAM) and Proposed Approximation Method (PAM). These were used to find an initial basic feasible solution for the transportation balanced model. The results of VAM, MTCM and PAM are noted to be the same which are either optimal or close to optimal, but ATCM provides the minimum optimal cost as compare to the above three methods . It is important to note that we have used only penalty obtained by taking the average of the costs in the respective row or column which is a simpler option and thus takes much less time in the calculation. In contrast, other methods using maximum penalty of smallest numbers of each row and column makes the problem lengthy and the calculation takes longer. Moreover, the method presented here is simpler in comparison of other presented methods earlier and can be easily applied by anyone to find the initial basic feasible solution for the balanced and unbalanced transportation problems.

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Review: Article

An outline on the construction of balanced incomplete Block designs.

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ABSTRACT
The concept of construction of balance incomplete block designs comes from the theory of experimental design. Many statisticians were thoroughly studied and analysed the problem of construction of balance incomplete block designs. In recent years there has been very rapid improvement in this area of construction and characterisation of experimental design. This paper presents a review of the available literature on construction and characterisation of balance incomplete block design.

Introdution

An experimental design is a set of rules by which the varieties (treatments) to be used in the experiment are assigned to experimental units, so to produce valid results in a very efficient way. Experimental Design plays a significant role on establishing a relationship between Applied Mathematics and statistical applications in several fields, like Agriculture, Industry, social science, and Education Sciences. The main function of any Experimental Design is to obtain the maximum amount of information for a given experimental effort, to allow comparisons between varieties and to control for sources of variation which has random behavior."Design of Experiments" in its present form owes its continuation to the sound foundation laid by Sir R.A. Fisher, who formulated and developed the basic ideas of statistical designing in the period 1919-1930. Fisher proposed three principles of design of experiments viz. randomization, replication and blocking. Blocking is considered as most difficult aspect because it places special restrictions on experimental designs. The idea of blocking in statistically planned experiments was first introduced in the agricultural field experiments, conducted at the Rothamsted Experimental Station during the period of Fisher as the Chief Statistician. A randomized block design is said to be Balanced Incomplete Block Design (BIB Design) when the number of treatments greater than the block size and with all pairs of varieties (treatments) occurring equal number of times within each block.the trade-off method is most important method for the construction of BIB Designs with repeated blocks (BIBDR) is due to Hedayat and Li (1979). The importance of incomplete block designs is very well known in experiment involving a big number of varieties and a large class of incomplete block designs consists of the so-called balanced incomplete block designs (BIB Designs) Yates (1936a) introduced BIB Designs in agricultural experiments and several challenging problems arrived during that period regarding the construction, non-existence and combinatorial properties of balanced incomplete block designs. A BIB Design is an incomplete block design for v treatments in b blocks of size k, so that each variety occur exactly r times along the blocks and every pair of treatment concur exactly in λ blocks. The five integers v,b,r,k,λ are the parameters of the BIBD, and they are not independent. A new method of arranging variety trials, involving a large number of varieties", Journal Agr. Sci. 26, 424-455, 1936, like, Agrawal and Prasad, Calinski, Alltop, Bose, Hanani.

Related work

In recent years various attempts have been made to construct the balanced incomplete block design, but

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still there are some research problems which remain unsolved. It is well known that proper blocking reduces random experimental error. An experiment with least error looks more sensitive in detecting significance of effects, so less experimentation may be necessary. Blocking of experimental units on a variety of physical, chemical, genetic, socioeconomic, psychological or temporal characters have been adopted by various researchers. There are large number of block designs are available in literature which have countless applications in almost all areas of scientific investigation. But in practical problems there exist some situations where there are more sources of variation that cannot be controlled by ordinary blocking. BIBD Designs with repeated blocks in Experimental Design have great role to play under such circumstances. The importance of BIB designs in statistical design of experiments for variental trials was, however, realized only in 1936 when Yates discussed these designs in the context of biological experiments. F.Yates introduced these designs in his paper, "A new method of arranging variety trials, involving a large number of varieties", Journal Agr. Sci. 26, 424-455, 1936, like, Agrawal and Prasa, Calinski, Alltop, Bose, Hanani, Majinde. Different methods of construction of balanced incomplete block designs have been given in literature Mills, Shrikhande and Ragava Rao etc. design contexts is explained in Foody and Hedayat (1977) and Wynn (1977).Yates (1936a) formally introduced BIB Designs in agricultural experiments and since that time several challenging problems concerning the construction, non-existence and combinatorial properties of BIB Designs have been posed. A BIB Design is a binary incomplete block design for v varieties in b blocks of size k, so that each variety occur exactly r times along the blocks. Blocking in its actual situation has been discussed by various statisticians Kempthorne (1952); Cochran and Cox (1957); Cox, (1958); and Box *et al*, (1978). When the number of treatments is very large and blocking is must, the Incomplete Block Designs are generally used. The origins of incomplete block designs go back to Yates who introduced the concept of balanced incomplete block designs and their analysis utilizing both intra and inter-block information.

