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INDUSTRIAL WASTE WATER TREATMENT USING COCONUT SHELL,MORINGA LEAF AND CHARCOL AND THEIR COMBINATIONS

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Industrial wastewater treatment is the process of removing contaminants from water that has been used for industrial processes. This can involve physical, chemical, and biological methods to remove pollutants such as heavy metals, chemicals, and organic matter.Industrial wastewater treatment is a crucial process to ensure that industrial activities do not cause harm to the environment and human health..Moringa leaf powder, Activated carbon and moringa leaf powder are having better adsorption properties.These three are used for filtration in whole project. Overall, 4 different types of filtration is done such as taking coconut shell powder,moringa leaf powder ,activated carbon and mixture of three were taken as adsorbent layer and water from two different industries are passed. Different physical and biological parameters of initial water collected from two industries and after filtration are tested. Results are compared,then the efficiencies of each parameter for all filtration is found out and compared the efficiencies of two industries.Finally we concluded that the water filtered through moringa leaf powder as adsobant layer gives the more accurate values within the limits for irrigation.Also we concluded that waste water taken from plastic manufacturing industry gives more efficient values. The higher effieciecy values includes pH

- 31.1%, Electrical conductivity -1% ,Total alkalinity as $CaCO_3$ -7.7%, Total hardness as $CaCO_3$ -16.3%, Calcium hardness as $CaCO_3$ -22.2%, Turbidity -33.7% ,Phosphate

-21.4%.

Keywords: moringaleaf,coconut shell ,charcoal,wastewater,industry,activated Charcoal etc

1. INTRODUCTION

Industrial wastewater treatment is a crucial process that helps to protect the environment and human health. The discharge of untreated industrial wastewater can cause pollution, which can have a negative impact on aquatic life and the environment. In this project, we aim to investigate the use of coconut shell and moringa leaf as natural adsorbents for the treatment of industrial waste water.Coconut shell and moringa leaf are natural materials that have been shown to be effective in removing pollutants from wastewater. The use of these materials as adsorbents can help to reduce the cost of wastewater treatment and provide a sustainable solution for the management of industrial waste water.The project will involve the collection of industrial wastewater samples from different sources, such as textile mills, chemical industries, and food processing plants. The samples will be analysed to determine the levels of pollutants present. The coconut shell and moringa leaf will then be used as adsorbents to treat the wastewater samples, and the effectiveness of the process will be evaluated by analysing the treated water.

The project aims to provide a sustainable solution for industrial wastewater treatment that is cost-effective and environmentally friendly. The use of natural adsorbents such as coconut shell and moringa leaf can help to reduce the reliance on chemical-based treatments and provide a more sustainable approach to wastewater management. This project has the potential to contribute to the development of a more sustainable and eco-friendly industrial sector.

Filtered water refers to water that has been treated to remove impurities, contaminants, and other unwanted substances. This process typically involves the use of various filtration methods to purify the water and make it safe for consumption. The scope of filtered water encompasses a wide range of topics, including the different types of filtration systems, the benefits of filtered water, and the importance of clean drinking water .One of the most common methods of filtering water is through the use of activated carbon filters. These filters work by trapping impurities and contaminants in the water, such as chlorine, lead, and other harmful substances. Activated carbon filters are often used in water pitchers, faucet attachments, and refrigerator water dispensers, providing a convenient and cost-effective way to improve the quality of drinking water.Another popular method of filtering water is through reverse osmosis systems. These systems use a semi-permeable membrane to remove impurities from the water, producing high- quality, purified water. Reverse osmosis systems are often installed under the sink or as a whole- house filtration system, providing a comprehensive solution for ensuring clean and safe drinking water throughout the home.In addition to these methods, there are also other types of filtration systems available, such as UV filters, ceramic filters, and distillation systems. Each of these methods offers unique benefits and advantages, making it important for consumers to understand the differences between them and choose the best option for their specific needs.The benefits of filtered water are numerous and far-reaching. By removing impurities and contaminants from the water, filtered water can improve its taste, odor, and overall quality. Additionally, filtered water can help reduce the risk of exposure to harmful substances, such as lead, chlorine, and other potentially dangerous contaminants. This can have a positive impact on overall health and well-being, particularly for those with compromised immune systems or other health concerns.Filtered water also plays a crucial role in environmental sustainability. By reducing the need for single-use plastic bottles and minimizing the use of disposable water filters, filtered water systems can help minimize waste and promote eco-friendly practices. This can contribute to a healthier planet and reduce the environmental impact of traditional water treatment methods.Furthermore, access to clean and safe drinking water is a fundamental human right. Unfortunately, many people around the world lack access to clean water sources, leading to widespread health issues and economic challenges. Filtered water systems can help address this issue by providing an affordable and effective way to improve the quality of drinking water, particularly in areas where traditional water treatment infrastructure is lacking.the scope of filtered water encompasses a wide range of topics, from the different types of filtration systems to the benefits of clean drinking water. By understanding the importance of filtered water and exploring the various options available, consumers can make informed decisions about how to ensure access to safe and high-quality drinking water in their homes and communities. Ultimately, filtered water represents a critical component of a healthy and sustainable lifestyle, with far-reaching benefits for both individuals and the environment.

1.1OBJECTIVES

- To determine the quality parameters of waste water taken from interlock manufacturing industry
- To determine the quality parameters of waste water taken from plastic manufacturing industry
- To compare the quality parameters after filtration through coconut shell powder, moringa leaf powder and activated charcoal and combination of three
- To compare the results from interlock manufacturing industry and plastic manufacturing industry
- To compare the waste water efficiencies of interlock manufacturing industry and plastic manufacturing industry.

1.2SCOPE

Treated wastewater helps protect the environment by reducing the discharge of pollutants into water bodies, thereby minimizing the impact on aquatic ecosystems and human health.Treated wastewater can be reused for a variety of non-potable purposes such as irrigation, industrial processes, and toilet flushing, conserving freshwater resources and reducing demand on potable water sources.Treated wastewater can be used for agricultural irrigation, providing a sustainable water source for crop production and reducing the reliance on freshwater resources.Treated wastewater can be used in various industrial processes, such as cooling water systems, boiler feedwater, and manufacturing processes, reducing the demand for freshwater and lowering operational costs.Treated wastewater can be utilized in energy generation processes, such as bioenergy production from organic matter in wastewater, contributing to renewable energy production and resource recovery.Treated wastewater can be used for recreational purposes, such as landscaping, golf course irrigation, and artificial lakes, providing aesthetic and functional benefits.The scope of treated wastewater also includes research and innovation in wastewater treatment technologies, resource recovery, and water reuse practices to improve efficiency, sustainability, and environmental protection.

2. LITERATURE REVIEW

2.1GENERAL

Wastewater filtration is a critical process that plays a pivotal role in ensuring the safety and sustainability of our water resources. As communities and industries generate wastewater containing various contaminants and pollutants, it becomes imperative to treat and clean this water before it is released back into the environment or reused for other purposes. Wastewater filtration involves a series of techniques and technologies designed to remove impurities and harmful substances from water, making it safe for discharge or reuse.

One of the primary objectives of wastewater filtration is to remove solid particles and debris suspended in the water. Physical filtration methods, such as screening, settling, and filtration through sand or other porous materials, are commonly used to separate these particles from the water. By effectively removing solids, physical filtration helps prevent clogging of pipes and equipment, reduces the load on downstream treatment processes, and improves the overall efficiency of wastewater treatment systems.

In addition to physical filtration, chemical filtration is another essential aspect of wastewater treatment. Chemicals such as coagulants, flocculants, and disinfectants are used to treat wastewater and remove contaminants like heavy metals, pathogens, and organic compounds. Coagulants help bind together small particles to form larger clumps that can be easily removed through filtration, while disinfectants like chlorine are used to kill harmful bacteria and pathogens present in the water. Chemical filtration plays a crucial role in ensuring the safety and quality of treated wastewater before it is discharged into rivers, lakes, or oceans.

Biological filtration is another key component of wastewater treatment that harnesses the power of microorganisms to break down organic matter and pollutants in the water. Biological filtration systems, such as activated sludge processes and biofilters, provide an environment for beneficial bacteria and other microorganisms to degrade organic compounds, nitrogen, and phosphorus present in wastewater. By promoting the growth of these microorganisms, biological filtration helps reduce the concentration of pollutants in water and improve its overall quality.

Wastewater filtration is essential not only for protecting public health but also for safeguarding the environment. Untreated or poorly treated wastewater can contain a wide range of contaminants that pose serious risks to human health and aquatic ecosystems. By implementing effective filtration practices, we can reduce pollution levels, prevent the spread of waterborne diseases, and minimize the impact of wastewater discharge on rivers, lakes, and coastal areas. Moreover, wastewater filtration enables the safe reuse of water for various purposes, including irrigation, industrial processes, and even potable uses. As freshwater resources become increasingly scarce due to population growth, urbanization, and climate change, the recycling and reuse of treated wastewater are becoming more important for ensuring a sustainable water supply. Proper filtration ensures that recycled water meets stringent quality standards and is safe for use in different applications.

In conclusion, wastewater filtration is a vital process that is essential for protecting water resources, public health, and the environment. By employing a combination of physical, chemical, and biological filtration techniques, we can effectively treat wastewater and ensure that it meets regulatory standards before being discharged or reused. Continued investment in wastewater filtration technologies and practices is crucial for addressing water pollution challenges and securing a clean and reliable water supply for future generations

2.2INDUSTRIAL WASTE WATER AND ITS CHARACTERISTICS

Industrial wastewater refers to the water that is discharged from industrial processes, operations, and facilities. It contains various contaminants, pollutants, and chemicals that can pose significant risks to the environment and public health if not properly treated and managed. The characteristics of industrial wastewater can vary widely depending on the type of industry, the processes involved, and the pollutants generated. In this section, we will explore the key characteristics of industrial wastewater and their implications for water quality and treatment. One of the primary characteristics of industrial wastewater is its high concentration of organic and inorganic pollutants. Industries such as manufacturing, mining, chemical production, and food processing generate wastewater containing a wide range of organic compounds, heavy metals, toxic chemicals, and other contaminants. These pollutants can have harmful effects on aquatic ecosystems, wildlife, and human health if released untreated into water bodies.

Organic pollutants in industrial wastewater include substances like oils, greases, solvents, pesticides, and detergents. These compounds can be persistent in the environment, leading to long-term contamination of water sources and soil. Inorganic pollutants, such as heavy metals and toxic chemicals , are also common in industrial wastewater and can cause serious environmental damage if not properly controlled.

Another characteristic of industrial wastewater is its high temperature. Many industrial processes involve the use of heat for manufacturing, cooling, or cleaning purposes, resulting in the discharge of hot water into water bodies. Elevated water temperatures can negatively impact aquatic ecosystems by reducing oxygen levels, altering aquatic habitats, and promoting the growth of harmful microorganisms. Thermal pollution from industrial wastewater can disrupt the balance of aquatic ecosystems and harm fish, plants, and other aquatic organisms.

Industrial wastewater may also contain high levels of nutrients such as nitrogen and phosphorus. These nutrients are essential for plant growth but can cause eutrophication when present in excessive amounts in water bodies. Eutrophication leads to the overgrowth of algae and other aquatic plants, which depletes oxygen levels in water and creates dead zones where fish and other organisms cannot survive. Nutrient-rich industrial wastewater can exacerbate eutrophication in rivers, lakes, and coastal areas, leading to water quality degradation and ecological imbalances.

Furthermore, industrial wastewater often contains a variety of suspended solids, sludges, and sediments. These solid particles can clog water treatment equipment, pipes, and filters if not removed effectively. Suspended solids can also carry contaminants such as heavy metals, pathogens, and organic compounds, further complicating the treatment process and increasing the risk of pollution in receiving water bodies.

Industrial wastewater can have several disadvantages, which can have significant environmental, social, and economic impacts. Here are some of the key disadvantages of industrial wastewater:

1. Environmental Pollution: One of the most significant disadvantages of industrial wastewater is its potential to cause environmental pollution. Industrial processes often generate wastewater containing harmful chemicals, heavy metals, and other pollutants. When this contaminatedwater is discharged into water bodies or the environment without proper treatment, it can lead to water pollution, harming aquatic life, disrupting ecosystems, and affecting human health.
2. Soil Contamination: Industrial wastewater, if not properly managed, can seep into the soil, leading to soil contamination. This can have detrimental effects on agricultural productivity, as contaminated soil may not support healthy plant growth. Additionally, the pollutants present in the soil can leach into groundwater, further exacerbating the problem.
3. Public Health Risks: Industrial wastewater may contain toxic substances and pathogens that pose risks to public health. If untreated or improperly treated wastewater enters drinking water sources or recreational water bodies, it can lead to waterborne diseases and other health issues in communities located downstream from industrial facilities.
4. Impact on Aquatic Ecosystems: Discharging untreated industrial wastewater into rivers, lakes, or oceans can have severe consequences for aquatic ecosystems. Pollutants in the wastewater can disrupt the balance of aquatic flora and fauna, leading to reduced biodiversity, fish kills, and long-term damage to the ecosystem's health.
5. Economic Costs: The presence of industrial wastewater pollutants in water bodies can result in economic costs for communities and industries. For example, contaminated water sources may require expensive treatment processes to make the water safe for consumption. Additionally, industries may face fines and legal liabilities for non-compliance with environmental regulations related to wastewater discharge.
6. Long-Term Effects on Water Resources: Industrial wastewater can contribute to the depletion and degradation of water resources. Excessive withdrawal of water for industrial processes, coupled with the discharge of polluted wastewater, can strain local water supplies and contribute to long-term water scarcity issues.
7. Regulatory Compliance Challenges: Industries that generate wastewater must comply with stringent environmental regulations regarding wastewater discharge. Failure to meet these regulations can result in legal repercussions, fines, and reputational damage for the company.

8. Impact on Food Chain: Contaminated water sources can affect the food chain as pollutants accumulate in aquatic organisms, leading to bioaccumulation and biomagnification of toxic substances. This can ultimately impact human health through the consumption of contaminated fish and seafood.

Industrial wastewater poses several disadvantages, including environmental pollution, soil contamination, public health risks, impacts on aquatic ecosystems, economic costs, long-term effects on water resources, regulatory compliance challenges, and effects on the food chain. Addressing these challenges requires effective wastewater management practices, stringent regulations, and investment in sustainable industrial processes and treatment technologies to minimize the negative impacts of industrial wastewater on the environment and society.

Fig 2.1 Industrial waste water

2.2.1 Types of industrial waste water

1. Acidic wastewater: Generated from industries that use acids in their processes, such as metal finishing and mining. It can have a low pH level, which can be harmful to aquatic life and ecosystems if discharged untreated.
2. Alkaline wastewater: Produced by industries that use alkaline substances in their processes, such as chemical manufacturing and food processing. It can have a high pH level, which can disrupt the balance of aquatic ecosystems if not properly treated.
3. Textile dyeing wastewater: Generated by textile dyeing and printing industries, it contains dyes, pigments, and other chemicals used in the coloring process. If released untreated, it can lead to water pollution and harm aquatic organisms.

4. Tannery wastewater: Produced by leather tanning industries, it contains organic matter, salts, and toxic chemicals used in the tanning process. Tannery wastewater can be highly polluting and harmful to both the environment and human health.
5. Paper mill wastewater: Generated by paper manufacturing industries, it contains organic matter, lignin, and

6. chemicals used in the production process. Paper mill wastewater can deplete oxygen levels in water bodies and impact aquatic ecosystems if
7. not treated properly.
8. Pharmaceutical manufacturing wastewater: Produced by pharmaceutical industries, it contains residues of drugs, chemicals, and solvents used in the manufacturing process. Pharmaceutical wastewater can contain harmful compounds that pose risks to human health and the environment.Petrochemical wastewater: Generated by industries involved in petroleum refining and chemical production, it contains hydrocarbons, heavy metals, and other pollutants. Petrochemical wastewater can be toxic and flammable, posing risks to water sources and ecosystems.
9. Electroplating wastewater: Produced by electroplating industries, it contains heavy metals, acids, and other chemicals used in the plating process. Electroplating wastewater can be highly toxic and corrosive if discharged without proper treatment.
10. Pulp and paper mill wastewater: Generated by pulp and paper manufacturing industries, it contains organic matter, lignin, and bleaching chemicals. Untreated pulp and paper mill wastewater can cause water pollution and harm aquatic life.
11. Mining runoff: Generated by runoff from mining activities, it contains sediments, heavy metals, and other contaminants from mining sites. Mining runoff can degrade water quality and damage ecosystems if not managed effectively.
12. Cooling tower blowdown: Produced by cooling systems in industries such as power plants and refineries, it contains high levels of salts, minerals, and chemicals used for cooling purposes. Cooling tower blowdown can contribute to water pollution if discharged without proper treatment.
13. Food processing effluent: Generated by food processing industries, it contains organic matter, nutrients, and food waste from processing operations. Food processing effluent can cause eutrophication and harm aquatic ecosystems if released untreated.

14. Metalworking fluid wastewater: Produced by metalworking industries, it contains oils, lubricants, and metal particles from machining operations. Metalworking fluid wastewater can be hazardous if not properly managed and treated.
15. Paint manufacturing wastewater: Generated by paint manufacturing industries, it contains pigments, solvents, and chemicals used in the production of paints and coatings. Paint manufacturing wastewater can contain harmful substances that require specialized treatment to prevent environmental damage.
16. Semiconductor manufacturing wastewater: Produced by semiconductor fabrication facilities, it contains heavy metals, solvents, and chemicals used in the production of electronic components. Semiconductor manufacturing wastewater can be highly toxic and require advanced treatment methods to remove contaminants effectively.

17. Rubber processing wastewater: Generated by rubber manufacturing industries, it contains latex, chemicals, and additives used in the production of rubber products. Rubber processing wastewater can be harmful to aquatic life if released untreated into water bodies.
18. Plastic manufacturing wastewater: Produced by plastic manufacturing industries, it contains polymers, additives, and chemicals used in the production of plastic products. Plastic manufacturing wastewater can contain toxic compounds that require specialized treatment for safe disposal.
19. Leather processing wastewater: Generated by leather processing industries, it contains organic matter, salts, and chemicals used in the treatment of animal hides. Leather processing wastewater can be highly polluting and require treatment to prevent environmental contamination.
20. Brewery wastewater: Produced by breweries during beer production, it contains organic matter, nutrients, and yeast from brewing processes. Brewery wastewater can contribute to water pollution if discharged without proper treatment.
21. Pharmaceutical waste effluent: Generated by pharmaceutical industries during the disposal of expired drugs, unused chemicals, and pharmaceutical waste. Pharmaceutical waste effluent can contain hazardous substances that require safe disposal methods to protect human health and the environment.

2.3WATER FILTRATION

Water filtration is the process of removing or reducing the concentration of particulate matter, including suspended particles, parasites, bacteria, algae, viruses, and fungi, as well as other undesirable chemical and biological contaminants from contaminated water to produce safe and clean water for a specific purpose, such as drinking, medical, and pharmaceutical applications. The filtration systems for drinking water usually incorporate a five-stage filtration process: sediment, mechanical, chemical, mineral, and bacterial.

With consideration of the requirements of avoidance of fibre shedding in the filtration process, nonwoven fabrics made from continuous fibres such as melt blown, spunbond, and hydroentangled nonwovens and electrospun/centrifugal spinning nanofibre nonwovens, as well as their composite combinations comprising both microfibres and nanofibres, are widely used in microfiltration as a water filtration media. They functions as either an independent microfiltration media or prefilters to remove a high contaminant content within the fluid to protect membrane filters.

Examples of such nonwoven filters comprising one or more layers of microfibres and nanofibres for microfiltration of specific biological contaminants were reported in US patents 2004/0038014, 2007/0075015, and 2007/0018361. Prefilters are commonly pleated or wound filter fabrics. Prefilters have a large band of retention ratings. The most common retention rating of these filters is 20 or 50 nm, and it can be engineered to all necessary applications.In the water filtration system, membrane filters are highly efficient in filtering submicron contaminants in water, but have a deficiency of very limited filtrate holding capacity. Nanofibre nonwoven fabrics are widely used in membrane water filtration system as viral removal filters. They have two roles in the composite filter structure: they act as a separate prefilter to separate out particles of larger size than the rating of the membrane to promote the high filtration efficiency of membrane filters, and they also provide depth filtration to the membrane to improve the particle holding capacities of the membrane filtration system to extend the lifetime of the membranes. Examples of such composite liquid filtration media, comprising a layer of nanoweb adjacent to a microporous membrane, were reported in US patent 8038013[146]; a nanofiber web containing liquid filtration medium that simultaneously exhibits high liquid permeability and high microorganism retention was reported in patent EP2408482.[147] Log

Reduction Value (LRV) has been used to quantify the filters in liquid sterilisation filter tests, it is defined as the logarithm of the ratio of the total micro-organisms in challenge to the micro- organisms in filtered fluid. Microorganisms such as bacteria *Brevundimonas diminuta*, *Mycoplasma*, and other bacteria are removed from a liquid by passing the liquid through a porous nanofiber containing a filtration medium having a bacteria *B. diminuta* LRV (Log Reduction Value) greater than about 9, and the nanofiber(s) has a diameter from about 10 nm to about 1000 nm.

Biofouling from bacterial, fungi, and other microorganisms in the water decrease nonwoven prefilter membrane performance and increase the frequency and cost of its chemical cleaning. There are many ways to make nonwoven filters antibacterial and biocidal. Water filters could be made to incorporate biocides, including quaternary phosphonium salt, polymeric phosphonium salts,and onium-functionalized polymers, into nonwoven filters to remove bacteria and other microorganisms. Nanoparticles having antimicrobial functionalities are also employed to remove microorganisms from water. Examples of such filters include covalently or ionically tethering antimicrobial nanoparticles nanoparticles encapsulated in positively- charged polyethyleneimine (PEI)) into the surface of oxygen plasma modified polysulfone ultrafiltration membranes,[151] nanofibrous nonwoven membranes made from a mixture of poly, and chitosan functionalized with graphene oxide (GO)–Ag nanocomposites and carbon nanotubes to prevent bacterial colonization on the membrane surfaces. The GO–Ag nanoparticles are bonded onto the nanofibrous membrane via a chemical reaction between the carboxyl groups of graphene and the primary amine functional groups on the PLGA–chitosan fibres using 3-(dimethylaminopropyl)-N′-ethylcarbodiimide hydrochloride and N- hydroxysuccinimide as cross-linking agents.

Nonwovens made from polymers having antibacterial activities are another route to achieve antimicrobial filters. One of such polymers against *Escherichia coli* and *Staphylococcus hyicus* was synthesed[154] via copolymerization of three monomers of N,N′-dimethyl-N- alkylmethacryloxylethyl ammoniumbromide with different lengths of alkyl chains , acrylic acid

, and acrylamide.

Water filters containing fibres, especially nanofibers, of ion exchange properties[155] have been applied in the fields of biotechnology, pharmaceutical processing, producing ultrapure water for the semiconductor industry, catalytic conversion processing, and battery technologies.[156] Polymers containing ionic functional groups might be difficult to be made into ion exchange fibres using electrospinning methods because polymer solutions with a high electric conductivity (eg, polyelectrolyte solution) prevent electric field-induced charging of the solution and lead to a low electrospinnability. Therefore, ion exchange nanofibers formed using electrospinning methods have relied on the following three approaches

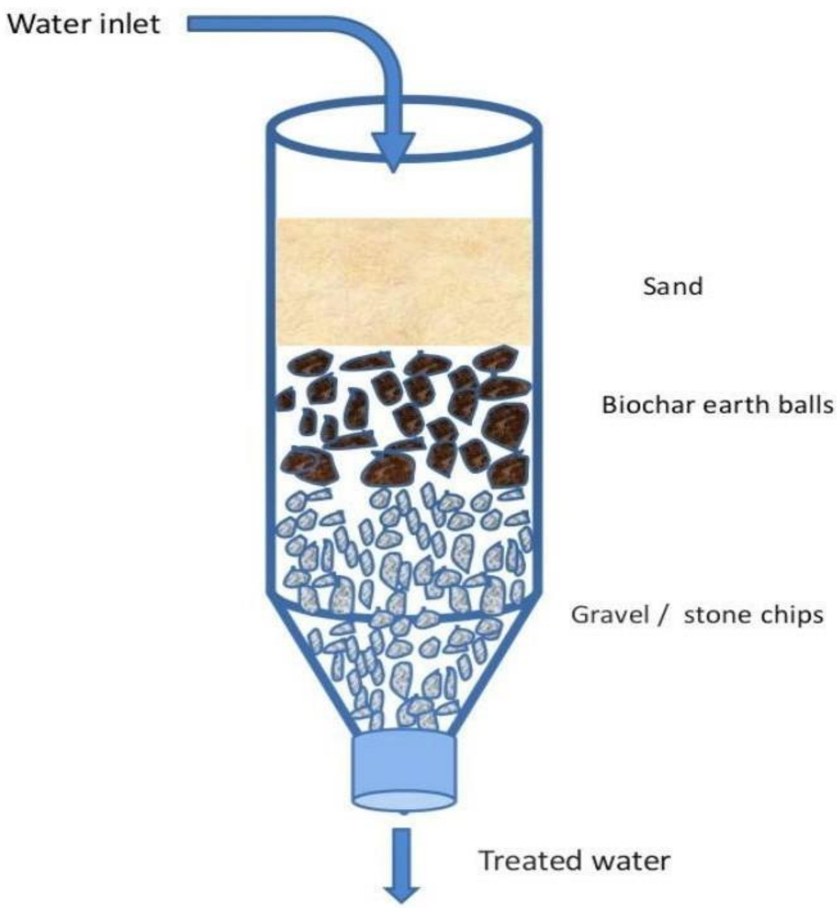

Fig 2.2 Conventional water filtration system(source:www.google.com)

2.3.1 Different types of waste water filtration

- Physical filtration: This method involves passing the wastewater through a physical barrier, such as a screen or filter, to remove larger particles and debris.
- Chemical filtration: Chemical filtration involves the use of chemicals, such as coagulants and flocculants, to help bind together smaller particles in the water so that they can be easily removed.
- Biological filtration: This method uses living organisms, such as bacteria or algae, to break down organic matter and remove contaminants from the water.
- Membrane filtration: Membrane filtration involves passing the wastewater through a membrane that

selectively removes particles based on size or other properties. Examples include reverse osmosis and ultrafiltration.

- Activated carbon filtration: Activated carbon is a highly porous material that can adsorb contaminants from the water, making it an effective method for removing organic compounds, odors, and certain chemicals.
- Ion exchange filtration: This method involves passing the wastewater through a resin that exchanges ions with the contaminants in the water, effectively removing them from the solution.
- UV disinfection: UV light is used to disinfect wastewater by damaging the DNA of microorganisms, rendering them harmless and unable to reproduce.

2.4CHARCOL AS FILTRATION MATERIAL

The use of carbon in the form of charcoal has been used since antiquity for many applications. In Hindu documents dating from 450 BC charcoal filters are mentioned for the treatment of water. Charred wood, bones, and coconut charcoals were used during the 18th and 19th centuries by the sugar industry for decolorizing solutions. Activated carbon is a material prepared in such a way that it exhibits a high degree of porosity and an extended surface area . A typical carbon particle has numerous pores that provide a larger surface area for water treatment. During water filtration through activated carbon, contaminants adhere to the surface of the carbon granules or become trapped in the small pores of the activated carbon. This process is called adsorption. Activated carbon filters are efficient in removing certain organics (such as unwanted taste and odors, micropollutants), chlorine, fluorine, or Radon, from drinking water or wastewater.

However, it is not effective for other contaminants. Activated carbon filtration is commonly used in centralized treatment plants and at the household level, to produce drinking water and in industries to treat effluents. It is also an upcoming treatment applied for the removal of micropollutants both in drinking water production and for the purification of treated wastewater before disposal. There are two basic types of water filters; particulate filters and absorptive/ reactive filters. A particulate filter excludes particles by size, and adsorptive/reactive filters contain a material (medium) that either adsorb or react with a contaminant in water. The principles of adsorptive activated carbon filtration are the same as those of any other adsorption material. The contaminant is attracted to and held (adsorbed) on the surface of the carbon particles. The characteristics of the carbon material (particle and pore size, surface area, surface chemistry, etc.) influence the efficiency of adsorption. The characteristics of the chemical contaminant are also important. Less water-soluble compounds are more likely to be absorbed into a solid. A second characteristic is an affinity that a given contaminant has with the carbon surface. This affinity depends on the charge and is higher for molecules possessing less charge. If several compounds are present in the water, strong absorbers will attach to the carbon in greater quantity than those with weak adsorbing ability. Activated carbon filtration is recognized by the water quality Association as an acceptable method to maintain certain drinking water contaminants within the limit of the EPA National Drinking

Water Standards. The safe drinking water ACT mandates EPA to strictly regulate contaminants in community drinking water systems.

2.4.1 Cost of charcoal

Charcoal is a readily available, affordable, and disposable material. It is relatively cheap and easier to handle. Charcoal for filter material performs better when it is of good quality. The cost of charcoal depends on its quality. The higher the quality of the charcoal, the higher its cost the

6.3 mm gravel size charcoal was at the bottom. This was to create as fine a matrix as possible for the water to drip through slowly, thus trapping more sediment and wee beasties. Another piece of a fine –mesh material was placed at the top of the uppermost charcoal layer to prevent it from becoming displaced when water was added. However, about 18 L of raw turbid water can be filtered continuously without clogging of the filter. Also, the flow rate of the filter

decreases after continuous use of two months continuously and a higher flow rate could be achieved by washing the charcoal layer and replacing the powder charcoal.

Fig 2.3 Charcol

2.4.2 Preparation of activated charcol

Activated charcoal, (also called activated carbon) is a form of carbon having small pores that helps in increasing the surface area available for adsorption. All the activated carbon with more micropores show high specific surface area as well as total pore volume which depends upon the activation time prolonging; the highest ones were around 3100 m^2 /g and 1.5 mL/g, respectively . Coconut is a member of the palm tree family known for its versatility of uses. The shell of coconut contains cellulose, lignin, charcoal, tar, tannin etc. Coconut shell is first collected and then cut into small pieces, followed by washing with simple tap water for removal of dust adhering to it. It was followed by drying in sunlight and grinding into a powdered form called coconut husk. This powdered form is then heated in the oven at 110°C temperature. Dried materials were kept in the muffle furnace at 150°C for removal of other volatile impurities. This leads to the formation of fixed carbon (charcoal). For the first batch, whole fixed carbon istreated

at 300°C in a muffle furnace for formation of ash for proximate analysis. The sample was carbonized using a 25% concentrate solution of $CaCl_2$. The soaked sample was transferred into a tray and washed repeatedly with distilled water to remove traces of chemical. The washed
sample was transferred into an oven at 110℃ activated charcoal and stored for use.

2.4.3 **Properties of activated charcoal**, cooled and led to formation of chemically

Activated charcoal, also known as activated carbon, is a versatile and highly effective adsorbent with a wide range of properties and applications. This porous material is produced by heating carbon-rich materials, such as wood, coconut shells, or coal, at high temperatures in the absence of oxygen, resulting in a highly porous structure with a large surface area. Here are some key properties of activated charcoal:

1. High Surface Area: One of the most significant properties of activated charcoal is its exceptionally high surface area per unit mass. The activation process creates a network of pores and cavities on the surface of the charcoal, leading to a vast internal surface area that can range from 500 to 1500 square meters per gram. This extensive surface area provides activated charcoal with a high adsorption capacity for a wide variety of molecules and contaminants.

2. Adsorption Capacity: Activated charcoal exhibits strong adsorption properties due to its porous structure and large surface area. The porous network of activated charcoal traps and retains molecules, ions, and particles through physical adsorption, where contaminants adhere to the surface of the charcoal via van der Waals forces or other interactions. This adsorption process allows activated charcoal to effectively remove impurities, odors, toxins, and pollutants from gases, liquids, and solutions.

3. Chemical Inertness: Activated charcoal is chemically inert, meaning it does not react with most substances or undergo chemical changes during the adsorption process. This property makes activated charcoal a safe and reliable adsorbent for various applications, as it does not introduce unwanted chemical reactions or byproducts into the system.

4. Selective Adsorption: Activated charcoal exhibits selective adsorption properties, enabling it to preferentially adsorb certain molecules or compounds over others based on their size

5. , polarity,

or chemical properties. This selectivity allows activated charcoal to target specific contaminants while leaving other components unaffected, making it a versatile adsorbent for purification and separation processes.

6. Regeneration Capability: One of the unique properties of activated charcoal is its ability to be regenerated and reused multiple times. By subjecting spent activated charcoal to high temperatures in a controlled environment, contaminants can be desorbed and removed from the pores, restoring the adsorption capacity of the charcoal. This regeneration process allows activated charcoal to maintain its effectiveness over multiple cycles, making it a cost-effective and sustainable adsorbent.

7. Porous Structure: The porous structure of activated charcoal consists of a network of interconnected pores with varying sizes, including micropores, mesopores, and macropores. These pores provide multiple sites for adsorption and diffusion of molecules, allowing activated charcoal to efficiently capture and retain contaminants within its porous matrix.

8. Versatile Applications: Due to its unique properties, activated charcoal finds widespread applications in various industries and sectors. It is commonly used in water treatment processes to remove organic pollutants, heavy metals, and chlorine from drinking water. In air purification systems, activated charcoal filters are employed to eliminate odors, volatile organic compounds (VOCs), and airborne contaminants. Activated charcoal is also utilized in medical settings for detoxification treatments, poison control, and gastrointestinal disorders.

Activated charcoal possesses several key properties that make it a highly effective adsorbent for a diverse range of applications. Its high surface area, adsorption capacity, chemical inertness, selective adsorption, regeneration capability, porous structure, and versatility contribute to its widespread use in water treatment, air purification, medical treatments, environmental remediation, and industrial processes. The unique properties of activated charcoal make it an indispensable material for addressing pollution, contamination, and purification challenges across various sectors.

2.5 COCONUT SHELL AS FILTRATION MATERIAL

Coconut shells are a versatile and sustainable material that can be effectively used for water filtration purposes. With their natural adsorption properties and porous structure, coconut shells offer a cost-effective and eco-friendly solution for removing contaminants from water.

The unique structure of coconut shells makes them an ideal filtration medium. The shells contain micro-sized pores that provide a large surface area for adsorption processes to occur. When processed into activated carbon, coconut shells become even more effective at trapping impurities and pollutants in water. Activated carbon derived from coconut shells has been proven to efficiently remove organic compounds, heavy metals, chlorine, and other harmful substances from water.

One of the key advantages of using coconut shell-based activated carbon for water filtration is its high adsorption capacity. The porous nature of coconut shells allows them to trap a wide range of contaminants, making them a versatile and reliable filtration material. The high surface area of coconut shell-based activated carbon provides ample space for adsorption processes to take place, ensuring the efficient removal of pollutants from water

In addition to their effectiveness as a filtration medium, coconut shells offer several other benefits for water treatment applications. Coconut shells are a renewable resource, making them a sustainable alternative to traditional filtration materials. By utilizing coconut shells for water filtration, we can reduce our reliance on non-renewable resources and minimize the environmental impact of water treatment processes.

Furthermore, coconut shell-based filters are biodegradable, meaning they can be easily disposed of without causing harm to the environment. Unlike synthetic filtration materials that can contribute to pollution and waste accumulation, coconut shells decompose naturally, reducing the overall environmental footprint of water treatment systems.

Another advantage of using coconut shells for water filtration is their cost-effectiveness. Coconut shells are readily available in many regions where coconuts are grown, making them a cost-efficient filtration material compared to synthetic alternatives. By harnessing the natural

adsorption capabilities of coconut shells, water treatment facilities can achieve effective contaminant removal at a lower cost.

Figure 2.4 Coconut shell

2.5.1 Properties of coconut shell

Coconut shell water filters use activated carbon from coconut shells to remove impurities from water. Here’s how it works:

The activated carbon in the filter attracts and adsorbs specific contaminants as water flows through the filter. The porous structure of the carbon provides a large surface area for impurities to be trapped.As the water passes through the filter, chemical reactions occur between the impurities and the activated carbon. This helps to break down the contaminants and remove them from the water.The filter also physically strains out larger particles and sediment as the water flows through it, further improving water quality.

The clean, filtered water is then released from the filter and can be consumed or used for other purposes.The coconut shell carbon filter's effectiveness depends on the filter's size, the activated carbon quality, and the water's specific contaminants. Some filters may also contain additional stages, such as a sediment or membrane filter, to further improve water quality. Overall, coconut shell carbon water filters provide an effective and affordable method for removing impurities from water.

Advantage of using coconut shell as water filter

There are several advantages of using a coconut shell carbon water filter:Coconut shell carbon has a large surface area and high porosity, which makes it highly effective at adsorbing pollutants from water.What does coconut shell carbon remove? It can remove chlorine, volatile organic compounds (VOCs), pesticides, and other chemicals that can affect the taste and odor of water.By removing impurities, the coconut shell activated carbon water filter can improve the taste and smell of water. It can also remove unwanted flavors and odors from water, such as those caused by chlorine or organic matter.Coconut shell water filter has a long lifespan and can typically last for several months before needing to be replaced. This makes them a cost-effective option for water filtration.Coconut shell carbon is made from a renewable and biodegradable source, making it an environmentally friendly option for water filtration.Coconut shell carbon water filters are generally more affordable than other water filtration systems, such as reverse osmosis or distillation systems.Overall, the advantages of using a coconut shell carbon water filter include improved water quality, long lifespan, cost-effectiveness, and environmental sustainability.

2.5.2 Prepration of coconut shell powder

The preparation of coconut shell powder involves a series of steps to transform raw coconut shells into a fine powder that can be used in various industries. The process begins with the collection of coconut shells from coconut processing units or farms. The shells are then cleaned thoroughly to remove any dirt, debris, or external contaminants. This is essential to ensure the quality and purity of the final powder product.After cleaning, the coconut shells are dried to reduce their moisture content. Drying can be done using natural sunlight or through mechanical drying methods. Proper drying is crucial to prevent mold growth and ensure that the shells are suitable for grinding.Once dried, the coconut shells are crushed or ground into small pieces using a crusher or grinder. The crushed shells are further processed in a pulverizing machine to obtain a fine powder consistency. This grinding process helps break down the shells into smaller particles, resulting in a smooth and uniform powder.The powdered coconut shells are then sieved to remove any larger particles and ensure uniformity in size. This step is important to achieve a consistent texture and quality in the final product.Finally, the coconut shell powder is

packaged in suitable containers for storage and distribution. Proper storage conditions should be maintained to prevent moisture absorption and maintain the quality of the powder.

2.6MORINGA LEAF AS FILTRATION MATERIAL

Moringa leaves have gained attention as a natural and sustainable material for water filtration due to their unique properties and effectiveness in removing impurities from water. The moringa tree, also known as the "Miracle Tree," is native to parts of Africa, Asia, and Latin America and has been traditionally used for its medicinal and nutritional benefits. In recent years, research has highlighted the potential of moringa leaves as a low-cost and eco-friendly solution for water treatment.

One of the key advantages of using moringa leaves for water filtration is their natural coagulant properties. Moringa leaves contain cationic proteins that can bind to negatively charged particles in water, such as bacteria, viruses, and other contaminants, causing them to clump together and settle to the bottom. This process, known as coagulation, helps to remove suspended solids and pathogens from water, making it clearer and safer to drink.

In addition to their coagulant properties, moringa leaves also exhibit antimicrobial activity, which can help to inhibit the growth of bacteria and other microorganisms in water. Studies have shown that extracts from moringa leaves have antimicrobial effects against a wide range of pathogens, including E. coli, Salmonella, and Staphylococcus aureus. By incorporating moringa leaf extracts into water treatment systems, it is possible to enhance the disinfection of water and reduce the risk of waterborne diseases.

Furthermore, moringa leaves are rich in antioxidants and other bioactive compounds that can help to improve water quality. These compounds can help to neutralize free radicals and reduce the presence of harmful substances in water, enhancing its overall purity and safety. By using moringa leaves as a filtration material, water treatment facilities can benefit from the natural detoxifying properties of these leaves, resulting in cleaner and healthier drinking water.

Another advantage of using moringa leaves for water filtration is their availability and affordability. Moringa trees are easy to cultivate in tropical and subtropical regions, where they

can thrive in a variety of soil conditions. The leaves can be harvested throughout the year, providing a continuous supply of filtration material for water treatment purposes. Compared to conventional chemical coagulants and synthetic filtration materials, moringa leaves offer a cost- effective and sustainable alternative for communities with limited resources.

Moreover, moringa leaves are biodegradable and environmentally friendly, making them a preferred choice for sustainable water treatment solutions. Unlike synthetic chemicals that can have negative impacts on ecosystems and human health, moringa leaves decompose naturally without leaving harmful residues in the environment. By utilizing moringa leaves for water filtration, we can reduce our reliance on conventional treatment methods that may have adverse environmental consequences.

Fig 2.5 Moringa leaf

2.6.1 Properties of moringa leaf

Moringa leaves are a rich source of essential vitamins and minerals, including vitamin A, vitamin C, calcium, iron, and potassium.They contain high levels of antioxidants, such as quercetin and chlorogenic acid, which help to protect cells from damage caused by free radicals.Moringa leaves have anti-inflammatory properties that can help reduce inflammation

in the body and alleviate symptoms of conditions like arthritis.They are a good source of plant- based protein, containing all nine essential amino acids necessary for human health.Moringa leaves are low in calories but high in nutrients, making them a great addition to a balanced diet for weight management.They have been shown to have antimicrobial and antibacterial properties, helping to fight off infections and support immune health.Moringa leaves may help to lower blood sugar levels and improve insulin sensitivity, making them beneficial for individuals with diabetes.They can support heart health by lowering cholesterol levels and reducing the risk of cardiovascular diseases.Moringa leaves contain fiber, which aids in digestion, promotes gut health, and helps prevent constipation.They have been used traditionally in Ayurvedic medicine to treat various ailments and promote overall wellness.Moringa leaves have been shown to have neuroprotective effects and may help improve cognitive function.They can help to reduce oxidative stress and protect against neurodegenerative diseases like Alzheimer's and Parkinson's.Moringa leaves have been studied for their potential anti-cancer properties, with some research suggesting they may inhibit the growth of cancer cells.They are a good source of plant-based calcium, which is important for maintaining strong bones and teeth.Moringa leaves contain high levels of vitamin A, which is essential for healthy vision and immune function.They are a natural energy booster due to their nutrient content, helping to combat fatigue and improve overall vitality.Moringa leaves have been shown to have anti- allergic properties, potentially helping to alleviate symptoms of allergies and asthma.They can help to improve skin health and promote a youthful complexion due to their antioxidant and anti-inflammatory effects. Moringa leaves may aid in liver detoxification and support overall liver health.

They are a sustainable and environmentally friendly crop, as the entire plant is edible and can be used for various purposes.

2.6.2 Prepration of moringa leaf powder

The preparation of moringa leaf powder involves several steps to transform fresh moringa leaves into a fine powder that is rich in nutrients and can be used for various purposes. Here is a general outline of the process:

Moringa leaves are typically harvested from mature moringa trees. It is important to select healthy leaves that are free from pests, diseases, and damage.The harvested moringa leaves need to be cleaned thoroughly to remove any dirt, dust, or debris. This can be done by gently washing the leaves in clean water and allowing them to air dry.Once cleaned, the moringa leaves need to be dried to reduce their moisture content. Drying can be done in several ways, such as air drying in a well-ventilated area, using a dehydrator, or in an oven at low temperatures. Proper drying helps preserve the nutrients in the leaves and prevents mold growth. The dried moringa leaves are then ground into a fine powder using a grinder or food processor. It is important to grind the leaves into a smooth consistency to ensure uniformity in the powder.After grinding, the moringa leaf powder can be sieved through a fine mesh sieve to remove any larger particles or fibers. This step helps achieve a finer and smoother powder texture.The final moringa leaf powder is then packaged in airtight containers or bags to protect it from moisture, light, and air. Proper packaging helps maintain the freshness and quality of the powder.Store the moringa leaf powder in a cool, dry place away from direct sunlight. Proper storage conditions will help preserve the nutritional content and shelf life of the powder.In conclusion, the preparation of moringa leaf powder involves harvesting, cleaning, drying, grinding, sieving, packaging, and storage. This nutrient-rich powder can be used in various applications such as dietary supplements, teas, smoothies, and culinary dishes

Ali, E.N, Barth H, Habs, M et.al (2013) . This paper presents a review of these various applications of M. oleifera seeds extract in water treatment and highlights the areas requiring further investigations. Moringa oleifera is a single family of shrubs and trees that is cultivated in the whole of tropical belt. It belongs to the family Moringaceae and is one of the 14 known species. The tree has been described as a multi-purpose tree for life. It has, in recent times, been advocated as an outstanding indigenous source of highly digestible protein, Ca, Fe, Vitamin C, and carotenoids suitable for utilization in many of the developing regions of the world where undernourishment is a major concern.

Ayub, Sohail., Ali, S. I., Khan, N. A et.al(2014) s. The purpose of the present study is to evaluate the ability of agro-waste material coconut shell to remove Cr (VI) from wastewater. The extant of removal was found to be dependent on pH, contact time, adsorbent dose,

concentration of metal and particle size. The adsorption follows a first order kinetics. The adsorption process is endothermic with a maximum adsorption of 83 percent at 30o C for an initial concentration of 50 mg/l at pH 1.5. Thermodynamics parameters indicate the feasibility of the process. Column studies have been carried out to compare these with batch capacities.

Mehmet E.A., Sukru D., Celalettin O et.al(2013) Activated carbon produced from coconut shell (ACS) was used as adsorbent to remove Cu2+, Fe2+, Zn2+ and Pb2+ ions from electroplating industrial wastewater. The activated carbon produced was chemically activated with zinc chloride. Batch adsorption experiment was conducted to examine the effects of adsorbent dosage, contact time, pH and stirring rate on adsorption of Cu2+, Fe2+, Zn2+ and Pb2+ from the wastewater. The obtained results showed that, the adsorption of the metal ions was adsorbent dosage, contact time, pH and stirring rate dependent. The optimum adsorbent dosage, stirring rate and pH, were found to be at 1 g, 350 rpm and pH 6 respectively. Kinetic studies showed that pseudo-second-order reaction model best described the adsorption process. The study also showed that activated carbon prepared from coconut shell can be efficiently used as low cost alternative for removal of metal ions.

Garg, S.K, Erica K. Jacobsen, Muhammad B et.al (2018) The project proposes a grey water Recycling system that will provide water to meet the Needs of the college boy's hostel and irrigation Purpose around the hostel. The water can be used for cleaning and flushing purposes. The grey water Recycling system components were designed and they consist of piping system, diversion system, Filtration and storing system, pumping system and Distribution system. The project includes Underground storage tank, filtration tank and Overhead tank. The filtering media used is activated Charcoal, which is replaced every six months. The Filtered water is stored in underground storage tank for a particular time, then pumped to overhead tank by efficient piping system, and stored there. When the need for water arises, it can be delivered

Karnapa Ajit, Nargessh Amabadi, Sandhya Pushkar Singh et.al (2018) Water being one of the largest resources for the everyday lifestyle, still currently the whole country is facing the scarcity of water. Though it is available in plenty butstill it is very less to use and take in application and practicality. To fulfill the major and minor and every requirements of the society there is a great need of saving the water and also the main thing to do is making the water to apply in the everyday lifestyle. The amount of waste water in the country is very large. So not much but at least treating the waste water can greatly help in helping with the current situation

Alo, M.N., Anyim, C., Elom, M.et.al (2021) . The study was demonstrated that, the application of RSM for seeking optimum conditions in the coagulation process for the treatment of wastewater. Moringa seed powder works best with a 7–9 pH range. The study also investigated that, best adsorption equilibrium was observed when using 0.1 g of Moringa oleifera seed powder. All the results showed that Moringa oleifera seeds were very effective for the removal of impurities

M. A. Barakat, S. K. Gunatilake, E. Bernard, A et.al (2017) . In present study, Coconut coir powder is used as an adsorbent to remove the Heavy metals Copper, Nickel, and Cadmium. It is found that the coconut coir has good adsorption capacity to separate the metals from the wastewater. Heavy metals are one of the major components of wastewater. In particular industries such as metal-plating industry, these values are very high. Removal of heavy metals from wastewater requires significant attention. There are several conventional methods for treating industrial wastewater like Reverse-Osmosis, Electro-dialysis, Ion-exchange process which were found to be expensive and require continuous surveillance.