Different types of Partially Balanced Incomplete Block Designs (PBIBD) with two or more than two associate classes have been widely discussed by many statisticians like Bose and Nair (1939), Bose and Shimamoto (1952), and are solely characterized by their parameters and association schemes. Some of the most important PBIB association schemes with two (lasses are group divisible, triangular and Latin square. Schemes with more than two association classes are hierarchical group divisible Cubic Raghavarao and Chandrasekhararao (1964) and rectangular (Vartak, 1955) etc. Different methods of construction of balanced incomplete block designs have been given in literature Shrikhande and Ragava Rao (1963). He also reported that most of them having $r \leq 41$ and reported that some of these designs are resolvable and some (p^2+1), p $(p^2+1)/2$, p $(p+1/2)$, $(p+1)$, $(p+1)/2$ BIBDS for p a prime power. Shah (1995) studied the E-optimality of cubic designs whose concurrence matrix N~N~I has all diagonal elements equal and all of its off diagonal elements differing by 0 or 1 or 2. In recent times different methods of constructing variance balanced and efficiency balanced block designs with repeated blocks have been given in the literature Ghosh and Shrivastava(2001); Ceranka and Graczyk(2007,2008).Ghosh and Shrivastava (2001) developed the methods of construction of BIB designs with repeated blocks so as to distinguish the usual BIBD with repeated blocks. Adamczak *et al*, (2004) studied the tight incomplete block designs. Kipkemoi *et al*. (2014) worked on the Construction of some new three associate class partially balanced incomplete block designs in two eplicates Search for experimental designs which aid in research studies involving large number of treatments with minimal experimental units has been desired overtime. Qi and Luo (2015) studied the Characterization Tensors of Balanced Incomplete Block Designs. They reported

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that Balanced incomplete block designs (BIBDs) have wide applications in engineering, business and sciences. In this report, for each (v, k, λ)-BIBD, they construct a strongly symmetric k-th order v-dimensional tensor. They label such a strongly symmetric tensor the characterization tensor of that BIBD, and the absolute value tensor of the characterization tensor the sign less characterization tensor of that BIBD. Sharma J *et al*. (2016) have constructed the series of BIB and PBIB designs using either Semi-Regular Group Divisible Designs or Regular Group Divisible Designs along with its corresponding group. Agarwal B *et al*. (2016) have devised Some methods of affine resolvable balanced incomplete block designs and affine resolvable rectangular type partially balanced incomplete block designs with unequal block sizes, which are based on the incidence matrices of the known affine resolvable balanced incomplete block designs Arunachalam R *et al*, (2016) have proposed the two different methods for the construction of an efficiency balanced design by deleting the control treatment and by deleting the control treatment as well as all the main effect treatment combinations of a 2n symmetrical factorial experiment. Motsumi G T.*et al*, (2014) reviewed the mathematical concepts required for construction of ***t*** −designs via their isomorphisms and automorphisms. Das A.*et al*, (2002) devised a simple method of construction of BTIB designs based on BIB designs. The advantage of this method is that one can use the vast literature on BIB designs to obtain a large number of highly A-efficient BTIB designs. Rashmi A. *et al*, (2013) prepared the review based literature paper on balance incomplete block designs with repeated blocks

Conclusion :

This paper represents the review of some available research material on the construction of incomplete block designs and helps us to construct some new balanced incomplete block designs by following same terminology but different methodology mentioned in this review paper. The newly constructed BIBD design would be gre at helpful in different experimental situation.