Bansal RC, Donnet JB, Stoeckli F et.al (2004) Activated carbons with a high BET surface area and a well-developed porosity have been prepared from pyrolysis of H_3PO_4-impregnated lignin precipitated from kraft black liquors. Impregnation ratios within the range of 1–3 and activation temperatures of 623–873 K have been used, giving rise to carbons with different porous and surface chemical structure. Increasing the activation temperature and the impregnation ratio leads to a widening of the porous structure with a higher relative contribution of mesoporosity. The potential application of these carbons for the removal of water pollutants has been investigated by measuring their adsorption capacities for phenol, 2,4,5-trichlorophenol and Cr (VI) as representative of toxic contaminants found in industrial wastewaters. The results obtained compare well and even favorably with those reported in the literature for other activated carbons. An impregnation ratio and an activation temperature around 2 g H_3PO_4/g lignin and 700 K, respectively, are recommended as the best combination of operating

conditions to prepare activated carbons for aqueous phase applications although at lower values of these two variables carbons with good adsorption capacities are also obtained.

Alo MN, Anyim C, Amagloh FK, Benang A(2017) This study aims to investigate different parameters of water quality (BOD, COD, DO, TDS, salinity and conductivity) using different concentrations of MO son the ‘‘Sungai baluk’’ river and wastewater (WW) samples, as well as the coagulant properties of MO protein application to heavy metal removal and bacterial- consortium reduction in the water sample

Brunauer, S. Bansal R. C, Goyal M. et.al (2012) The objective of this study is to treat wastewater effluent from a brewery in Lagos, Nigeria using the manufactured activated carbon from coconut shell with a view to determining its efficacy and then establish the kinetics of the adsorption of organic pollutants in brewery wastewater effluent. Also, the influence of various production parameters and optimum conditions for the production of activated carbon from coconut shell by chemical activation is investigated. The production of activated carbon locally which can treat industrial wastewater will not only reduce the cost of treating wastewater for local industries but also increase the gross domestic product (GDP) of the nation which justifies this work.

3. METHODOLOGY

Here we taken samples of waste water from plastic manufacturing industry and interlock manufacturing industry. Quality parameters of each sample is tested .Then a filtration setup is made with coarse aggregate ,fine aggregate and an adsorbent layer. Filtration is done with four ways as taking adsorbent layers as activated charcoal , moringa leaf powder ,coconut shell powder and their combination. Then the quality parameters of each water taken out from filtration is tested.

3.1SAMPLE COLLECTION

The main sample that is industrial waste water is collected from two industries one is a plastic manufacturing industry named Planet polymers located at Kuthuparamba, Kannur,latitude 11°8’26.2’’N and longitude 75°60’51.1’’E . Another sample is collected from an interlock manufacturing company named Bright interlocks located at Panoor, Kannur, lattitude 11°7’40.4’’N and longitude 75°63’’49.3’’E.

Fig 3.1 a)Plastic manufacturing industry

Fig 3.1 b) Plastic manufacturing industry

Fig 3.2 a) Interlock manufacturing industry

Fig 3.2 b) Interlock manufacturing industry

Fig 3.3 Collected water samples

3.2MATERIALS AND APPARATUS

Coarse aggregate and fine aggregate are purchased from a local shop in Kannur, Coconut shell,moringa leaf and charcoal are collected from home itself, chokli, kannur

Fig 3.4 Coarse aggregate

Fig 3.5 Fine aggregate

Fig 3.6 Moringa leaf

Fig 3.7 Cconut shell

3.2.1 Experimental setup

The whole filtration is done with a setup made up of glass with thickness ,0.5 cm sides 25x25x35 cm and surface area 875cm^2. A pipe hole of 2.5 cm diameter is made at one side to collect filtered water .Top side of setup is made open.Coarse aggregate size ranges from 14mm to 63mm, fine aggregate size belongs to 4.75mm and smaller and adsorbent also having same size as fine aggregates.

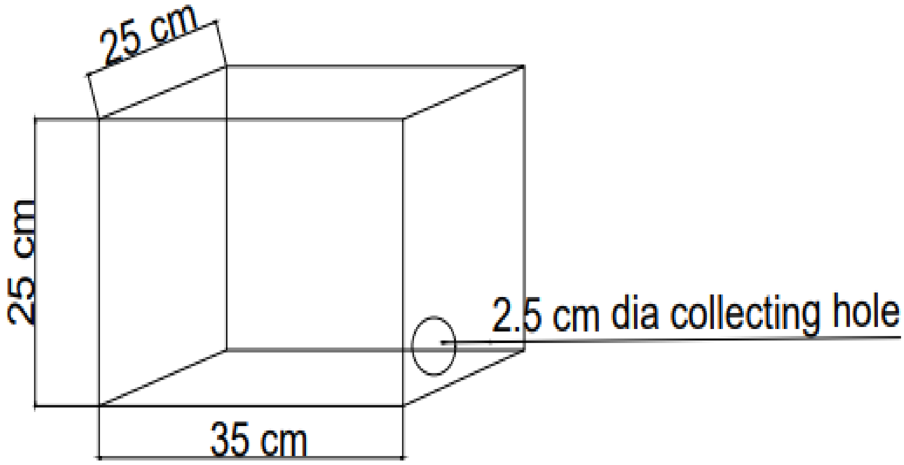

Fig 3.8 Experimental setup dimensions

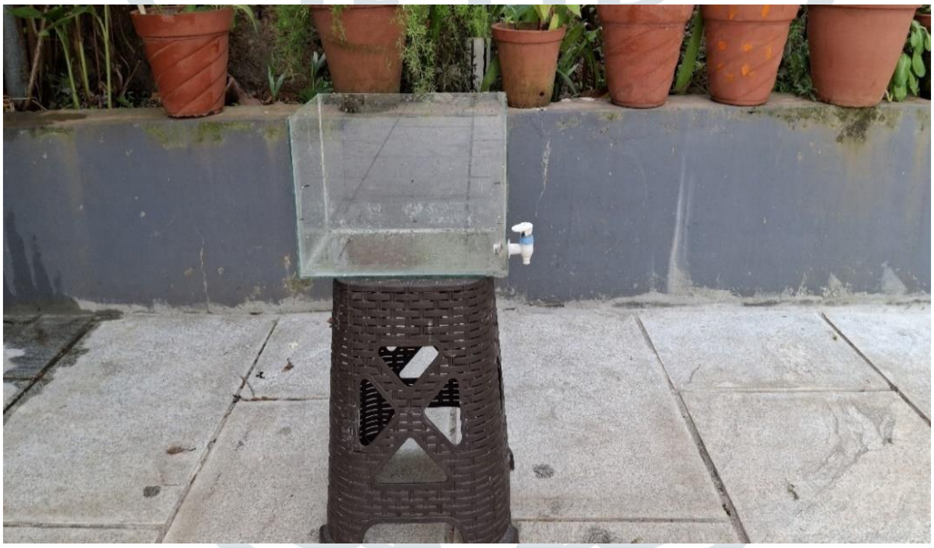

Fig 3.9 Experimental setup

3.3METHODS

The initial water quality test is done immediately after sample collection.2 Litre of each sample is tested initially.

Physicochemical and biological tests are done. Chemical tests involve

- ✓ pH
- ✓ Electrical conductivity
- ✓ Total Alkalinity as CaCO3
- ✓ Total Hardness as CaCO3
- ✓ Calcium Hardness as CaCO3
- ✓ Chloride
- ✓ Colour

- ✓ Taste and odour
- ✓ Turbidity
- ✓ Total Dissolved solids
- ✓ Magnesium Hardness as CaCO3
- ✓ Calcium
- ✓ Magnesium
- ✓ Ammonia as N
- ✓ Iron
- ✓ Nitrite
- ✓ Phosphate Biological tests
- ✓ Total Coliforms
- ✓ E.coli

Fig 3.11 Prepration of sample for the test

Table 3.1 Initial water quality parameters of interlock manufacturing industry

No:	Parameter	Unit	Results	Test method	Acceptable limit as per is 10500-2012(for irrigation purpose)	Permissible limit in the absence of alternative source

1	Ph	µS/cm	11.61	IS 3025(PART 11) 2022	6.5-8.5	No Relaxation
2	Electrical conductivity	m/L	1542	IS 3025(PART 14)2013 (RA:2019)		
3	Total Alkalinity as CaCO3	mg/L	300	IS 3025(PART 23) 1986 (RA:2019)	30	100
4	Total Hardness as CaCO3	mg/L	240	IS 3025(PART 21) 2009 (RA:2019)	100	150
5	Calcium Hardness as CaCO3	mg/L	180	IS 3025(PART 40) 1991 (RA:2019)	100	150
6	Chloride	mg/L	19.99	IS 3025(PART 32) 1988 (RA:2019)	250	1000
7	Sulphate	mg/L	16.43	IS 3025(PART 24) 1986 (RA:2019)	200	400
8	Colour	Hazen	>1	IS 3025(PART 4) 2021	5	
9	Taste and odour		Disagreeable	APHA 2150A & 2160 A(23rd Edition)	Agreeable	Agreeable
10	Turbidity	NTU	33.2	IS 3025(PART 10) 1984 (RA:2017)	1	1000
11	Total Dissolved solids	mg/L	823	IS 3025(PART 16) 1984 (RA:2017)	700	1750

12	Magnesium Hardness as CaCO3	mg/L	60	APHA 3500 Mg E (23rd Edition)	30	100
13	Calcium	mg/L	72.14	IS 3025(PART 40) 1991 (RA:2019)	75	200
14	Magnesium	mg/L	14.58	APHA 3500 Mg E (23rd Edition)	50	150
15	Ammonia as N	mg/L	0.38	IS 3025(PART 34) 1988 (RA:2019)	0.5	No Relaxation
16	Iron	mg/L	<0.01	IS 3025(PART 53) 2003(RA:2019)	0.3	10
17	Nitrite	mg/L	0.06	APHA 4500 NO2B (23rd Edition)	0.02	10
18	Phosphate	mg/L	42	APHA 4500 P-E (23rd Edition)	0.1	35
19	Total Coliforms	CFU/100ml	<1CFU/ml	APHA 9222 B (24th Edition)	<1CFU/ml	
20	E.coli	CFU/100ml	<1CFU/ml	APHA 9222 D (24th Edition)	<1CFU/ml	

Table 3.2 Initial water quality parameters of plastic manufacturing industry

No:	Parameter	Unit	Results	Test method	Acceptable limit as per is 10500-2012(For irrigation purpose)	Permissible limit in the absence of alternative source
1	Ph	µS/cm	6.96	IS 3025(PART 11) 2022	6.5-8.5	No Relaxation
2	Electrical conductivity	mg/L	212	IS 3025(PART 14)2013 (RA:2019)		
3	Total Alkalinity as CaCO3	mg/L	44	IS 3025(PART 23) 1986 (RA:2019)	30	100
4	Total Hardness as CaCO3	mg/L	70	IS 3025(PART 21) 2009 (RA:2019)	100	150
5	Calcium Hardness as CaCO3	mg/L	46	IS 3025(PART 40) 1991 (RA:2019)	100	150
6	Chloride	mg/L	.99	IS 3025(PART 32) 1988 (RA:2019)	250	1000
7	Sulphate	mg/L	15.53	IS 3025(PART 24) 1986 (RA:2019)	200	400
8	Colour	Hazen	<1	IS 3025(PART 4) 2021	5	
9	Taste and odour		Agreeable	APHA 2150A & 2160 A(23rd Edition)	Agreeable	Agreeable

10	Turbidity	NTU	<0.1	IS 3025(PART 10) 1984 (RA:2017)	1	1000
11	Total Dissolved solids	mg/L	111	IS 3025(PART 16) 1984 (RA:2017)	700	1750
12	Magnesium Hardness as CaCO3	mg/L	24	APHA 3500 Mg E (23rd Edition)	30	100
13	Calcium	mg/L	18.43	IS 3025(PART 40) 1991 (RA:2019)	75	200
14	Magnesium	mg/L	5.83	APHA 3500 Mg E (23rd Edition)	50	150
15	Ammonia as N	mg/L	0.41	IS 3025(PART 34) 1988 (RA:2019)	0.5	No Relaxation
16	Iron	mg/L	0.08	IS 3025(PART 53) 2003(RA:2019)	0.3	10
17	Nitrite	mg/L	0.18	APHA 4500 NO2B (23rd Edition)	0.02	10
18	Phosphate	mg/L	26	APHA 4500 P-E (23rd Edition)	0.1	35
19	Total Coliforms	CFU/100ml	85	APHA 9222 B (24th Edition)	<1CFU/ml	
20	E.coli	CFU/100ml	5	APHA 9222 D (24th Edition)	<1CFU/ml	

3.4FILTRATION

The filtration is done with 3 materials

1. Coconut shell powder
2. Moringa leaf powder
3. Activated charcoal

3.4.1. Prepration of coconut shell powder

Coconut shell powder is prepared by first collecting coconut shells, cleaning them, and then grinding them into a fine powder using a flour mill. The resulting powder is taken for filtration

Fig 3.12 Coconut shell powder

3.4.2. Prepration of moringa leaf powder

Moringa leaf was cultivated from home located at chokli, Kannur.The leaves were dried and powdered from mixer and taken for filtration

Fig 3.13 Moringa leaf powder

3.4.3. Prepration of activated charcoal

Charcol is prepared from burned wood scrpas used in the hearth at home.They were collected and crushed in to the fine particles.

Fig 3.14 Activated charcoal

3.4.4 Filtration with coconut shell powder

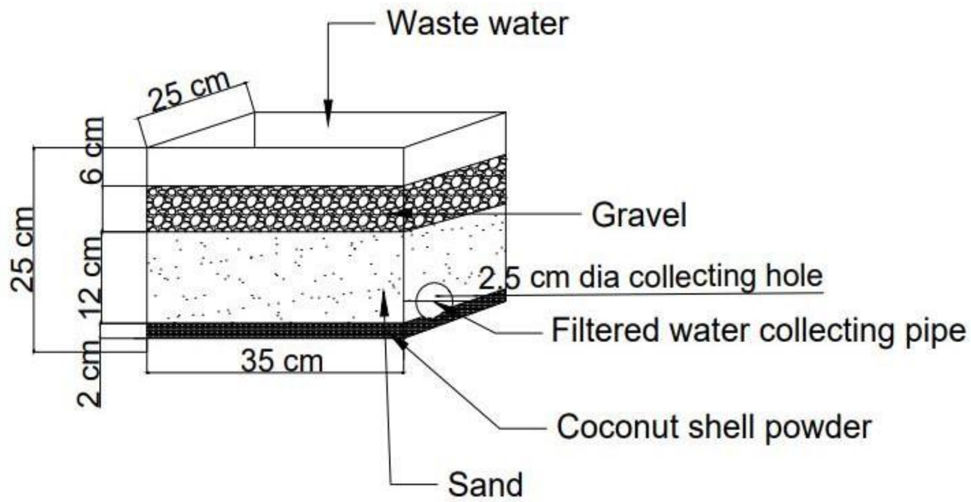

Fig 3.15 Filtration with coconut shell powder illustration

Filtration is done with 3 layers as coarse aggregate,fine aggregate and a layer of coconut shell powder. Coarse aggregate is taken 6 cm thickness,fine aggregate is 12 cm thickness and coconut shell is taken 2cm at the bottom layer. Waste water taken from two industries were passed through this setup and filtered water is collected from the outlet pipe.

Fig 3.16 Filtration with coconut shell powder

3.4.5 Filtration with activated charcol

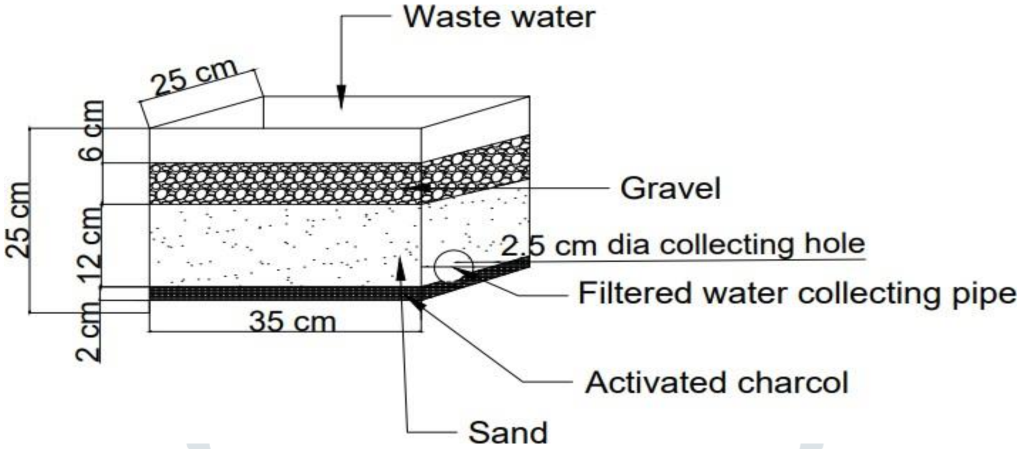

Fig 3.17 Filtration with activated charcoal illustration

Filtration is done with 3 layers as coarse aggregate,fine aggregate and a layer of activated charcol. Coarse aggregate is taken 6 cm thickness,fine aggregate is 12 cm thickness and activated charcoal is taken 2cm at the bottom layer. Waste water taken from two industries were passed through this setup and filtered water is collected from the outlet pipe.

Fig 3.18 Filtration with activated charcoal

3.4.6 Filtration with moringa leaf powder

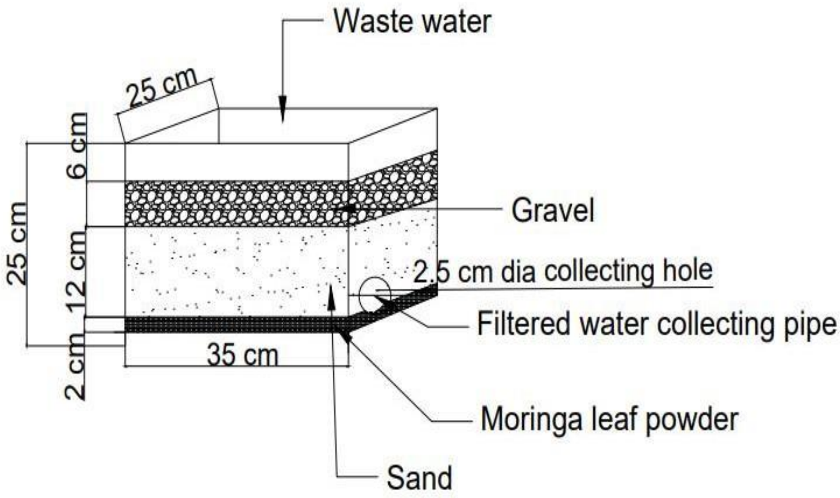

Fig 3.19 Filtration with moringa leaf powder illustration

Filtration is done with 3 layers as coarse aggregate,fine aggregate and a layer of moringa leaf powder. Coarse aggregate is taken 6 cm thickness,fine aggregate is 12 cm thickness and moringa leaf powder is taken 2cm at the bottom layer. Waste water taken from two industries were passed through this setup and filtered water is collected from the outlet pipe.

Fig 3.21 Filtration with moringa leaf powder

3.4.7 Filtration with combination of cconut shell powder, moringa leaf powder and activated charcoal.

Filtration is done with 5 layers as coarse aggregate,fine aggregate and a layer of moringa leaf powder, coconut shell powder and activated charcol. Coarse aggregate is taken 6 cm thickness,fine aggregate is 12 cm thickness and moringa leaf powder,activated charcoal and coconutshell powder is taken 6.7cm each. Waste water taken from two industries were passed through this setup and filtered water is collected from the outlet pipe.

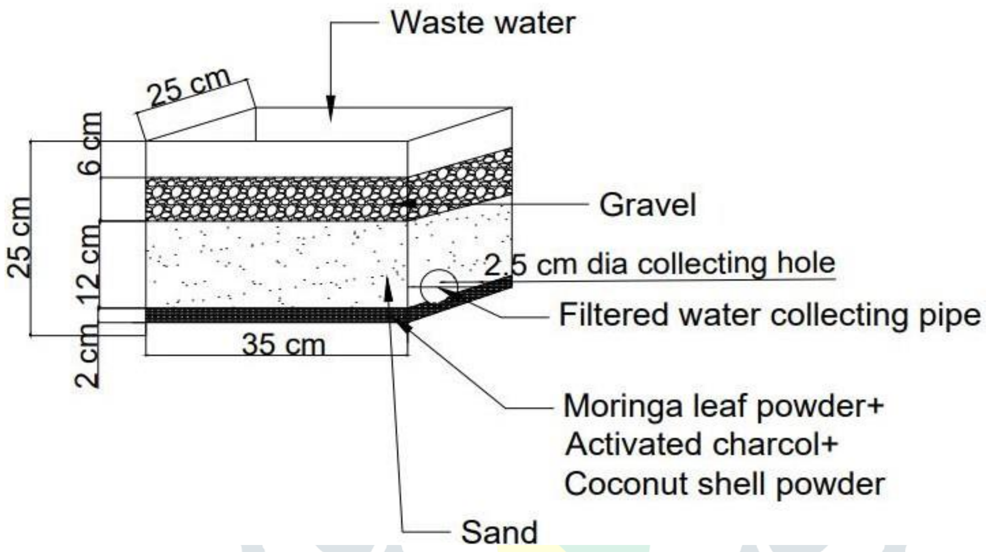

Fig 3.22 Filtration with coconut shell powder,activated charcoal and moringa leaf powder illustration

Fig 3.23 Filtration with coconut shell powder, activated charcoal and moringa leaf powder

4. RESULTS AND DISCUSSIONS

Here first we are passing the waste water sample collected from interlock manufacturing industry through the 4 different filtration setups mentioned in the methodology. Then we have done the same filtration for waste water taken from plastic manufacturing industry.The quality parameters of collected filtered water is tested and compared the results of different samples from two industries and compared their efficiencies also.

4.1QUALITY PARAMETERS OF FILTRATION IN INTERLOCK MANUFAXCTURING INDUSTRY

Table 4.1 Quality prameters of waste water collected from interlock manufacturing industry as activated carbon as adsorbant.

No:	Parameter	Initial results	Results after filtration	Acceptable limit as per is 10500-2012 (for irrigation purpose)	Permissible limit in the absence of alternative source
1	pH(µS/cm)	11.61	9.82	6.5-8.5	No Relaxation

2	Electrical conductivity(mg/L)	1542	1530		
3	Total Alkalinity as CaCO3(mg/L)	300	320	30	100
4	Total Hardness as CaCO3(mg/L)	240	200	100	150
5	Calcium Hardness as CaCO3(mg/L)	180	160	100	150
6	Chloride(mg/L)	19.99	19.99	250	1000
7	Sulphate(mg/L)	16.43	200	200	400
8	Colour(Hazen)	>1	5	5	
9	Taste and odour	Disaggreable	Agreeable	Agreeable	Agreeable
10	Turbidity(NTU)	33.2	20	1	1000
11	Total Dissolved solids(mg/L)	823	823	700	1750
12	Magnesium Hardness as CaCO3(mg/L)	60	60	30	100
13	Calcium(mg/L)	72.14	72.14	75	200
14	Magnesium(mg/L)	14.58	55	50	150
15	Ammonia as N(mg/L)	0.38	0.38	0.5	No Relaxation
16	Iron(mg/L)	<0.01	0.5	0.3	10
17	Nitrite(mg/L)	0.06	0.06	0.02	10
18	Phosphate(mg/L)	42	35	0.1	35
19	Total Coliforms(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	
20	E.coli(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	

Table 4.2 Quality parameters of waste water collected from interlock manufacturing industry as coconut shell powder as adsorbant.

No:	Parameter	Initial results	Results	Acceptable limit as per is 10500-2012 (for irrigation purpose)	Permissible limit in the absence of alternative source
1	pH(µS/cm)	11.61	8	6.5-8.5	No Relaxation
2	Electrical conductivity(mg/L)	1542	1528		
3	Total Alkalinity as CaCO3(mg/L)	300	321	30	100
4	Total Hardness as CaCO3(mg/L)	240	190	100	150
5	Calcium Hardness as CaCO3(mg/L)	180	148	100	150
6	Chloride(mg/L)	19.99	19.99	250	1000
7	Sulphate(mg/L)	16.43	212	200	400
8	Colour(Hazen)	>1	5	5	
9	Taste and odour	Disaggreable	Agreeable	Agreeable	Agreeable
10	Turbidity(NTU)	33.2	23.5	1	1000
11	Total Dissolved solids(mg/L)	823	823	700	1750
12	Magnesium Hardness as CaCO3(mg/L)	60	60	30	100
13	Calcium(mg/L)	72.14	72.14	75	200

14	Magnesium(mg/L)	14.58	58	50	150
15	Ammonia as N(mg/L)	0.38	0.38	0.5	No Relaxation
16	Iron(mg/L)	<0.01	0.6	0.3	10
17	Nitrite(mg/L)	0.06	0.06	0.02	10
18	Phosphate(mg/L)	42	33	0.1	35
19	Total Coliforms(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	
20	E.coli(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	

Table 4.3 Quality parameters of waste water collected from interlock manufacturing industry as moringa shell powder as adsorbant.

No:	Parameter	Initial results	Results	Acceptable limit as per is 10500-2012 (for irrigation purpose)	Permissible limit in the absence of alternative source
1	pH(µS/cm)	11.61	7.5	6.5-8.5	No Relaxation
2	Electrical conductivity(mg/L)	1542	1525		
3	Total Alkalinity as CaCO3(mg/L)	300	320	30	100
4	Total Hardness as CaCO3(mg/L)	240	187	100	150
5	Calcium Hardness as CaCO3(mg/L)	180	144	100	150
6	Chloride(mg/L)	19.99	19.99	250	1000

7	Sulphate(mg/L)	16.43	218	200	400
8	Colour(Hazen)	>1	5	5	
9	Taste and odour	Disaggreable	Agreeable	Agreeable	Agreeable
10	Turbidity(NTU)	33.2	24	1	1000
11	Total Dissolved solids(mg/L)	823	823	700	1750
12	Magnesium Hardness as CaCO3(mg/L)	60	60	30	100
13	Calcium(mg/L)	72.14	72.14	75	200
14	Magnesium(mg/L)	14.58	58.5	50	150
15	Ammonia as N(mg/L)	0.38	0.38	0.5	No Relaxation
16	Iron(mg/L)	<0.01	0.55	0.3	10
17	Nitrite(mg/L)	0.06	0.06	0.02	10
18	Phosphate(mg/L)	42	32	0.1	35
19	Total Coliforms(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	
20	E.coli(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	

Table 4.4 Quality parameters of waste water collected from Interlock manufacturing industry as moringa leaf powder,coconut shell powder and activated charcoal as asorbant.

No:	Parameter	Initial results	Results	Acceptable limit as per is 10500-2012(for irrigation purpose)	Permissible limit in the absence of alternative source

1	pH(µS/cm)	11.61	8	6.5-8.5	No Relaxation
2	Electrical conductivity(mg/L)	1542	1526		
3	Total Alkalinity as CaCO3(mg/L)	300	322	30	100
4	Total Hardness as CaCO3(mg/L)	240	188	100	150
5	Calcium Hardness as CaCO3(mg/L)	180	140	100	150
6	Chloride(mg/L)	19.99	19.99	250	1000
7	Sulphate(mg/L)	16.43	217	200	400
8	Colour(Hazen)	>1	5	5	
9	Taste and odour	Disaggreable	Agreeable	Agreeable	Agreeable
10	Turbidity(NTU)	33.2	22	1	1000
11	Total Dissolved solids(mg/L)	823	823	700	1750
12	Magnesium Hardness as CaCO3(mg/L)	60	60	30	100
13	Calcium(mg/L)	72.14	72.14	75	200
14	Magnesium(mg/L)	14.58	58	50	150
15	Ammonia as N(mg/L)	0.38	0.38	0.5	No Relaxation
16	Iron(mg/L)	<0.01	0.5	0.3	10
17	Nitrite(mg/L)	0.06	0.06	0.02	10
18	Phosphate(mg/L)	42	35	0.1	35

19	Total Coliforms(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	
20	E.coli(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	

This 3 D diagram explain the comparison of quality parameters given by four different filtrations.Here Mg hardness value,chloride value,calcium and colour does not change after filtration,phosphate value is higher for activated carbon adsorbent layer filtration, pH value is higher for activated charcoal filtration, Tubidity and Mg value is higher for moringa leaf powder filtration.

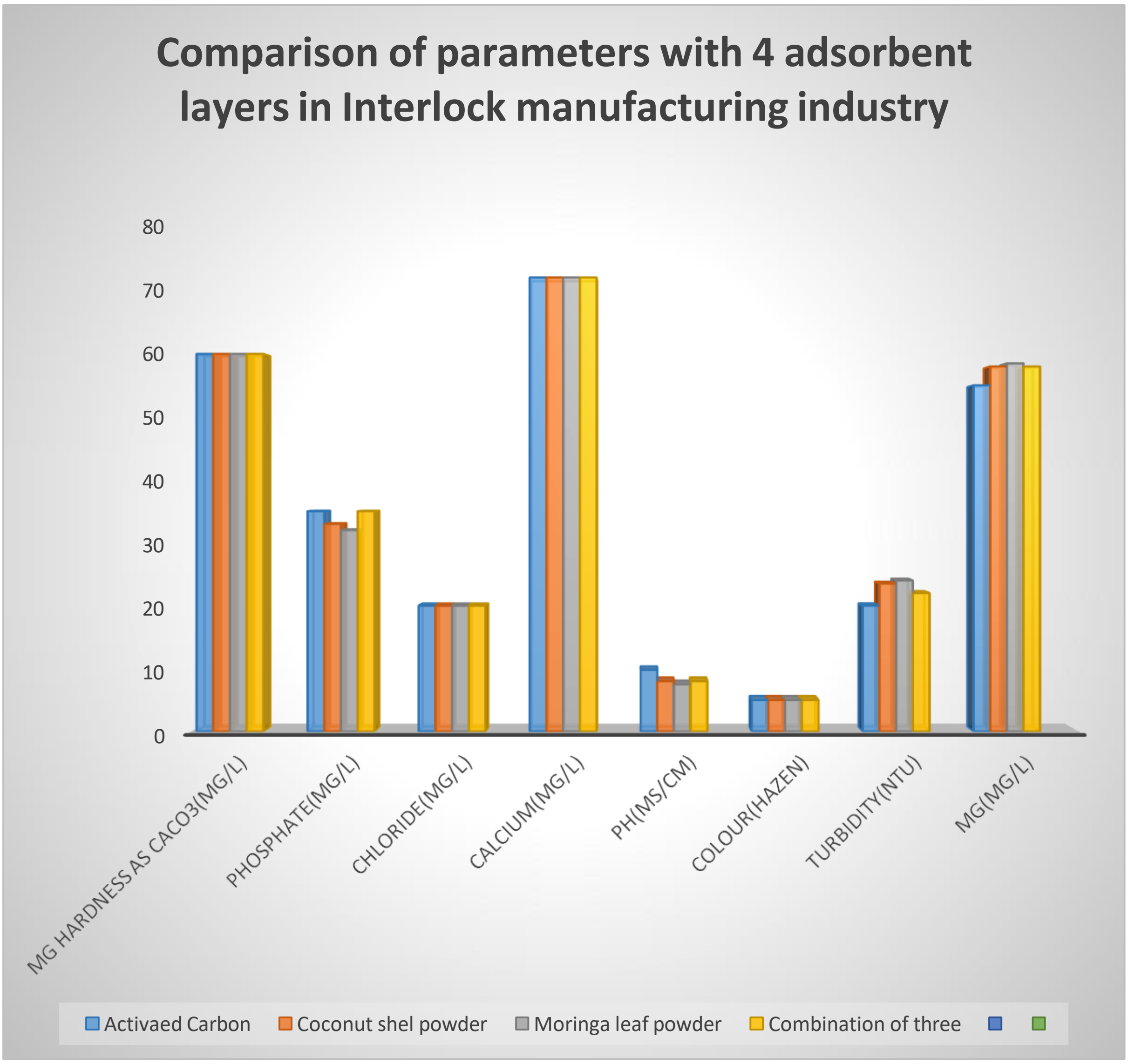

Fig 4.1 a Comparison of parameters with 4 adsorbent layers in Interlock manufacturing industry

This diagram explains the comparison of quality parameters with 4 adsobent layers for waste water filtration of interlock manufacturing industry.Here the parameters electrical conductivity,total alkalinity, total hardness ,calcium hardness, sulphate and total dissolved solids shows slight changes for different filtration where as the filtration through moringa leaf powder gives more accurate values

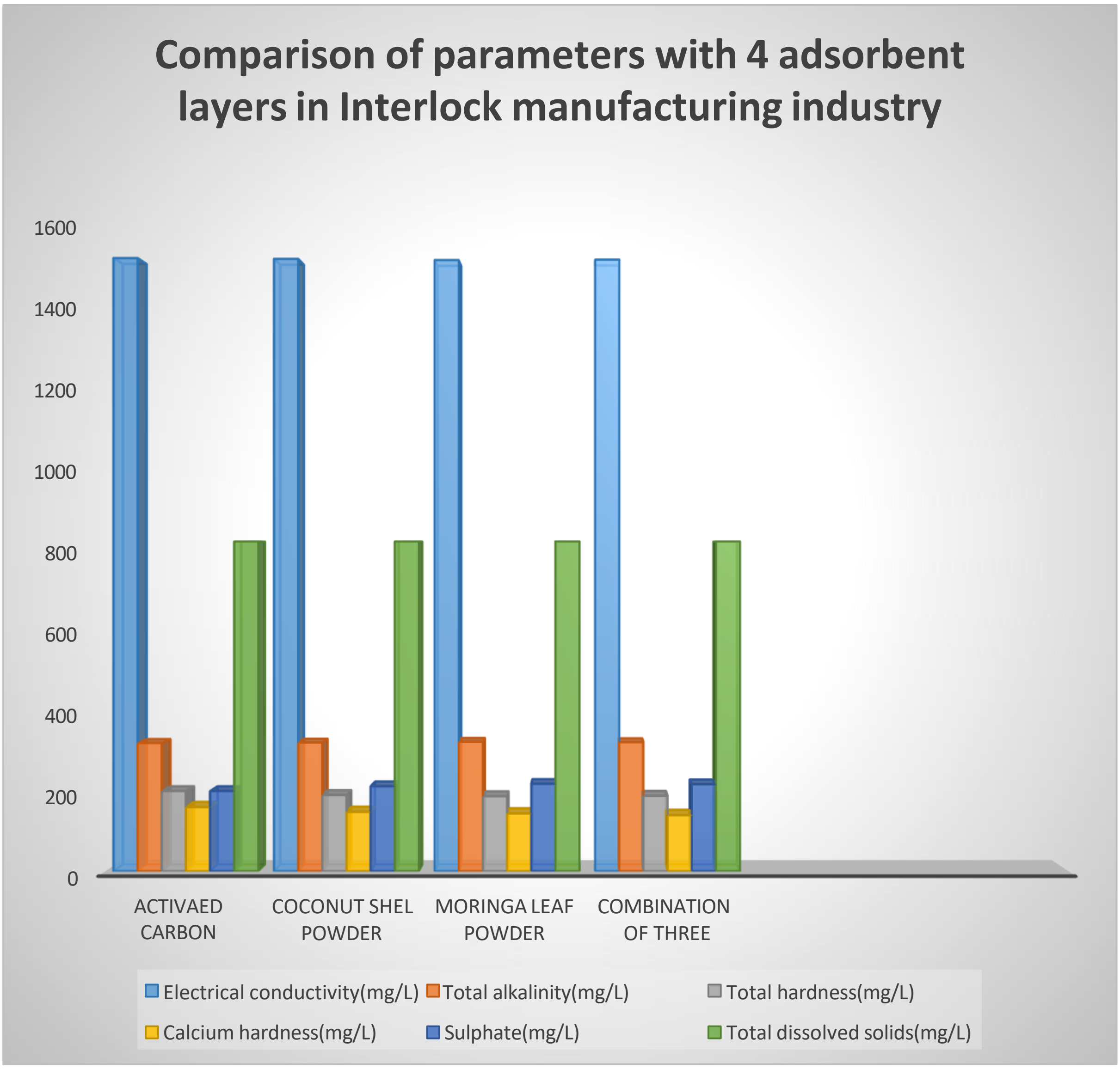

Fig 4.1 b Comparison of parameters with 4 adsorbent layers in Interlock manufacturing industry

water filtration of interlock manufacturing industry.Here ammonia as nitrogen and nitrite value is same for all filtration,where as iron value for moringa leaf powder filtration is higher.

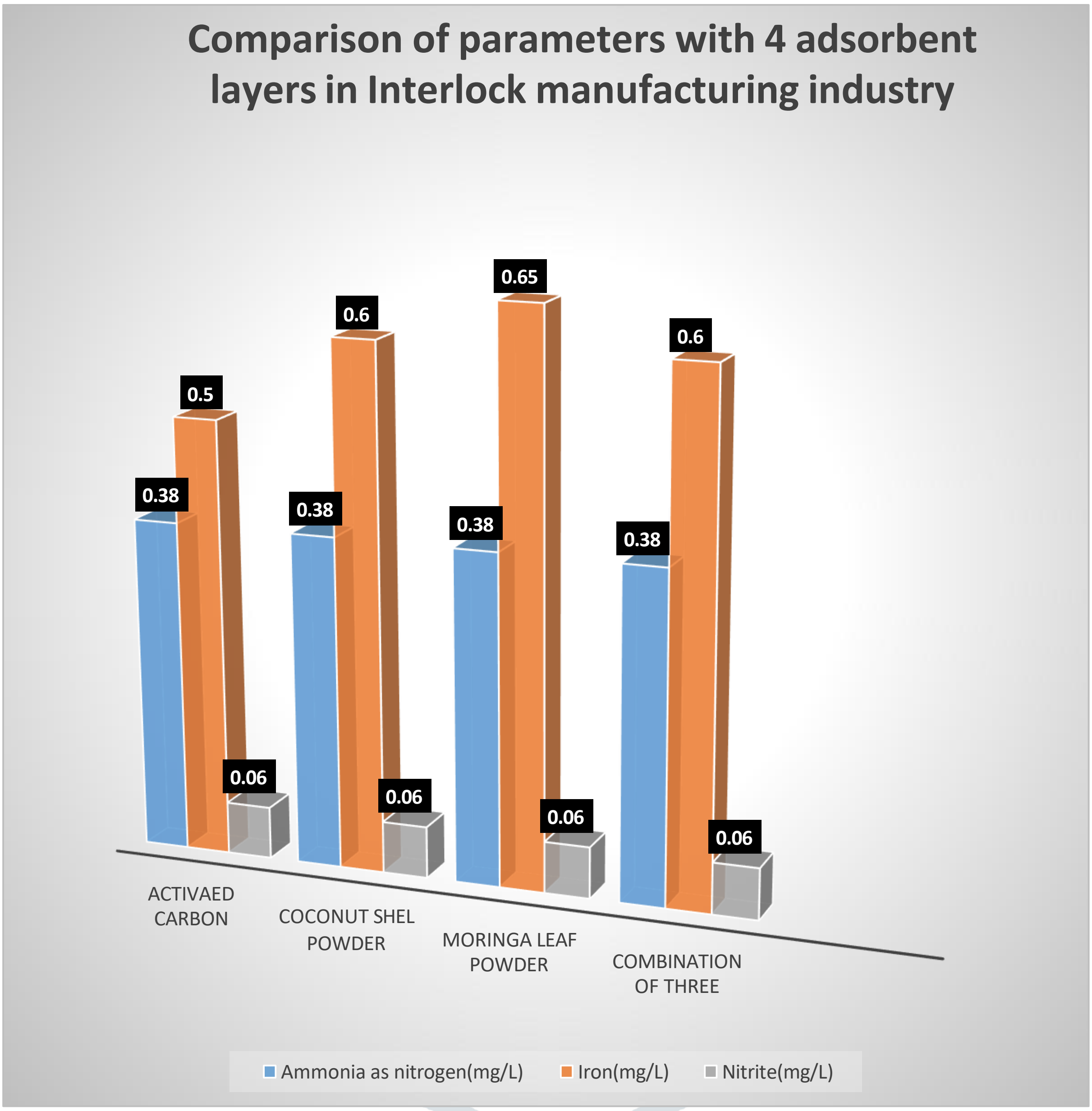

Fig 4.1 c Comparison of parameters with 4 adsorbent layers in Interlock manufacturing industry

4.2 QUALITY PARAMETERS OF FILTRATION IN PLASTIC MANUFACTURING INDUSTRY

Table 4.5 Quality parameters of waste water collected from plastic manufacturing industry as activated carbon powder as adsorbant.

No:	Parameter	Initial results	Results	Acceptable limit as per is 10500-2012(for irrigation purpose)	Permissible limit in the absence of alternative source
1	pH(µS/cm)	11.61	9	6.5-8.5	No Relaxation
2	Electrical conductivity(mg/L)	1542	1531		
3	Total Alkalinity as CaCO3(mg/L)	300	320	30	100
4	Total Hardness as CaCO3(mg/L)	240	201	100	150
5	Calcium Hardness as CaCO3(mg/L)	180	110	100	150
6	Chloride(mg/L)	19.99	19.99	250	1000
7	Sulphate(mg/L)	16.43	200	200	400
8	Colour(Hazen)	>1	5	5	
9	Taste and odour	Disaggreable	Agreeable	Agreeable	Agreeable
10	Turbidity(NTU)	33.2	22	1	1000

11	Total Dissolved solids(mg/L)	823	823	700	1750
12	Magnesium Hardness as CaCO3(mg/L)	60	60	30	100
13	Calcium(mg/L)	72.14	72.14	75	200
14	Magnesium(mg/L)	14.58	56	50	150
15	Ammonia as N(mg/L)	0.38	0.38	0.5	No Relaxation
16	Iron(mg/L)	<0.01	0.5	0.3	10
17	Nitrite(mg/L)	0.06	0.06	0.02	10
18	Phosphate(mg/L)	42	36	0.1	35
19	Total Coliforms(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	
20	E.coli(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	

Table 4.6 Quality parameters of waste water collected from plastic manufacturing industry as coconut shell powder as adsorbant.

No:	Parameter	Initial results	Results	Acceptable limit as per is 10500-2012(for irrigation purpose)	Permissible limit in the absence of alternative source
1	pH(µS/cm)	11.61	8.5	6.5-8.5	No Relaxation
2	Electrical conductivity(mg/L)	1542	1527		
3	Total Alkalinity as CaCO3(mg/L)	300	321	30	100
4	Total Hardness as CaCO3(mg/L)	240	202	100	150
5	Calcium Hardness as CaCO3(mg/L)	180	111	100	150
6	Chloride(mg/L)	19.99	19.99	250	1000
7	Sulphate(mg/L)	16.43	200	200	400
8	Colour(Hazen)	>1	5	5	
9	Taste and odour	Disaggreable	Agreeable	Agreeable	Agreeable
10	Turbidity(NTU)	33.2	23	1	1000
11	Total Dissolved solids(mg/L)	823	823	700	1750

12	Magnesium Hardness as CaCO3(mg/L)	60	60	30	100
13	Calcium(mg/L)	72.14	72.14	75	200
14	Magnesium(mg/L)	14.58	58	50	150
15	Ammonia as N(mg/L)	0.38	0.38	0.5	No Relaxation
16	Iron(mg/L)	<0.01	0.55	0.3	10
17	Nitrite(mg/L)	0.06	0.06	0.02	10
18	Phosphate(mg/L)	42	33	0.1	35
19	Total Coliforms(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	
20	E.coli(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	

Table 4.7 Quality parameters of waste water collected from plastic manufacturing industry as moringa leaf powder as adsorbant.

No:	Parameter	Initial results	Results	Acceptable limit as per is 10500-2012(for irrigation purpose)	Permissible limit in the absence of alternative source
1	pH(µS/cm)	11.61	8	6.5-8.5	No Relaxation
2	Electrical conductivity(mg/L)	1542	1526.5		
3	Total Alkalinity as CaCO3(mg/L)	300	323	30	100

4	Total Hardness as CaCO3(mg/L)	240	203	100	150
5	Calcium Hardness as CaCO3(mg/L)	180	112	100	150
6	Chloride(mg/L)	19.99	19.99	250	1000
7	Sulphate(mg/L)	16.43	200	200	400
8	Colour(Hazen)	>1	5	5	
9	Taste and odour	Disaggreable	Agreeable	Agreeable	Agreeable
10	Turbidity(NTU)	33.2	24	1	1000
11	Total Dissolved solids(mg/L)	823	823	700	1750
12	Magnesium Hardness as CaCO3(mg/L)	60	60	30	100
13	Calcium(mg/L)	72.14	72.14	75	200
14	Magnesium(mg/L)	14.58	59	50	150
15	Ammonia as N(mg/L)	0.38	0.38	0.5	No Relaxation
16	Iron(mg/L)	<0.01	0.6	0.3	10
17	Nitrite(mg/L)	0.06	0.06	0.02	10
18	Phosphate(mg/L)	42	35	0.1	35
19	Total Coliforms(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	
20	E.coli(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	

Table 4.8 Quality parameters of waste water collected from plastic manufacturing industry as moringa leaf powder ,coconut shell powder and activated charcoal as adsorbant.

No:	Parameter	Initial results	Results	Acceptable limit as per is 10500-2012(for irrigation purpose)	Permissible limit in the absence of alternative source
1	pH(µS/cm)	11.61	9	6.5-8.5	No Relaxation
2	Electrical conductivity(mg/L)	1542	1527		
3	Total Alkalinity as CaCO3(mg/L)	300	326	30	100
4	Total Hardness as CaCO3(mg/L)	240	204.5	100	150
5	Calcium Hardness as CaCO3(mg/L)	180	115	100	150
6	Chloride(mg/L)	19.99	19.99	250	1000
7	Sulphate(mg/L)	16.43	202	200	400
8	Colour(Hazen)	>1	5	5	
9	Taste and odour	Disaggreable	Agreeable	Agreeable	Agreeable
10	Turbidity(NTU)	33.2	22	1	1000
11	Total Dissolved solids(mg/L)	823	823	700	1750

12	Magnesium Hardness as $CaCO_3$(mg/L)	60	60	30	100
13	Calcium(mg/L)	72.14	72.14	75	200
14	Magnesium(mg/L)	14.58	57	50	150
15	Ammonia as N(mg/L)	0.38	0.38	0.5	No Relaxation
16	Iron(mg/L)	<0.01	0.6	0.3	10
17	Nitrite(mg/L)	0.06	0.06	0.02	10
18	Phosphate(mg/L)	42	36	0.1	35
19	Total Coliforms(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	
20	E.coli(CFU/100ml)	<1CFU/ml	<1CFU/ml	<1CFU/ml	

This diagram explains the comparison of quality parameters with 4 adsobent layers for waste water filtration of plastic manufacturing industry.Here Mg hardness value,chloride value,calcium and colour does not change after filtration,phosphate value is higher for activated carbon adsorbent layer filtration, pH value is higher for activated charcoal filtration, Turbidity and Mg value is higher for moringa leaf powder filtration.