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A Study of Green Marketing in India – Its Challenges and Opportunities

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ABSTRACT
In present days environmental issue is a sizzling topic as almost in the entire world, the government and society have started to be more aware about these hot issues. This tends to green marketing strategic efforts to gain profit and protect the environment. The present paper makes an attempt to analyse the new challenges in green marketing, in present trend and to discuss their benefits for the entire community as a whole.

Introdution

Green Marketing refers to the process of selling goods and /or services based on their environmental benefits. These products or service should be environmentally friendly in itself or may produce in an environment-friendly way. The word "Green" has become a buzz word in today's environmentally conscious world. Green causes are increasingly popular with public making green marketing good for public relations and sales.

Green marketing is the marketing of products that are presumed to be environmentally friendly preferable to all others. Therefore, green marketing inherit a broad range of activities, including product modification, changes in the process of manufacturing, as well as modifying in their advertisement.

Society becomes more concerned about natural environment when the negative effects of degradation of the environment are experienced by the society. Global warming, ozone depletion, carbon credits, environmental hazards, impact of environmental assessment have all become common terminology in the 21st century and it is an environmental indication for the conscious society. One of the reasons for this degradation is due to the problems that arise out of bulk production, bulk consumption and excess marketing of environmentally irresponsible products. As a matter of fact various business houses have started modifying their behavior now a days identify and support these kinds of new concerns of the society.

Traditional marketing involves selling goods and services which satisfy consumer needs, wants and demand at a very affordable price, whereas green marketing has the additional challenges of identifying and acknowledging 'what is green' in developing and selling out those products that the consumer may like.

Definition of Green Marketing

The American Management Association (AMA) has defined green marketing as "The study of the positive and negative aspects of marketing activities on pollution, energy depletion and non-energy resource depletion".

According to Tapan K. Panda "Environmental Marketing or Green Marketing consists of all activities designed to generate and facilitate an exchange intended to satisfy human wants or needs such that the satisfaction of these needs and wants occurs with minimal detrimental impact on the natural environment".

Literature Review

Charter and Polonsky, 1999 - In challenging phase, green marketing has entered as a "self-adjusting" mode, whereas only corporations with a real intention for long-term business development sustainable continued to stay and improve on their products. Green marketing, since 2000 has evolved into a third stage. Anticipating the continuous uprising consumerism force, "sustainable marketing"

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has been started addressing by scholars the late-1990s.

Armstrong and Kotler, 2007 – In management, environmental sustainability is defined as an approach that involves developing strategies that sustain the environment and started producing benefits to the company. It is a crucial but difficult social target and many companies are taking at least some action to preserve and protect the environment. It is also the idea taken into consideration that environmental objectives are not compared with the prevailing economic success, as it is one step nearer to marketing (Grant, 2007, p. 2).

Uusitalo and Oksanen, 2004- Consumerism ethically refers to buyer behaviour that project an issue that arise from unethical and unjustified global trades, such as child labour, low-paid labour, etc., infringement of human rights, animal testing, suppressions of labour unions, trading relations inequalities with the Third World and environmental pollution (Strong, 1996). Green consumerism has led to an even more broadened consumption concept in ethical consumerism. Green consumerism and its subsequent ethical consumerism are forms of symbolic consumption because consumers are not only considered individual but also their social values, ideologies and ideals (Uusitalo and Oksanen, 2004).

Green Marketing -Challenges

Standardization required -Approximately 5% of the marketing messages from "Green" campaigns are entirely true and to authenticate these claims there is a lack of standardization. There is no standardization to authenticate these claims. There is no current process of standardization to certify an organic product. Unless, regulatory bodies should involve in providing these certifications to check the authentication. The quality control board required to place such labeling and licensing.