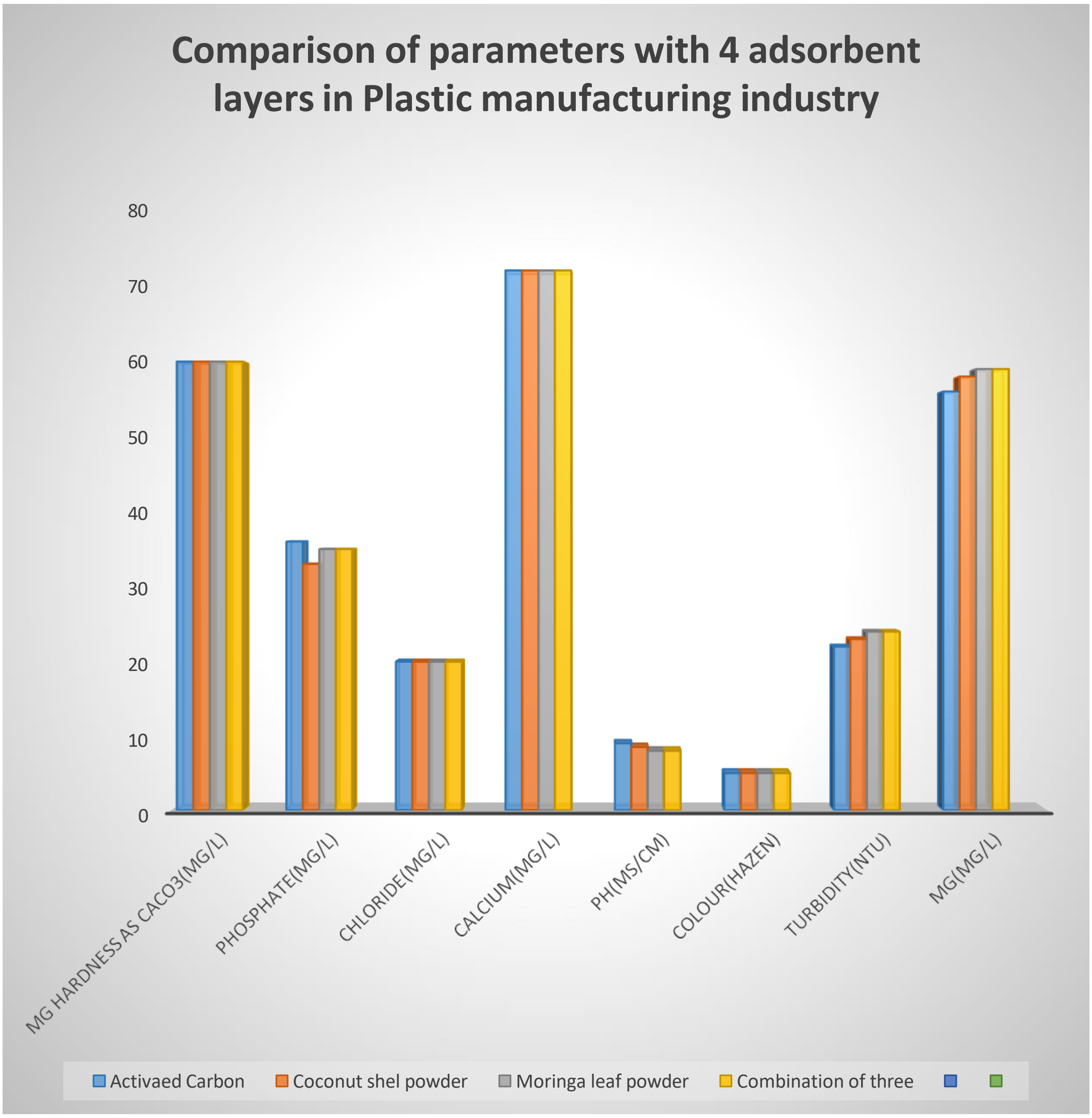

Fig 4.2 a Comparison of parameters with 4 adsorbent layers in Plastic manufacturing industry

water filtration of in plastic manufacturing industry.Here the parameters electrical conductivity,total alkalinity, total hardness ,calcium hardness, sulphate and total dissolved solids shows slight changes for different filtration where as the filtration through moringa leaf powder gives more accurate values

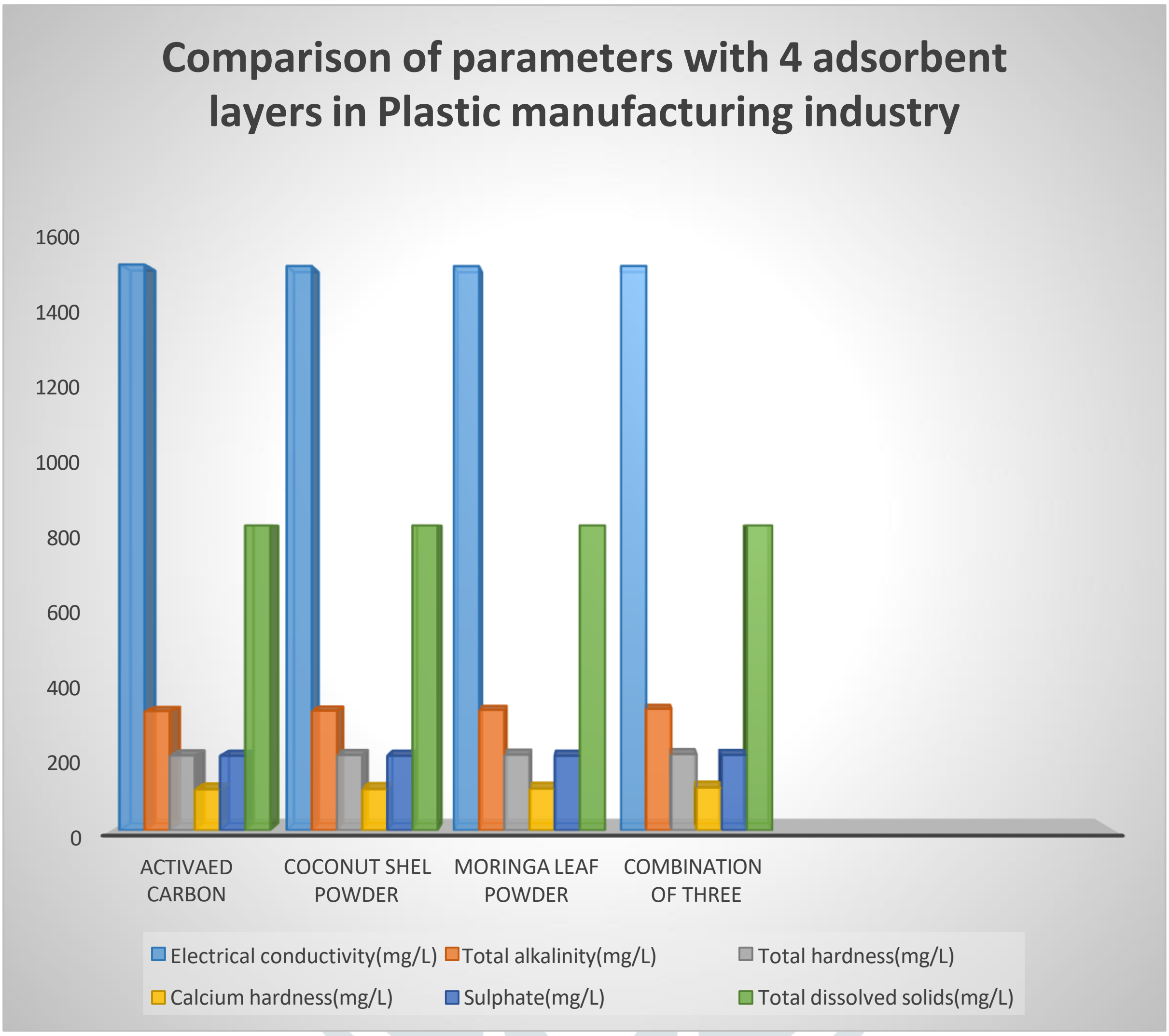

Fig 4.2 b Comparison of parameters with 4 adsorbent layers in Plastic manufacturing industry

water filtration of plastic manufacturing industry.Here ammonia as nitrogen and nitrite value is same for all filtration,where as iron value for moringa leaf powder filtration and combination of three is higher.

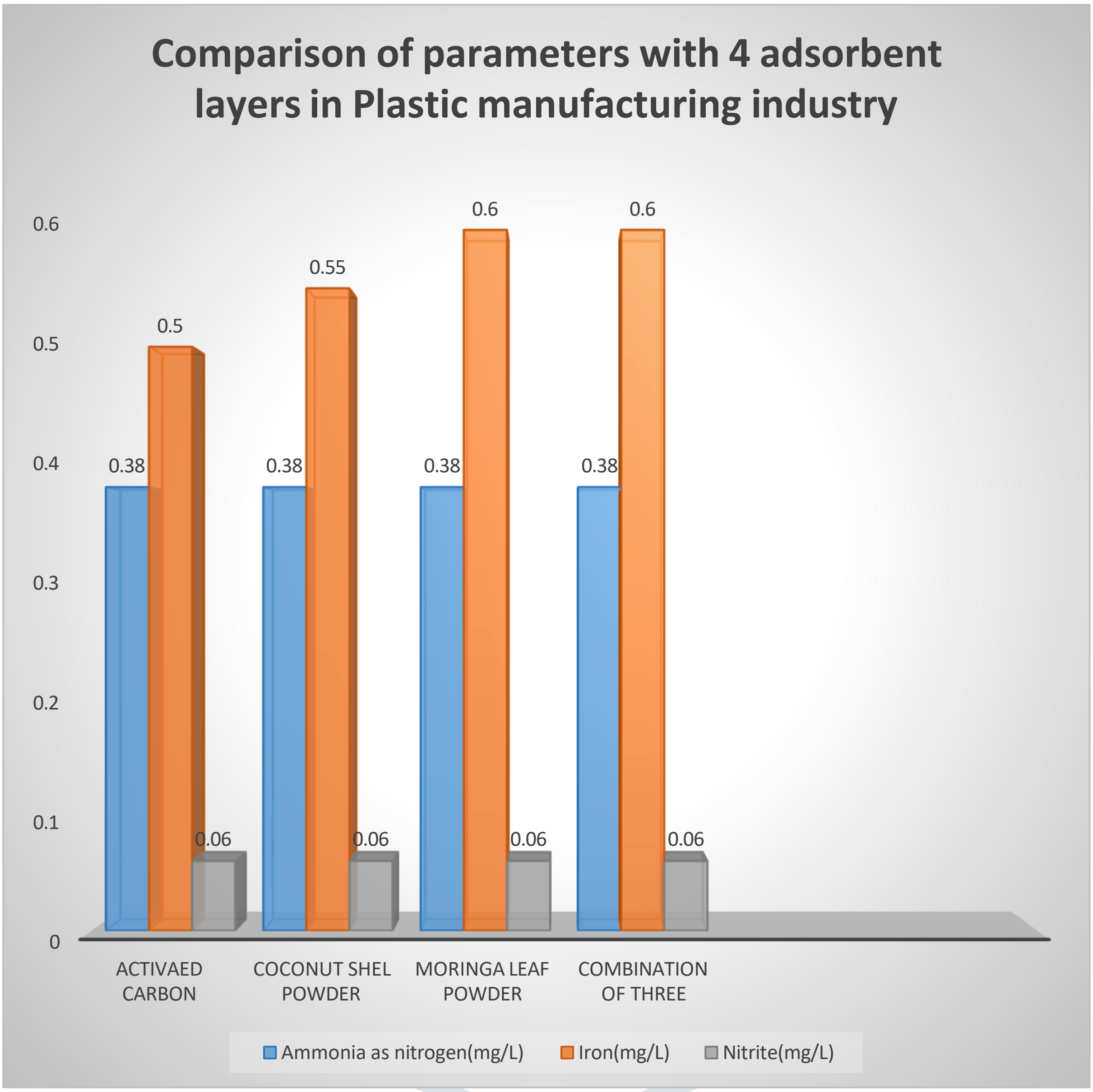

Fig 4.2 c Comparison of parameters with 4 adsorbent layers in Plastic manufacturing industry

4.3COMPARISON OF QUALITY PARAMETERS OF WASTE WATER IN PLASTIC MANUFACTURING INDUSTRY AND INTERLOCK MANUFACTURING INDUSTRY

Here we compare each parameters between two industries .

4.3.1 pH

As we compare the total pH of two industries,moringa leaf powder adsorbent filtration in plastic industry water gives the most feasible value.

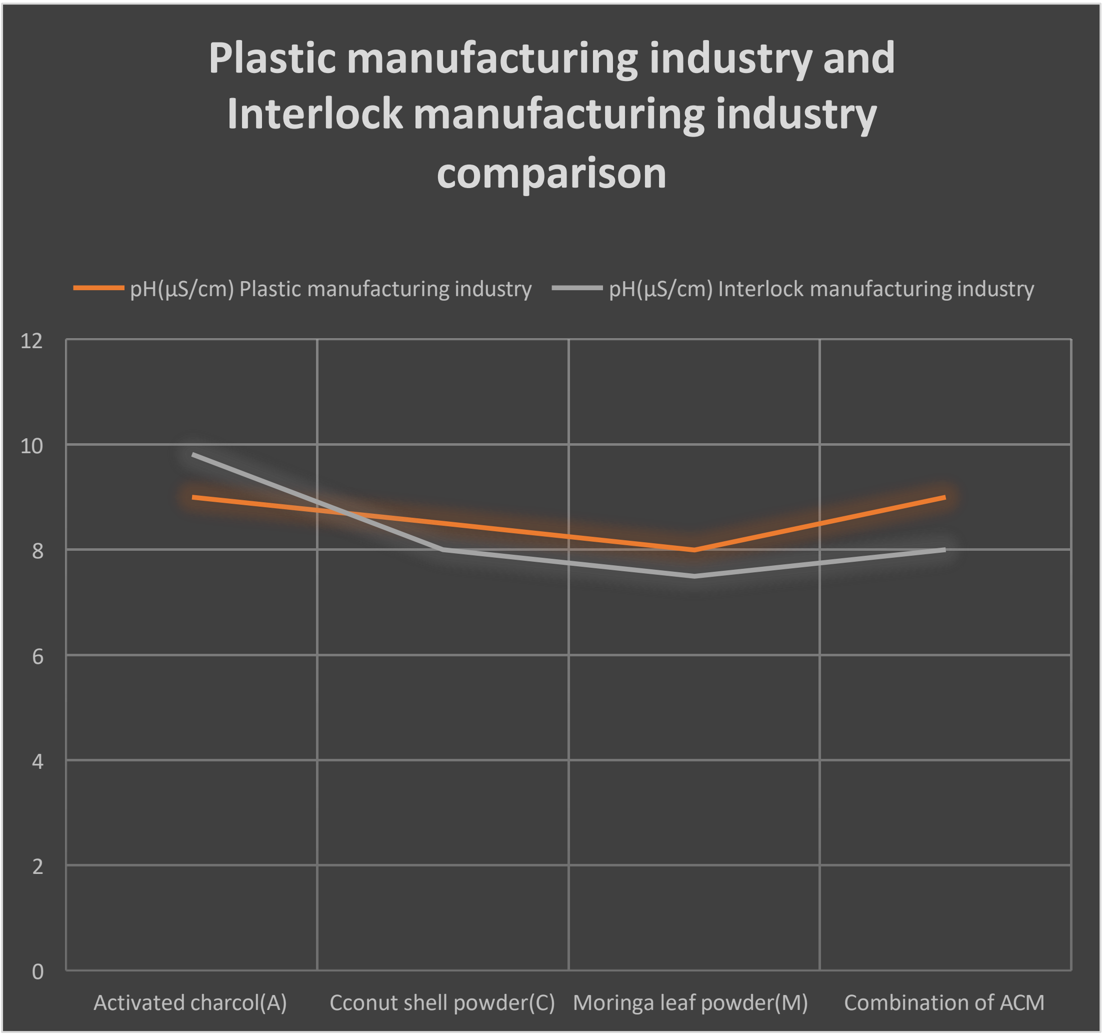

Fig 4.3 Comparison of pH in plastic manufacturing industry and interlock manufacturing industry water

4.3.2 Total alkalinity as $CaCO_3$

As we compare the total alkalinity of two industries,moringa leaf powder adsorbent filtration in plastic industry water gives the most feasible value.

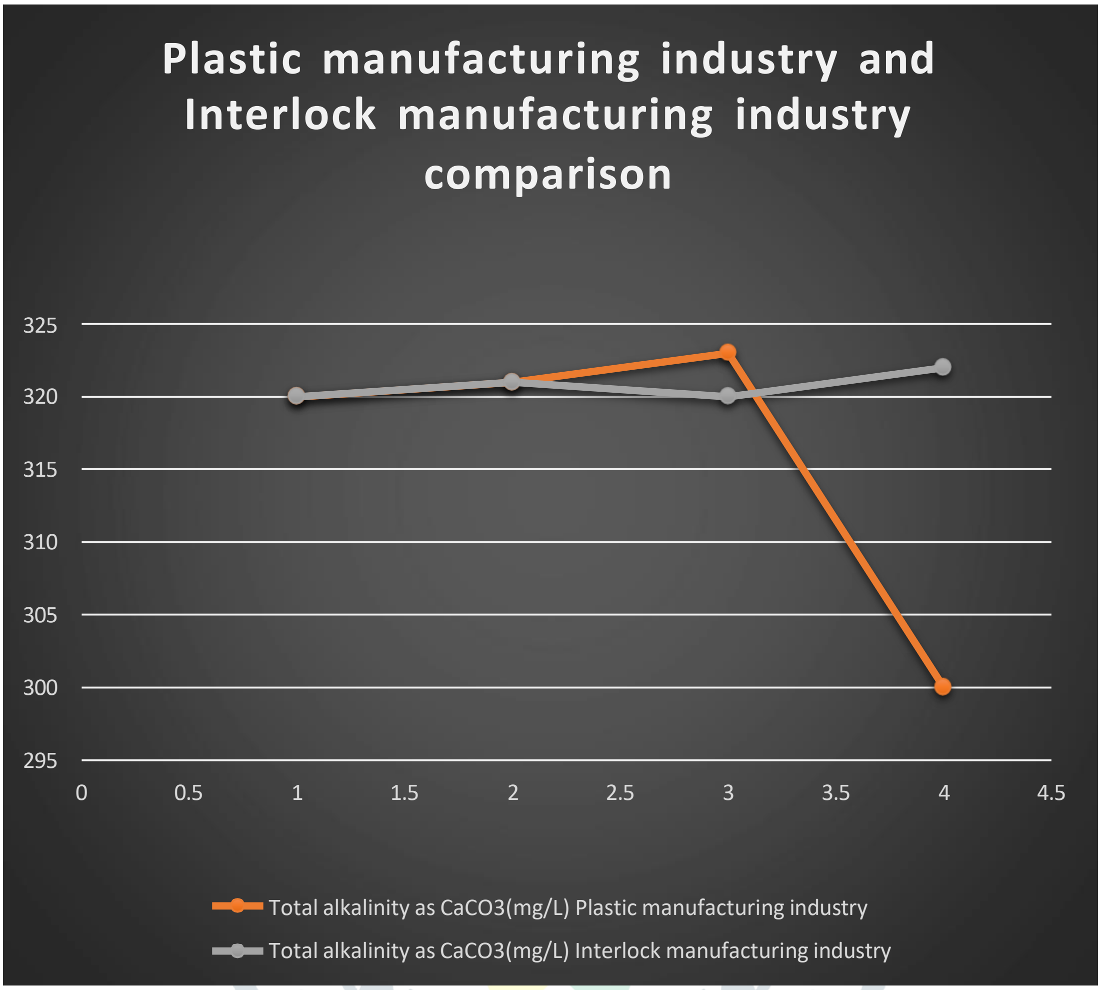

Fig 4.4 Comparison Total alkalinity as $CaCO_3$ in plastic manufacturing industry and interlock manufacturing industry water

4.3.3 Electrical conductivity

As we compare the electrical conductivity values for different filtration in two industrial waste waters, ,moringa leaf powder adsorbent filtration in plastic industry water gives the most feasible value.

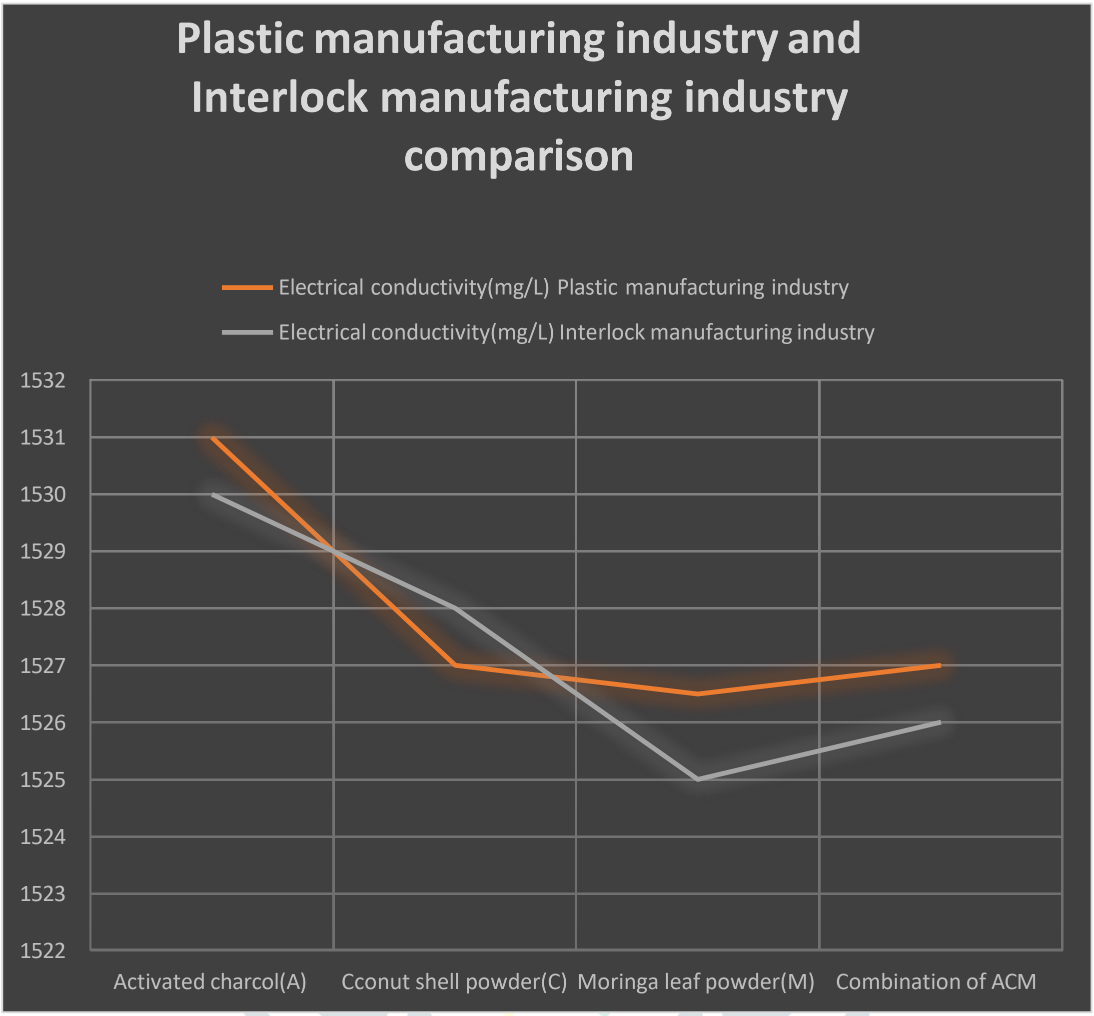

Fig 4.5 Comparison of electrical conductivity in plastic manufacturing industry and interlock manufacturing industry water

4.3.4 Total alkalinity as $CaCO_3$

As we compare the total alkalinity values for different filtration in two industrial waste waters, ,moringa leaf powder adsorbent filtration in plastic industry water gives the most feasible value