New ideas & Concept – General, Indian literate, urban consumer is getting more conscious about the advantages of Green products. But it is still a new concept for the rural and the masses. The consumer needs to be educated and responsible about the environmental threats. Lots of efforts and time have been needed to reach out to the masses. India's heritage on Ayurveda, Indian consumers do appreciate the importance of using natural and herbal beauty products. The Indian consumer is exposed towards more healthy & perfect lifestyles such as yoga, meditation and Ayurveda food consumption. In those aspects the consumer must be aware and inclined towards the greener products.

Perseverance & Patience -The investors and industry need to view the environment as a major and long-term investment opportunity, the marketers who are marketing their products are looking for a long term benefit from this new green movement.

Avoiding Green Myopia - Green marketing must focus on customer advantage, i.e. the primary reason why consumers buy certain products in the first phase. Is this right? Motivate consumers to pay a premium, or to a switch a brand for the greener alternative. It is not going to help if a product may developed which must absolutely green in many aspects, but does not pass the customer satisfaction criteria. This would lead to green myopia. And if the green products are priced very high, then again it will lose its market acceptability

Opportunities at Green Marketing

1. Your customer, we must know: Make sure that the consumer is aware of and concerned about the present issues that your product attempts to address, for example Whirlpool learned the hard way that consumers wouldn't have paid a premium for a CFC-free refrigerator because advertisers know that the consumers are unknown about the basic knowledge of CFCs.
2. Educating Your Customers: isn't just a matter of letting people know you're doing whatever you're managing to protect the environment, in fact you are also educating them to know why it matters. A significant portion of your target market consumer must be aware of, it's a case of "what's wrong?" and your green marketing campaign goes distracted.
3. Being transparent and genuine policy: It includes *(a).* You must claim the actual things you are going to do in your marketing campaign and *(b)* your business policies must be consistent with whatever you are doing that would be environmentally friendly. Both these conditions should be met for the success of your business and to establish a fair environmental

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credentials that will allow a green marketing campaign for its complete success.

4. Assure the Buyer: Consumers must be confident about the quality of the products before buying and he is rest assured that the product he is buying is environment friendly and the quality of the product is not deteriorating.

5. Price Consideration: If you're charging a premium for your product and premium for another several environmentally friendly products cost you more because of economies of scale and use of high quality of ingredients to make sure that those consumers can enjoy the premium and feel it's worth it.

6. Customers Participation, an opportunity for them: means personalizing the benefits of your friendly environmental actions, which usually letting the customer take active part in maintaining positive environmental action.

7. Generally speaking, leading consumer brands should recognize that consumer expectations might have changed: It is not enough for any company to make their products greener; consumers would expect these products that they purchase pocket friendly and also to help reduce the environmental impact in their own lives too.

Discussion

The main objective of this paper was to determine the study of the awareness of green marketing and need to know what are the challenges and opportunities/ benefit of the masses, this finding is important because the global resources are gradually depleting and the entire environment is getting more and more polluted. Green marketing is that strategy which usually benefits the environment and the firms. Green marketing concept does not only benefits the company but it is also work as a strategic role in preserving our environment. Therefore, every company or industry, regardless of its size, should consider and inherit sustainable strategy into their marketing strategy. This green marketing concept should consider by these companies, keeping in mind that green marketing is not at all cure, but it is one way of increasing ethical sales. Firstly, the companies have to understand the customers' needs and wants, then only these companies may produce a suitable product for the customers. Moreover, the product's price is considerably a very important aspect. The price has to be affordable to the consumers in the majority. Finally, the places who distribute green products have to be convenient for the consumers. After all, companies are adopting a concept of green marketing as one of their strategy which will benefit the firm

Conclusion

Green environment includes mainly 3R‟ like Reduce, Re-use and Recycle of products. It would only possible when we reduce our consumption of resources like turn-off lights, recycle packaging, reduce usage of car use, etc. Re-use means repurchase rechargeable batteries, re-useable shopping bags, etc. Recycle means, reprocessing, re-blending, and restructuring of recyclable products, recycle papers, etc. It has been observed that cans, glass bottles, plastics waste, paper, and cardboard these all can be recycled easily. By analyzing existing literature and based on our small field survey, it may be concluded that green marketing, awareness as well as green consumerism may be explored for better livelihoods in a sustainable environment

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