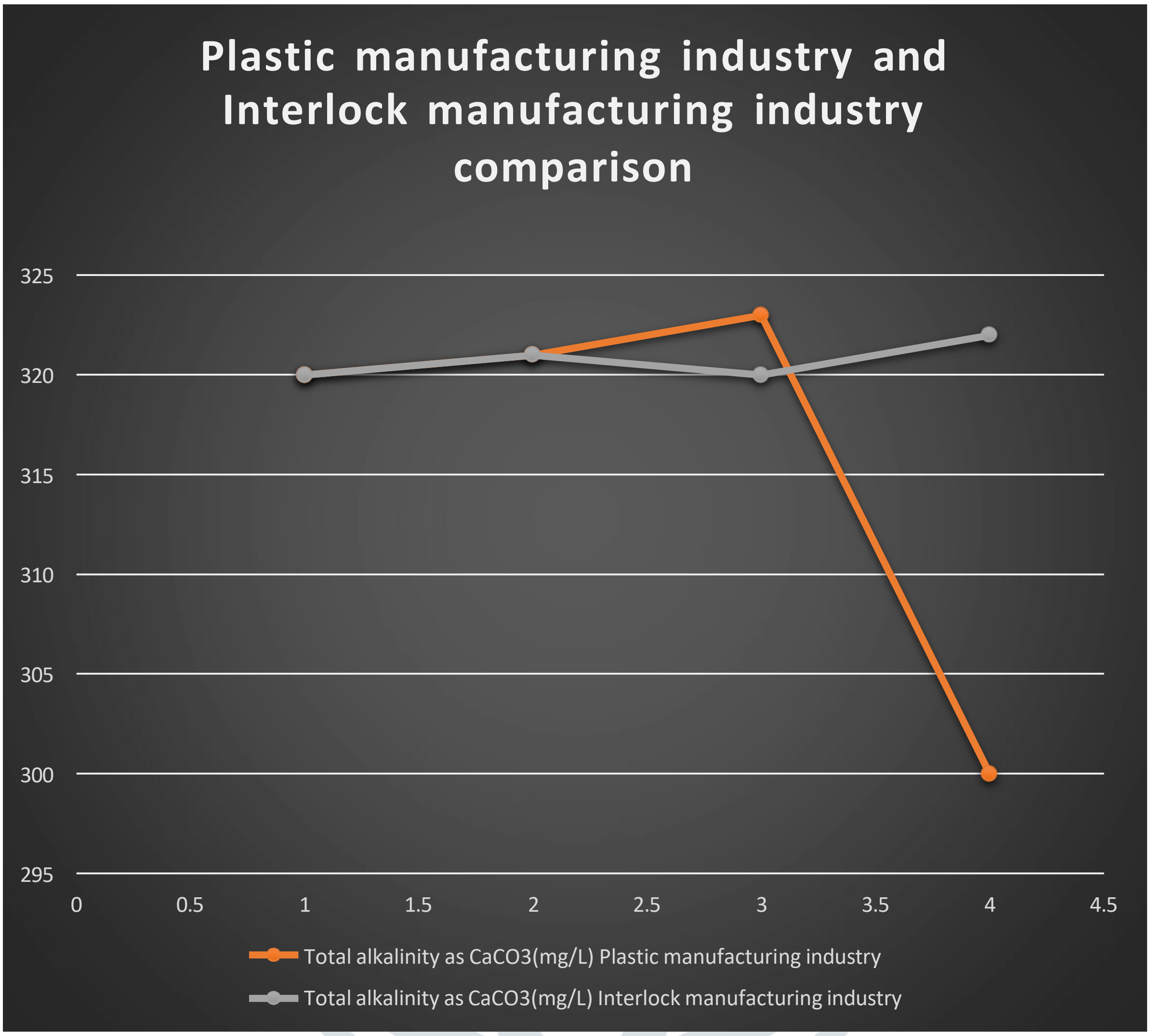

Fig 4.6 Comparison of Total alkalinity as $CaCO_3$ in plastic manufacturing industry and interlock manufacturing industry water

4.3.5 Calcium hardness as $CaCO_3$

As we compare the total calcium hardness values for different filtration in two industrial waste waters, ,moringa leaf powder adsorbent filtration in plastic industry water gives the most feasible value

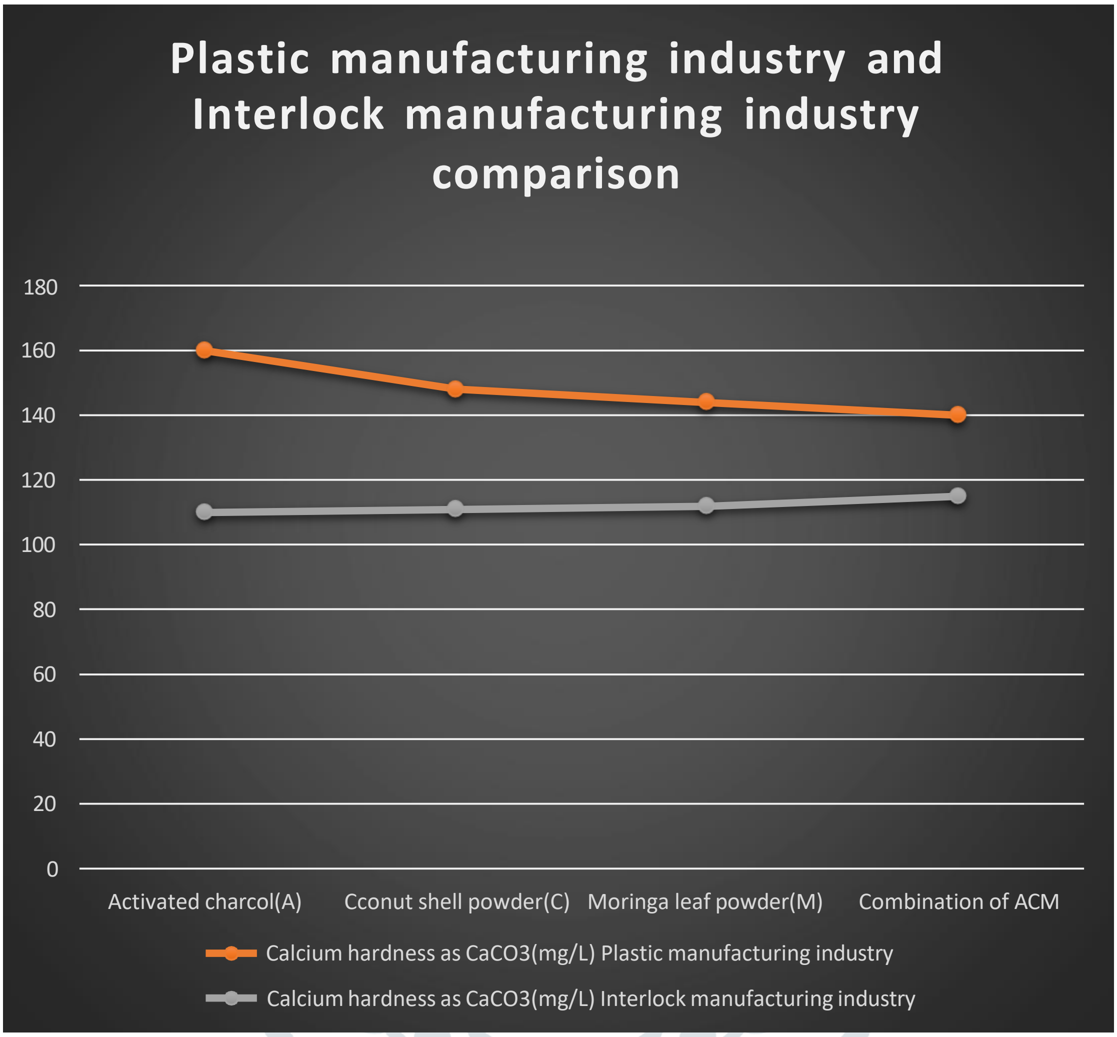

Fig 4.7 Comparison of calcium hardness as $CaCO_3$ in plastic manufacturing industry and interlock manufacturing industry water

4.3.6 Phosphate

As we compare the total phosphate values for different filtration in two industrial waste waters, ,moringa leaf powder adsorbent filtration in plastic industry water gives the most feasible value

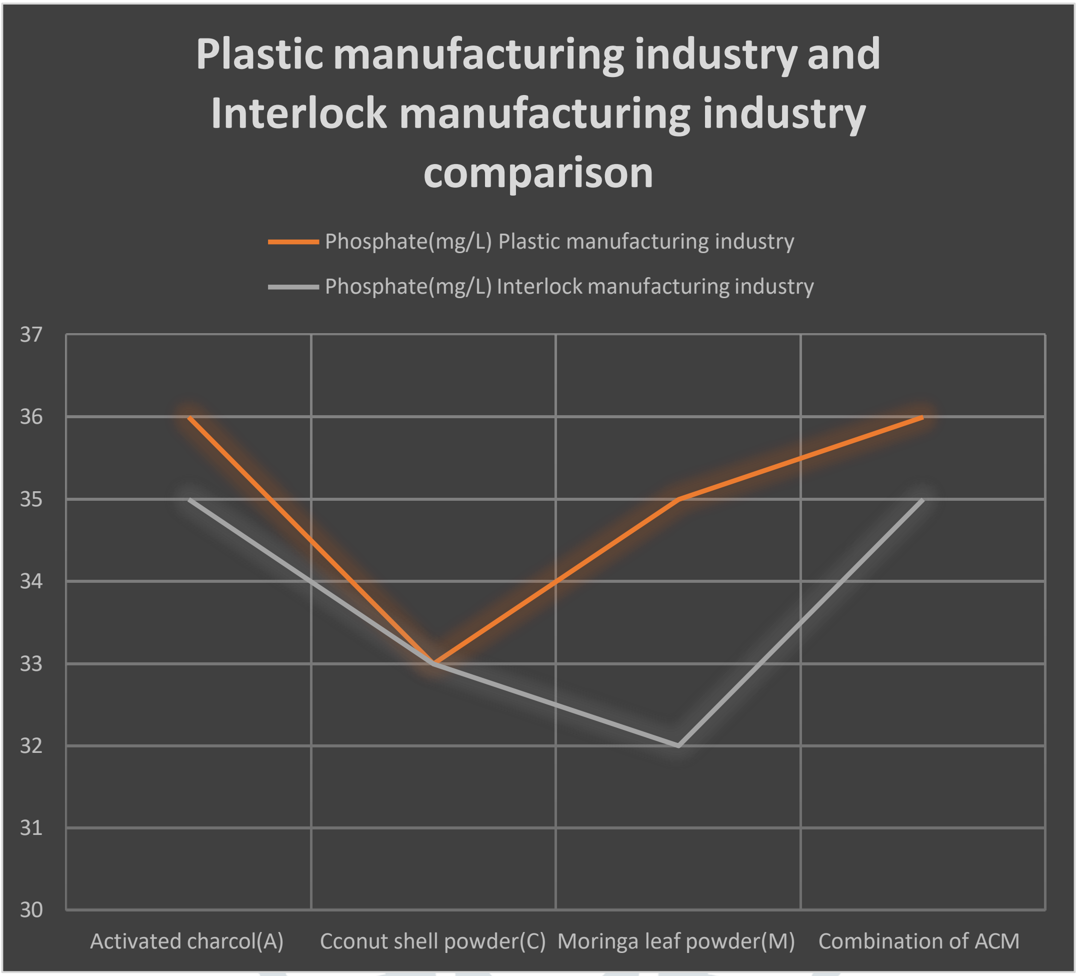

Fig 4.8 Comparison of phosphate in plastic manufacturing industry and interlock manufacturing industry water

4.3.7 Chloride

As we compare the total chloride values for different filtration in two industrial waste waters, ,there is no change in values after filtration with different adsorbent layers in two industries

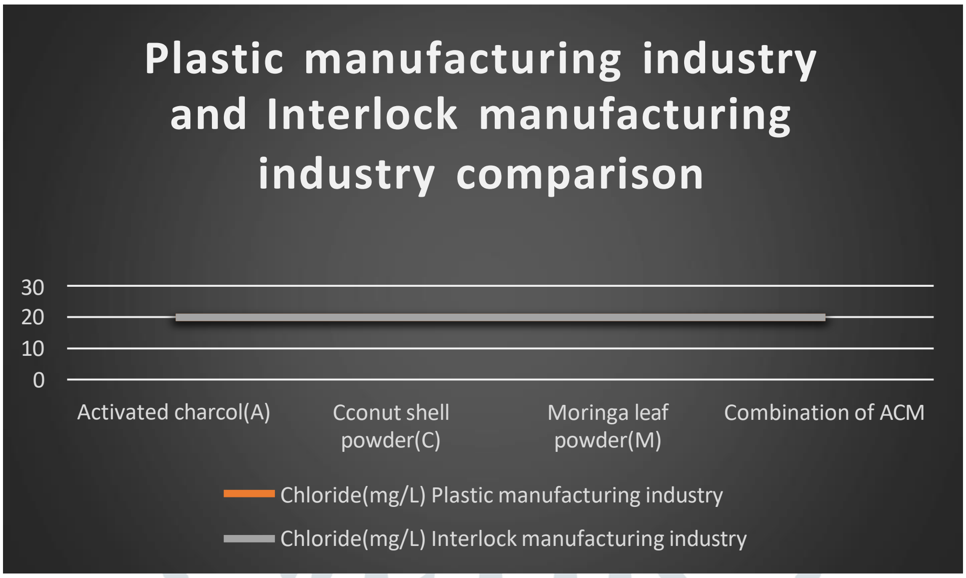

Fig 4.9 Comparison of chloride in plastic manufacturing industry and interlock manufacturing industry water

4.3.8 Color

As we compare the total color values for different filtration in two industrial waste waters, ,there is no change in values after filtration with different adsorbent layers in two industries

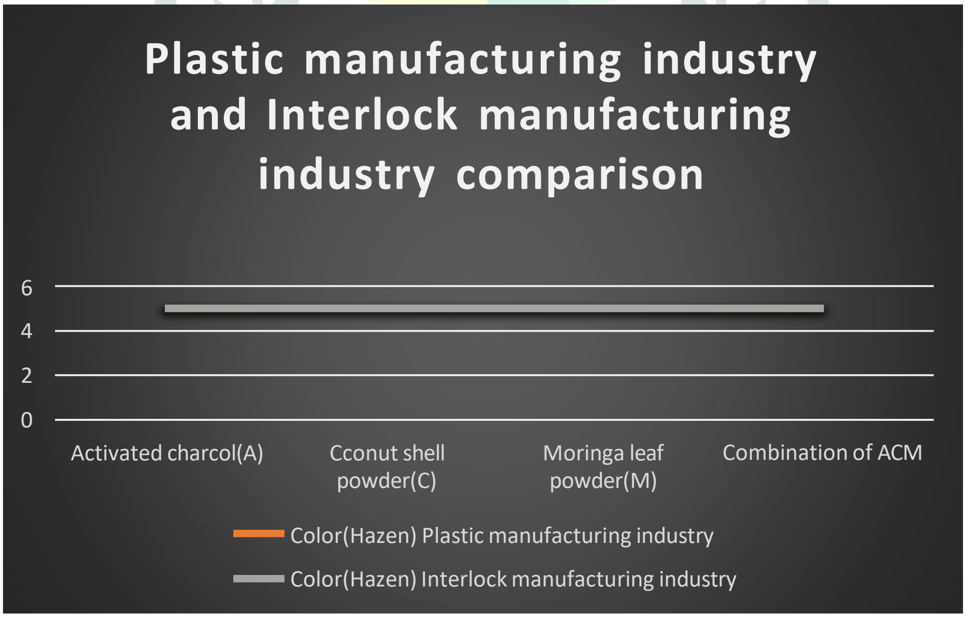

Fig 4.11 Comparison of color in plastic manufacturing industry and interlock manufacturing industry water

4.3.9 Sulphate

As we compare the sulphate values for different filtration in two industrial waste waters, ,moringa leaf powder adsorbent filtration in plastic industry water gives the most feasible value.

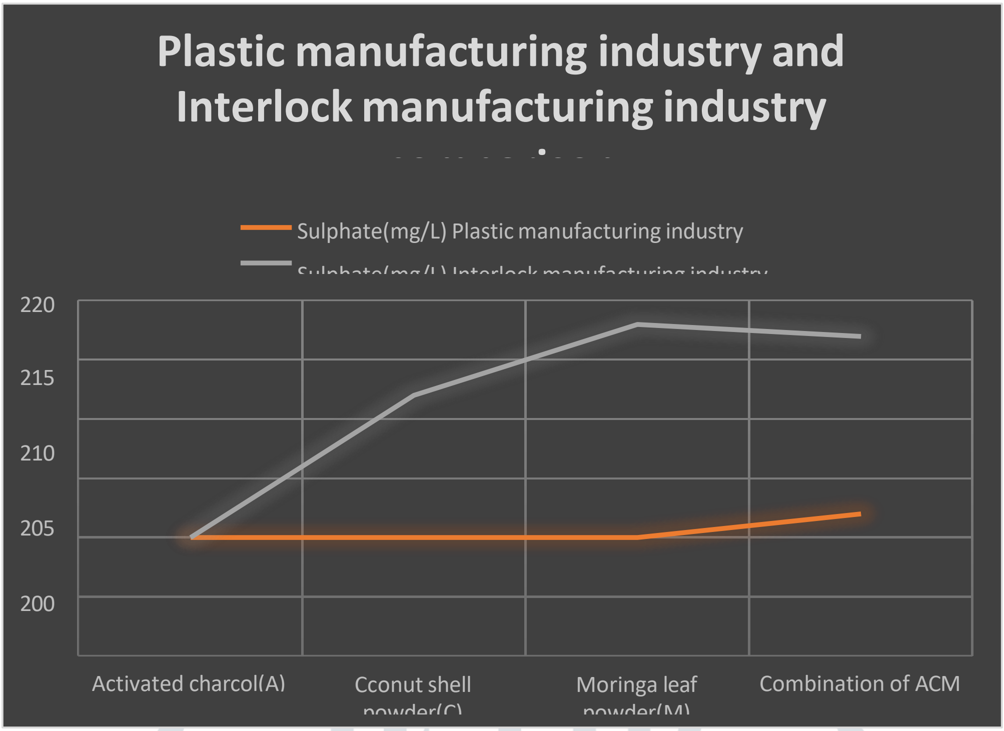

Fig 4.12 Comparison of sulphate in plastic manufacturing industry and interlock manufacturing industry water

4.3.11 Nitrite

As we compare the nitrite values for different filtration in two industrial waste waters, ,there is no change in values after filtration with different adsorbent layers in two industries

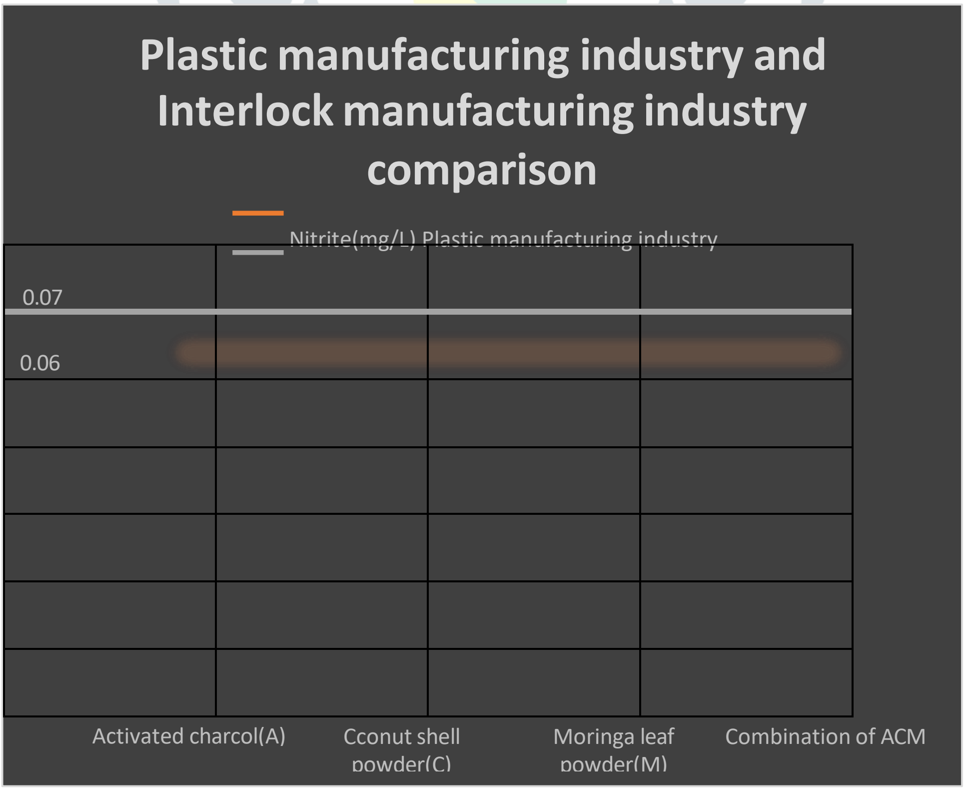

Fig 4.13 Comparison of nitrite in plastic manufacturing industry and interlock manufacturing industry water

4.3.12 Turbidity

As we compare the turbidity values for different filtration in two industrial waste waters, ,moringa leaf powder adsorbent filtration in plastic industry water gives the most feasible value.

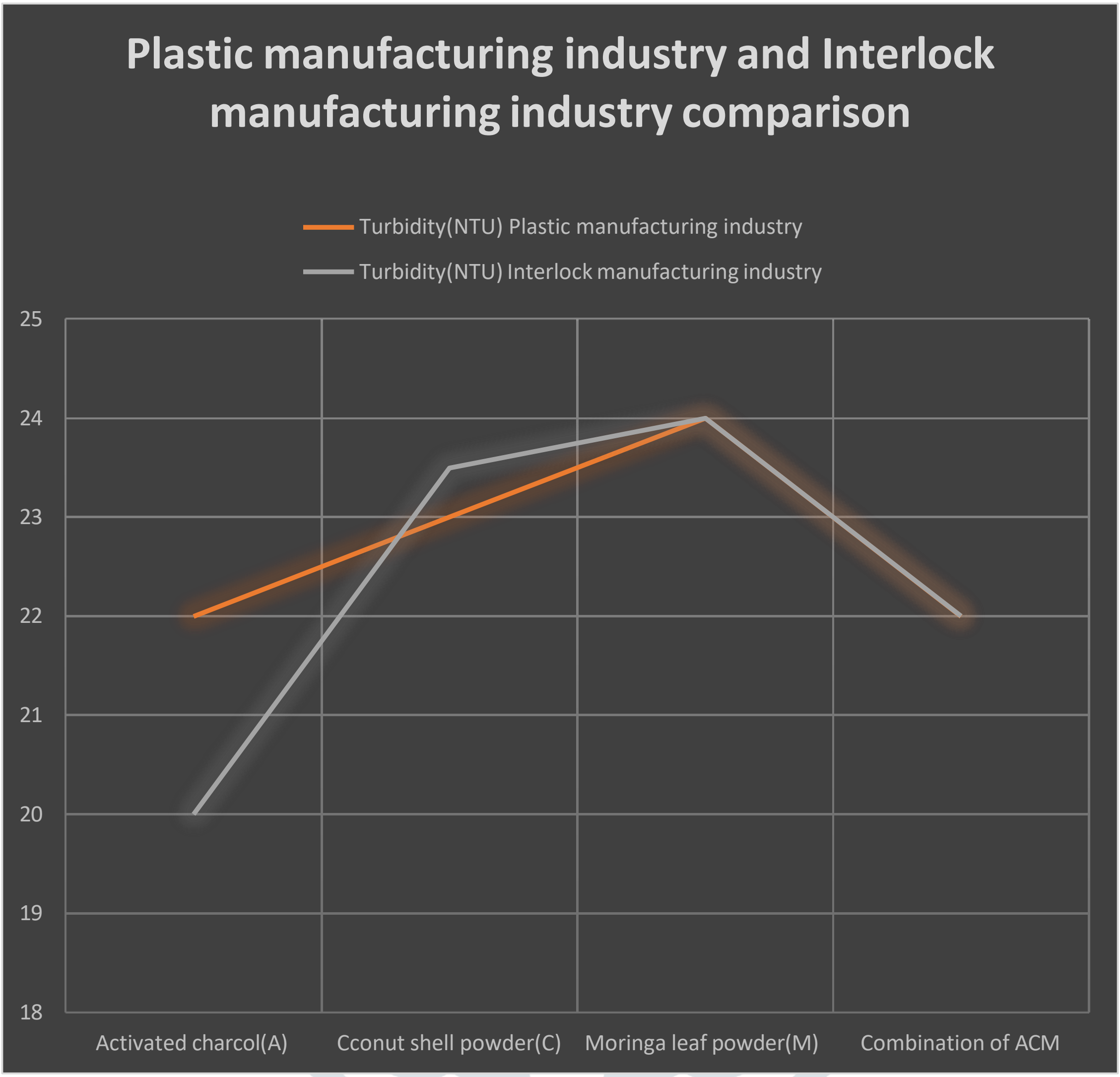

Fig 4.14 Comparison of turbidity in plastic manufacturing industry and interlock manufacturing industry water

4.3.13 Magnesium

As we compare the magnesium values for different filtration in two industrial waste waters, ,moringa leaf powder adsorbent filtration in plastic industry water gives the most feasible value**.**

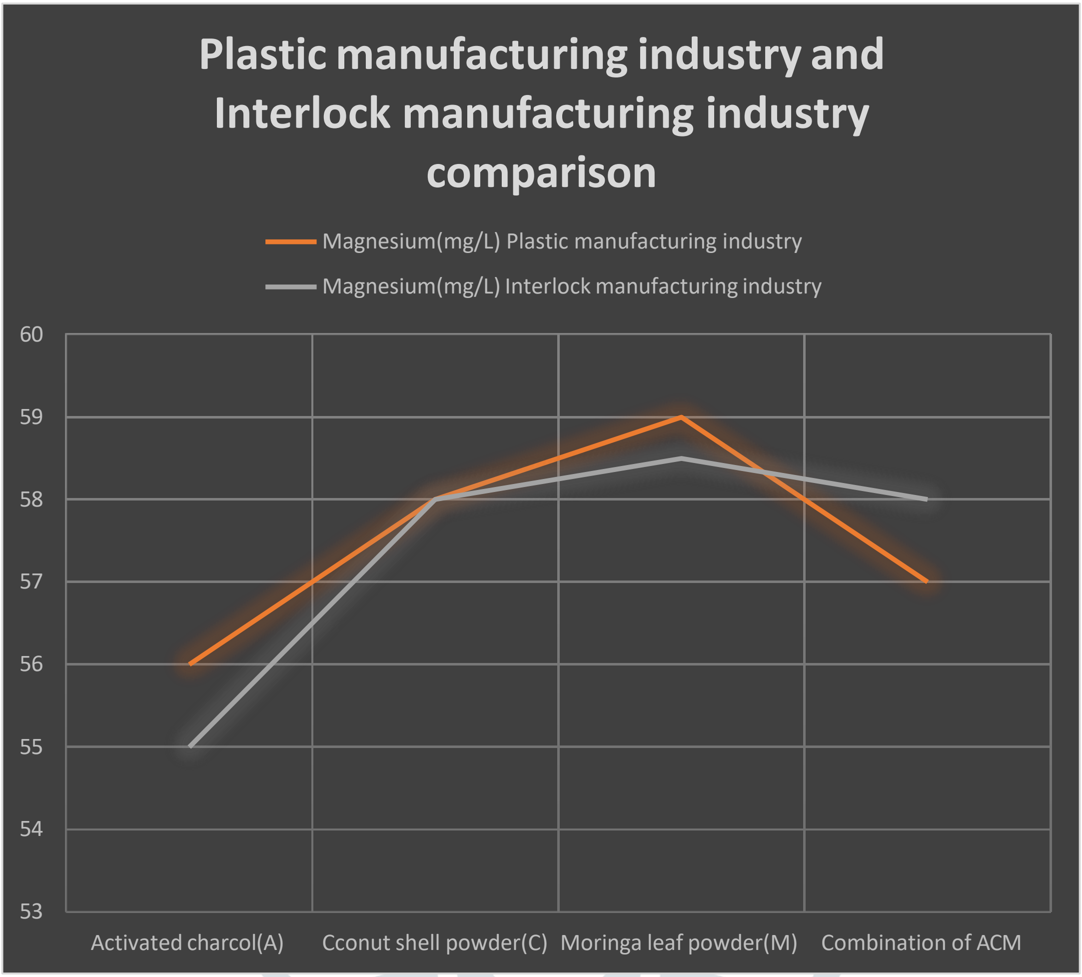

Fig 4.15 Comparison of magnesium in plastic manufacturing industry and interlock manufacturing industry water

4.3.14 Iron

As we compare the iron values for different filtration in two industrial waste waters, ,moringa leaf powder adsorbent filtration in plastic industry water gives the most feasible value.

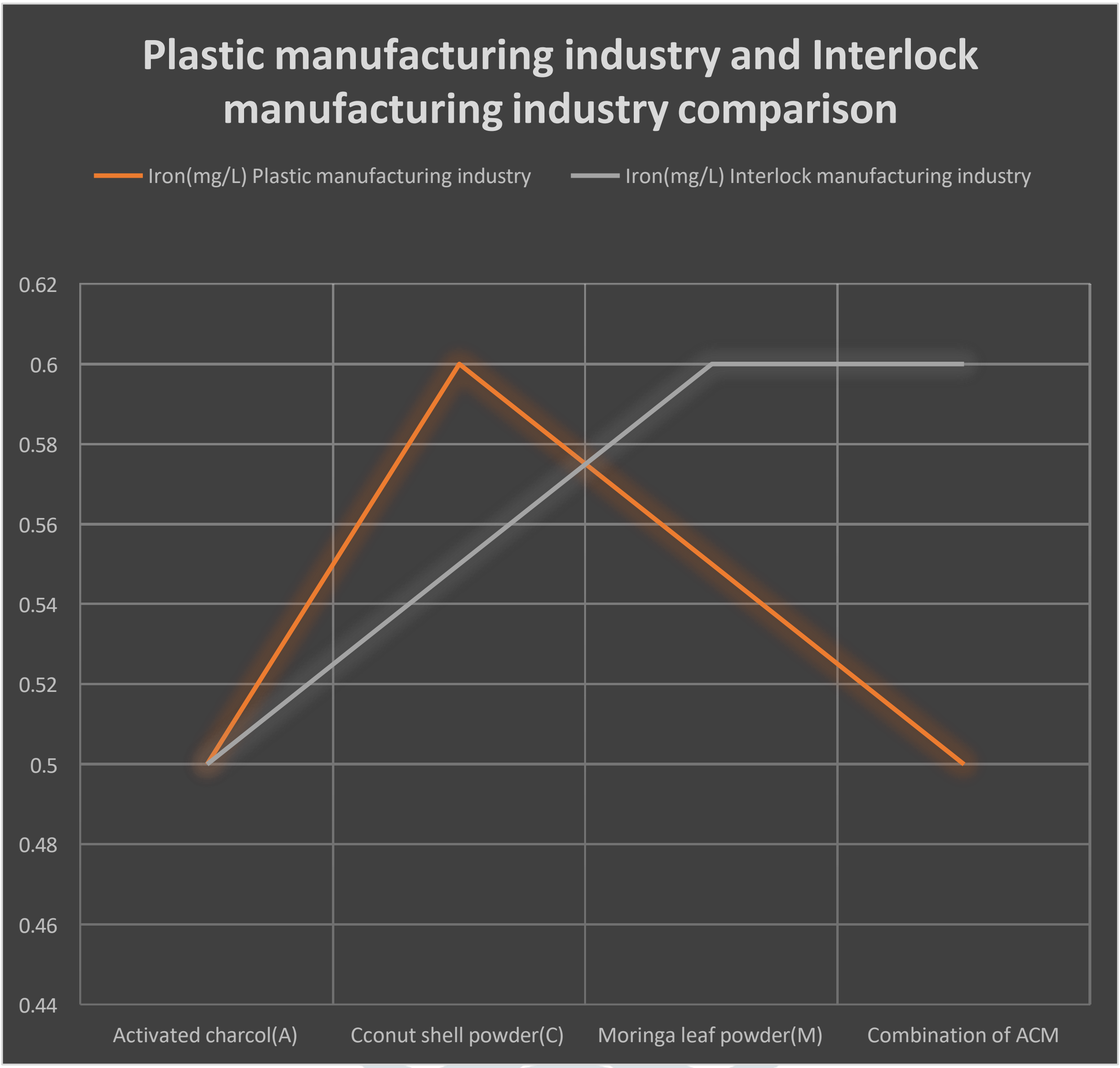

Fig 4.16 Comparison of iron in plastic manufacturing industry and interlock manufacturing industry water

4.3.15 Calcium

As we compare the calcium values for different filtration in two industrial waste waters, ,there is no change in values after filtration with different adsorbent layers in two industries

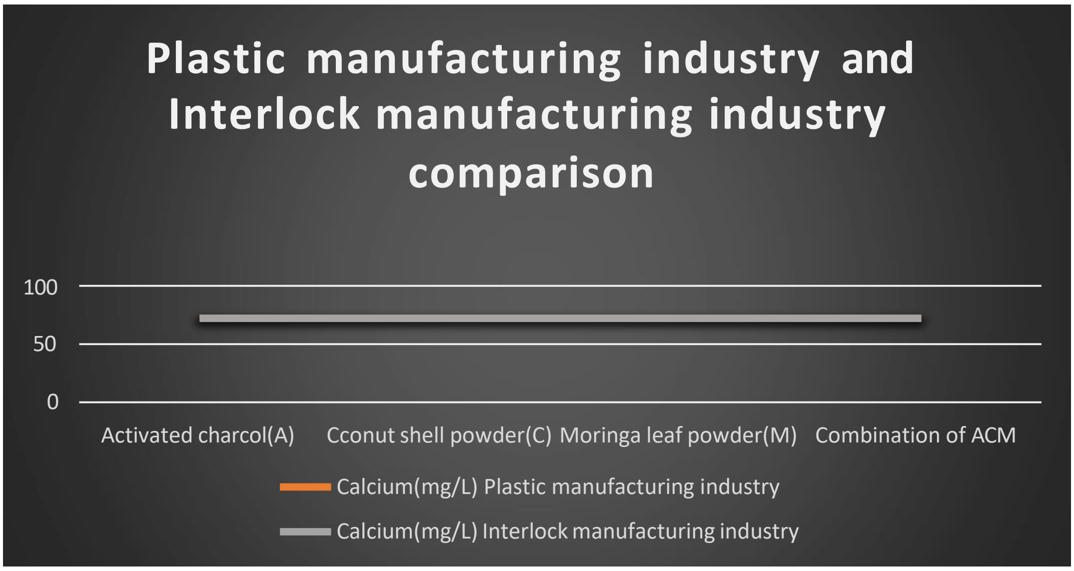

Fig 4.17 Comparison of calcium in plastic manufacturing industry and interlock manufacturing industry water

4.3.16 Ammonia as nitrogen

As we compare the ammonia as nitrogen values for different filtration in two industrial waste waters, ,there is no change in values after filtration with different adsorbent layers in two industries

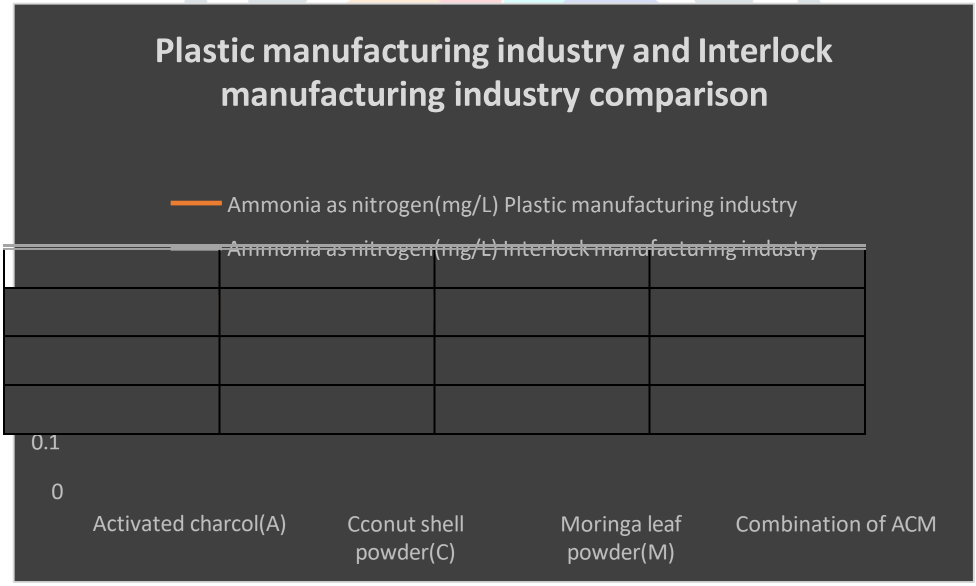

Fig 4.18 Comparison of ammonia as N in plastic manufacturing industry and interlock manufacturing industry water

4.3.17 Magnesium hardness as $CaCO_3$

As we compare the total magnesium hardness values for different filtration in two industrial waste waters, ,there is no change in values after filtration with different adsorbent layers in two industries

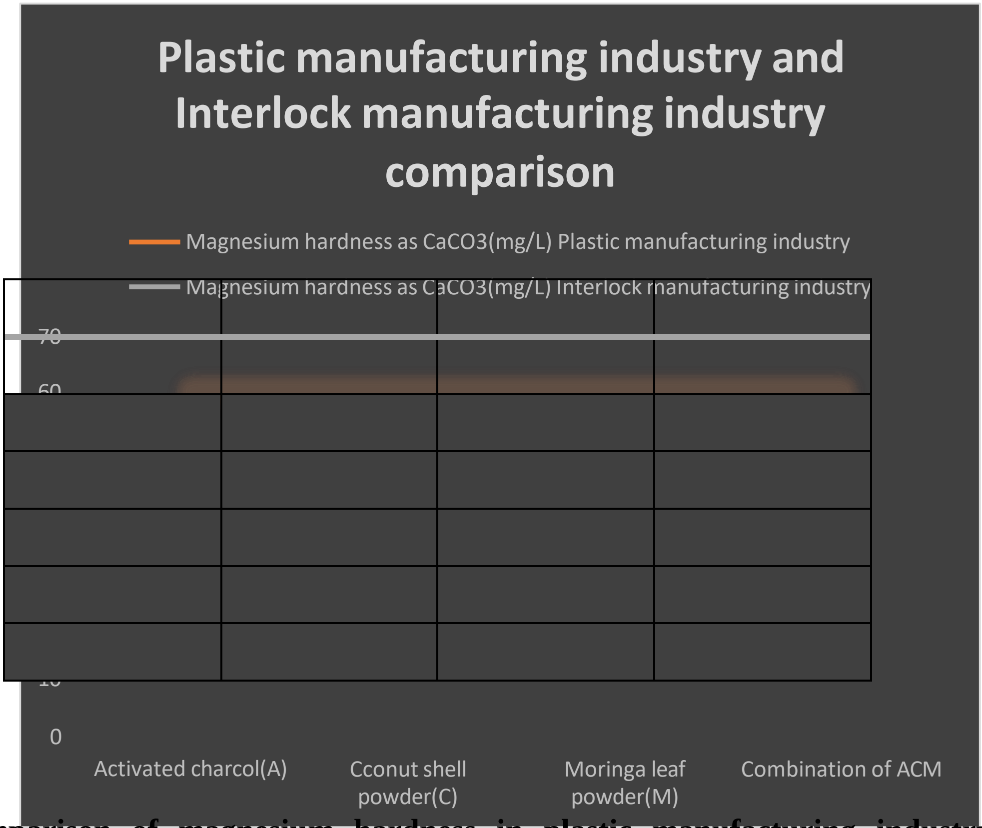

Fig 4.19 Comparison of magnesium hardness in plastic manufacturing industry and interlock manufacturing industry water

4.3.18 Total dissolved solids

As we compare the total total dissolved solid values for different filtration in two industrial waste waters, ,there is no change in values after filtration with different adsorbent layers in two industries

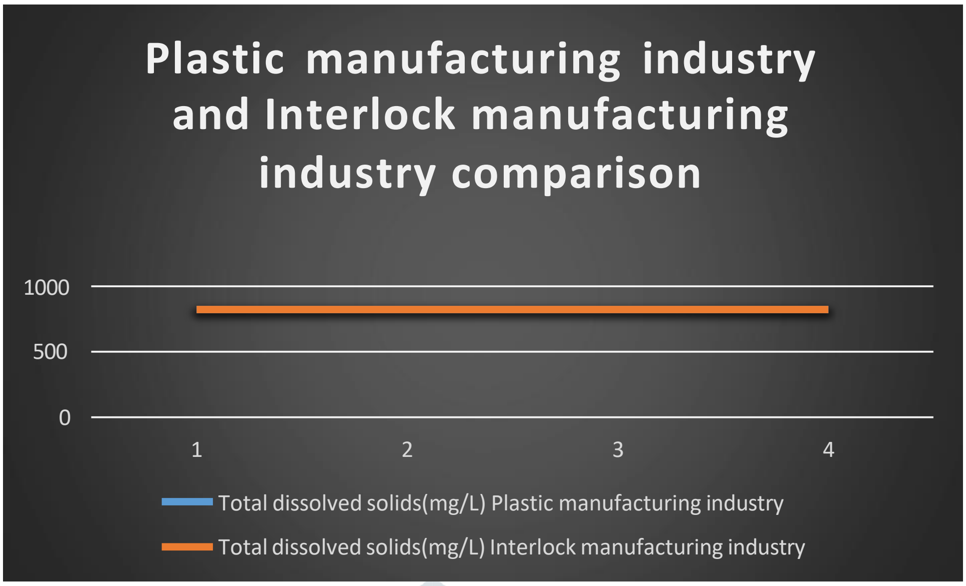

Fig 4.21 Comparison of total dissolved solids in plastic manufacturing industry and interlock manufacturing industry water

4.4COMPARISON OF EFFICIENCIES OF WASTE WATER IN PLASTIC MANUFACTURING INDUSTRY AND INTERLOCK MANUFACTURING INDUSTRY

Here we compare the efficiencies of waste waters in different adsorbent layers in two industries.

We have the formula of efficiency as,

Efficiency(η)=((Initial value-Final value)/Initial value)*100 Table 4.9 Waste water efficiencies of interlock manufacturing industry

No	Parameter	Adsorbent layer	Initial value	Final value	Efficiency(η)
1	Ph	Activated charcol(A)	11.61	9.82	15.4
		Coconut shell powder(C)	11.61	8	31.1
		Moringa leaf powder(M)	11.61	7.5	35.4
		Combination of ACM	11.61	8	31.1
2	Electrical conductivity	Activated charcol(A)	1542	1530	0.8
		Coconut shell powder(C)	1542	1528	0.9
		Moringa leaf powder(M)	1542	1525	1.1
		Combination of ACM	1542	1526	1.1

3	Total alkalinity as $CaCO_3$	Activated charcol(A)	300	320	6.7
		Coconut shell powder(C)	300	321	7
		Moringa leaf powder(M)	300	320	6.7
		Combination of ACM	300	322	7.3
4	Total hardness as $CaCO_3$	Activated charcol(A)	240	200	16.7
		Coconut shell powder(C)	240	190	20.8
		Moringa leaf powder(M)	240	187	22.1
		Combination of ACM	240	188	21.7
5	Calcium hardness as $CaCO_3$	Activated charcol(A)	180	110	38.9
		Coconut shell powder(C)	180	111	38.3
		Moringa leaf powder(M)	180	112	37.7
		Combination of ACM	180	115	36.1
6	Chloride	Activated charcol(A)	19.9	19.9	0
		Coconut shell powder(C)	19.9	19.9	0
		Moringa leaf powder(M)	19.9	19.9	0
		Combination of ACM	19.9	19.9	0
7	Sulphate	Activated charcol(A)	16.43	200	1117.2
		Coconut shell powder(C)	16.43	212	1190.3
		Moringa leaf powder(M)	16.43	218	1226.8
		Combination of ACM	16.43	217	1220.7
8	Turbidity	Activated charcol(A)	33.2	20	39.7
		Coconut shell powder(C)	33.2	23.5	29.2
		Moringa leaf powder(M)	33.2	24	27.7
		Combination of ACM	33.2	22	33.7
9	Totaldissolved solids	Activated charcol(A)	823	823	0
		Coconut shell powder(C)	823	823	0
		Moringa leaf powder(M)	823	823	0
		Combination of ACM	823	823	0
10	Magnesium hardness as $CaCO_3$	Activated charcol(A)	60	60	0
		Coconut shell powder(C)	60	60	0
		Moringa leaf powder(M)	60	60	0
		Combination of ACM	60	60	0
11	Calcium	Activated charcol(A)	72.14	72.14	0
		Coconut shell powder(C)	72.14	72.14	0
		Moringa leaf powder(M)	72.14	72.14	0
		Combination of ACM	72.14	72.14	0
12	Magnesium	Activated charcol(A)	14.58	55	277.2
		Coconut shell powder(C)	14.58	58	297.8
		Moringa leaf powder(M)	14.58	58.5	301.2
		Combination of ACM	14.58	58	297.8

13	Ammonia as N	Activated charcol(A)	0.38	0.38	0
		Coconut shell powder(C)	0.38	0.38	0
		Moringa leaf powder(M)	0.38	0.38	0
		Combination of ACM	0.38	0.38	0
14	Nitrite	Activated charcol(A)	0.06	0.06	0
		Coconut shell powder(C)	0.06	0.06	0
		Moringa leaf powder(M)	0.06	0.06	0
		Combination of ACM	0.06	0.06	0
15	Phosphate	Activated charcol(A)	42	35	16.6
		Coconut shell powder(C)	42	33	21.4
		Moringa leaf powder(M)	42	32	23.8
		Combination of ACM	42	35	16.6

Table 4.11 Waste water efficiencies of plastic manufacturing industry

No	Parameter	Adsorbent layer	Initial value	Final value	Efficiency(η)
1	pH	Activated charcol(A)	11.61	9	22.5
		Coconut shell powder(C)	11.61	8.5	26.8
		Moringa leaf powder(M)	11.61	8	31.1
		Combination of ACM	11.61	9	22.5
2	Electrical conductivity	Activated charcol(A)	1542	1531	0.7
		Coconut shell powder(C)	1542	1527	1.0
		Moringa leaf powder(M)	1542	1526.5	1.0
		Combination of ACM	1542	1527	1.0
3	Total alkalinity as $CaCO_3$	Activated charcol(A)	300	320	6.7
		Coconut shell powder(C)	300	321	7.0
		Moringa leaf powder(M)	300	323	7.7
		Combination of ACM	300	300	0.0
4	Total hardness as $CaCO_3$	Activated charcol(A)	240	201	16.3
		Coconut shell powder(C)	240	202	15.8
		Moringa leaf powder(M)	240	203	15.4
		Combination of ACM	240	204.5	14.8
5	Calcium hardness as $CaCO_3$	Activated charcol(A)	180	160	11.1
		Coconut shell powder(C)	180	148	17.8
		Moringa leaf powder(M)	180	144	20.0
		Combination of ACM	180	140	22.2
6	Chloride	Activated charcol(A)	19.9	19.9	0.0
		Coconut shell powder(C)	19.9	19.9	0.0
		Moringa leaf powder(M)	19.9	19.9	0.0

		Combination of ACM	19.9	19.9	0.0
7	Sulphate	Activated charcol(A)	16.43	200	1117.3
		Coconut shell powder(C)	16.43	200	1117.3
		Moringa leaf powder(M)	16.43	200	1117.3
		Combination of ACM	16.43	202	1129.5
8	Turbidity	Activated charcol(A)	33.2	22	33.7
		Coconut shell powder(C)	33.2	23	30.7
		Moringa leaf powder(M)	33.2	24	27.7
		Combination of ACM	33.2	22	33.7
9	Totaldissolved solids	Activated charcol(A)	823	823	0.0
		Coconut shell powder(C)	823	823	0.0
		Moringa leaf powder(M)	823	823	0.0
		Combination of ACM	823	823	0.0
10	Magnesium hardness as $CaCO_3$	Activated charcol(A)	60	60	0.0
		Coconut shell powder(C)	60	60	0.0
		Moringa leaf powder(M)	60	60	0.0
		Combination of ACM	60	60	0.0
11	Calcium	Activated charcol(A)	72.14	72.14	0.0
		Coconut shell powder(C)	72.14	72.14	0.0
		Moringa leaf powder(M)	72.14	72.14	0.0
		Combination of ACM	72.14	72.14	0.0
12	Magnesium	Activated charcol(A)	14.58	56	284.1
		Coconut shell powder(C)	14.58	58	297.8
		Moringa leaf powder(M)	14.58	59	304.7
		Combination of ACM	14.58	57	290.9
13	Ammonia as N	Activated charcol(A)	0.38	0.38	0.0
		Coconut shell powder(C)	0.38	0.38	0.0
		Moringa leaf powder(M)	0.38	0.38	0.0
		Combination of ACM	0.38	0.38	0.0
14	Nitrite	Activated charcol(A)	0.06	0.06	0.0
		Coconut shell powder(C)	0.06	0.06	0.0
		Moringa leaf powder(M)	0.06	0.06	0.0
		Combination of ACM	0.06	0.06	0.0
15	Phosphate	Activated charcol(A)	42	36	14.3
		Coconut shell powder(C)	42	33	21.4
		Moringa leaf powder(M)	42	35	16.7
		Combination of ACM	42	36	14.3

4.4.3 Efficiency of pH

As we compare the pH efficiency values of two industries with different adsorbent layer,moringa leaf powder filtration in plastic industry gives the most efficient value

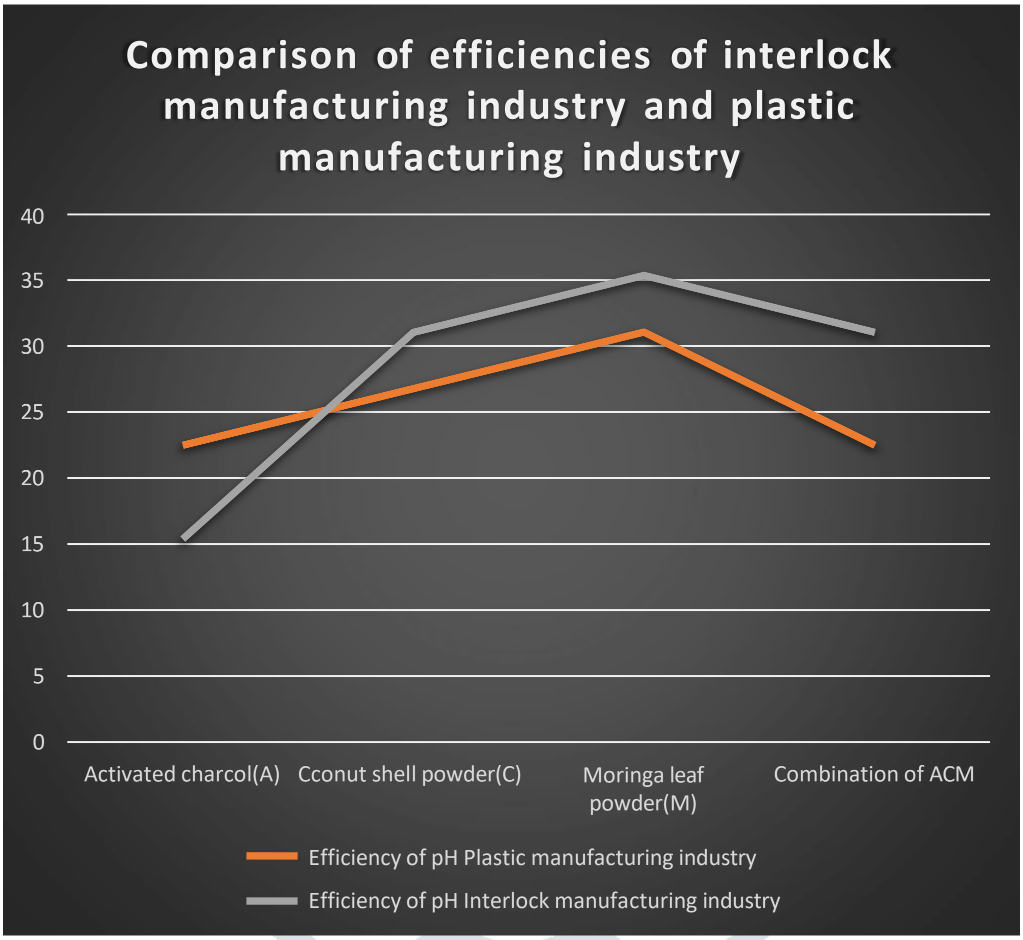

Fig 4.22 pH efficiency comparison of plastic manufacturing industry and interlock manufacturing industry water

4.4.4 Efficiency of Electrical conductivity

As we compare the electrical conductivity efficiency values of two industries with different adsorbent layer,moringa leaf powder filtration in plastic industry gives the most efficient value

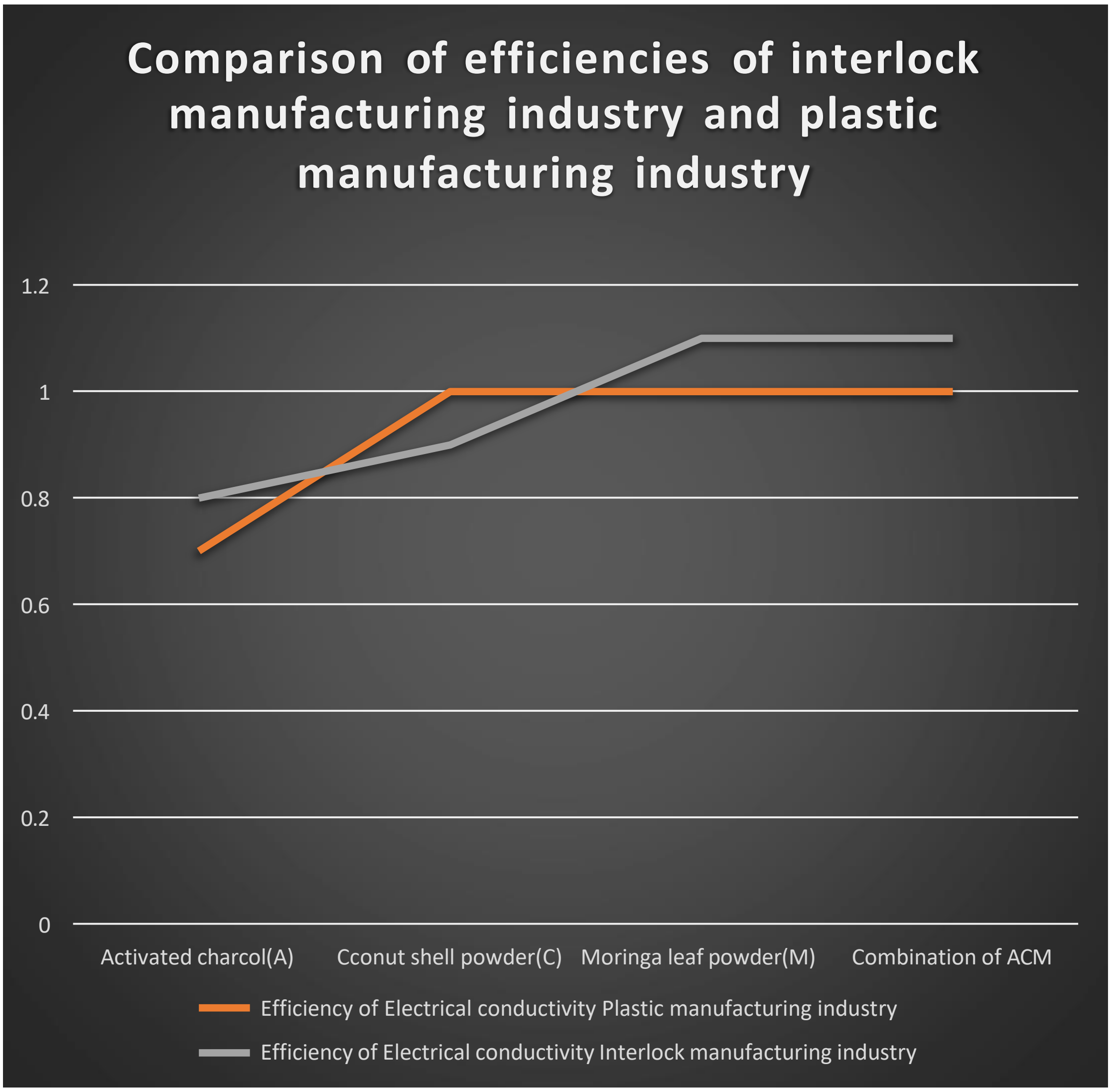

Fig 4.23 Electrical conductivity efficiency comparison of plastic manufacturing industry and interlock manufacturing industry water

4.4.5 Efficiency of Total alkalinity as $CaCO_3$

As we compare the total alkalinity efficiency values of two industries with different adsorbent layer,moringa leaf powder filtration in plastic industry gives the most efficient value

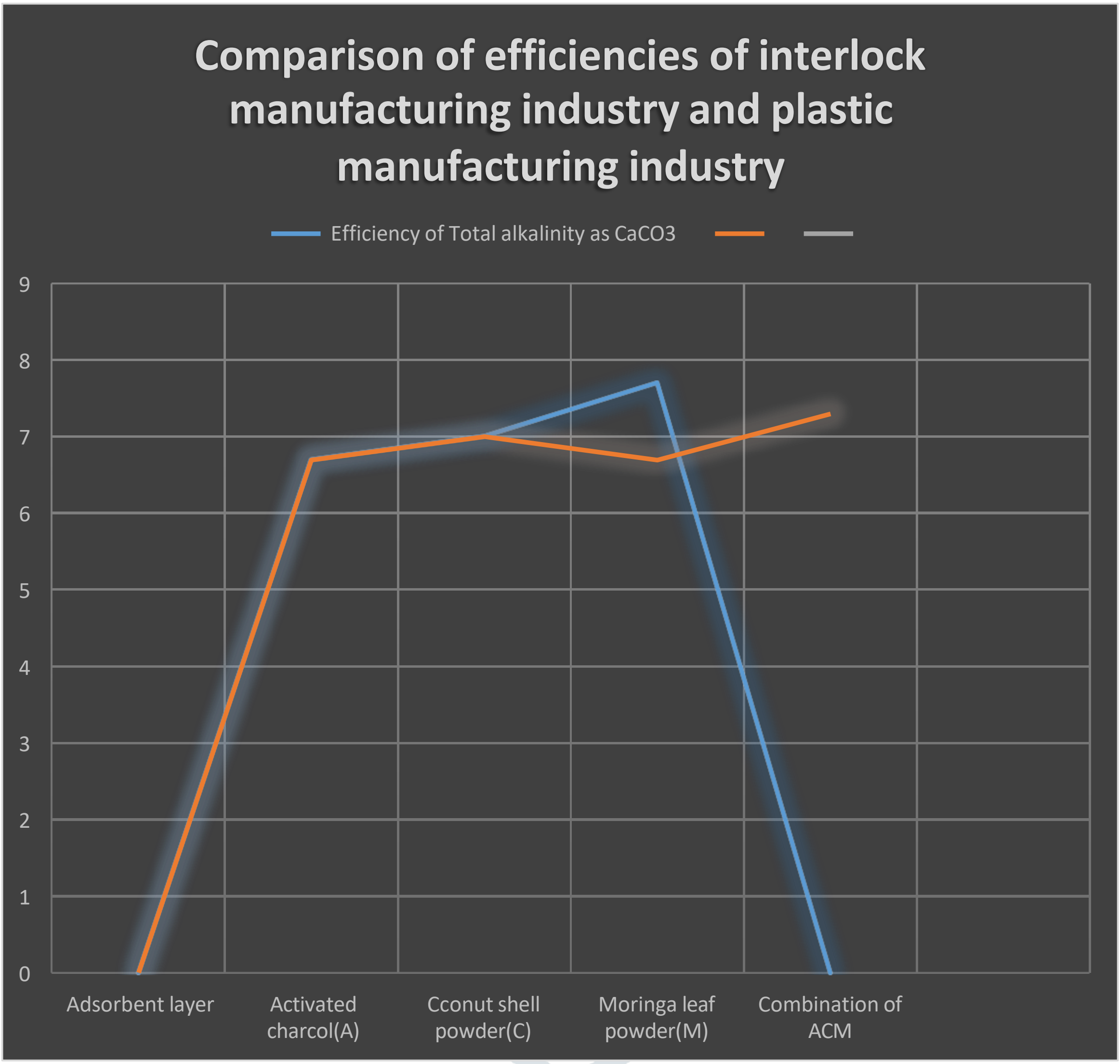

Fig 4.24 Total alkalinity efficiency comparison of plastic manufacturing industry and interlock manufacturing industry water

4.4.6 Efficiency of Total hardness as $CaCO_3$

As we compare the Total hardness efficiency values of two industries with different adsorbent layer,moringa leaf powder filtration in plastic industry gives the most efficient value

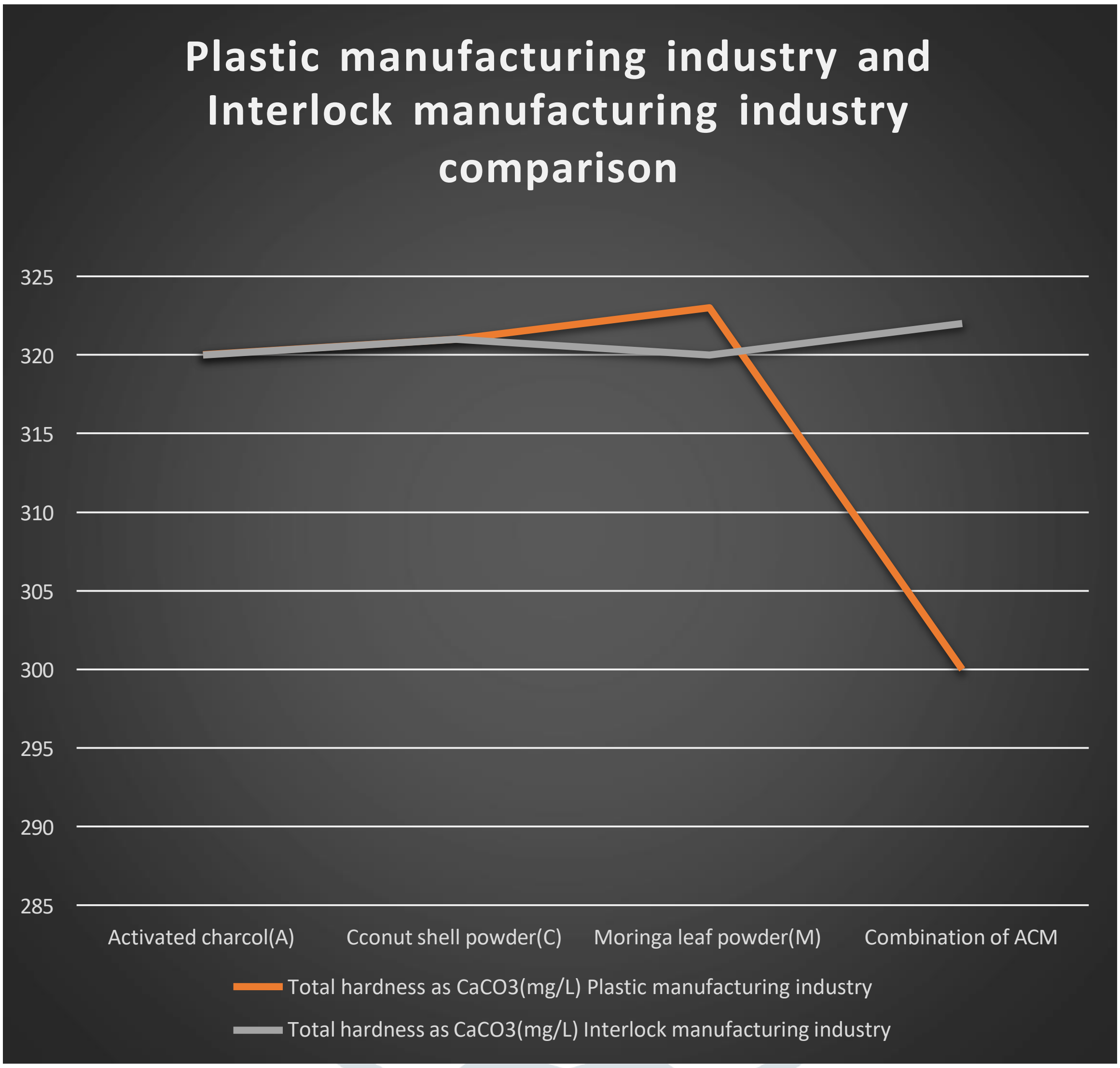

Fig 4.25 Total hardness efficiency comparison of plastic manufacturing industry and interlock manufacturing industry water

4.4.7 Efficiency of Calcium hardness as $CaCO_3$

As we compare the calcium hardness efficiency values of two industries with different adsorbent layer,moringa leaf powder filtration in plastic industry gives the most efficient value

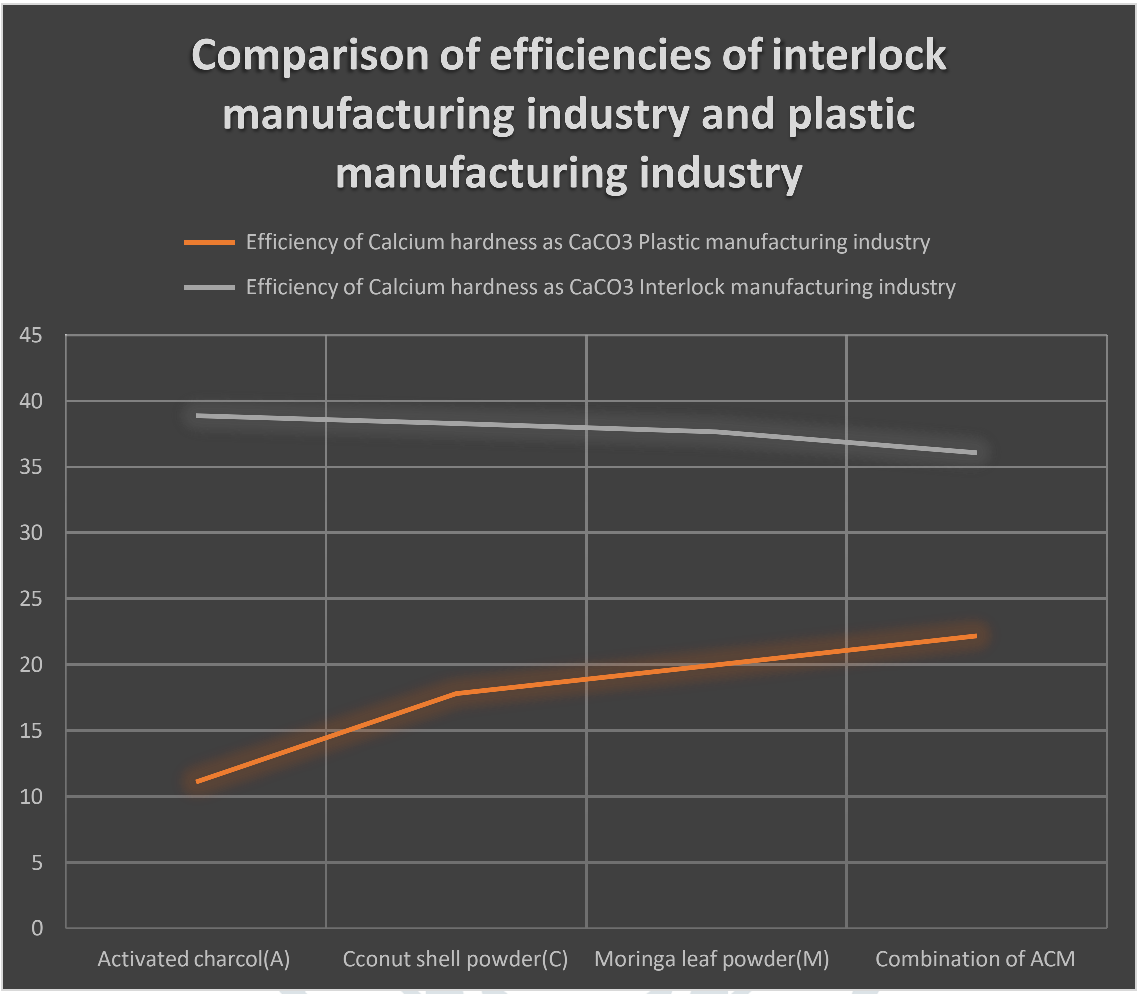

Fig 4.26 Calcium hardness efficiency comparison of plastic manufacturing industry and interlock manufacturing industry water

4.4.8 Efficiency of Sulphate

As we compare the sulphate efficiency values of two industries with different adsorbent layer,moringa leaf powder filtration in plastic industry gives the most efficient value

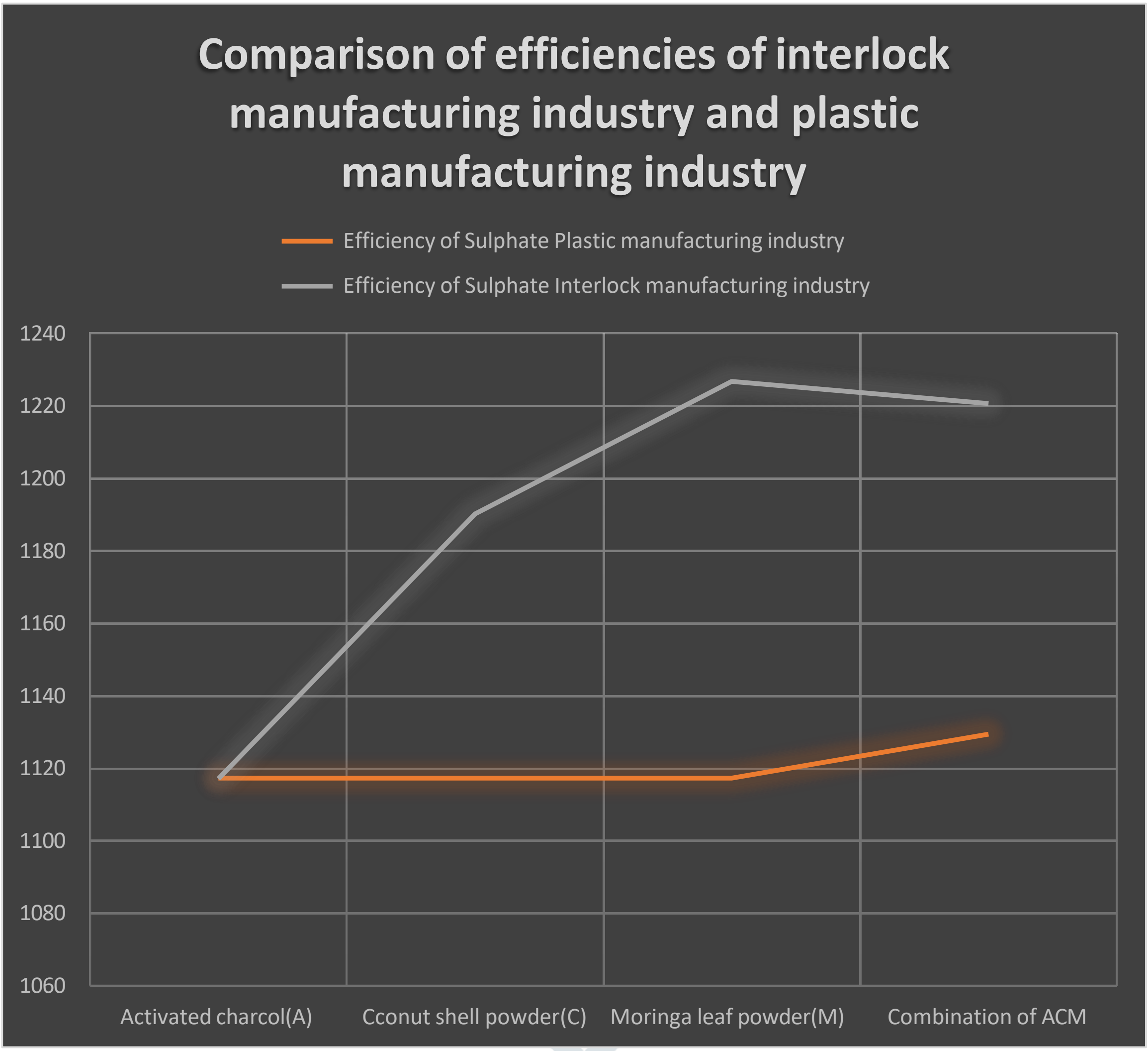

Fig 4.27 Sulphate hardness efficiency comparison of plastic manufacturing industry and interlock manufacturing industry water

4.4.9 Efficiency of Turbidity

As we compare the turbidity efficiency values of two industries with different adsorbent layer,moringa leaf powder filtration in plastic industry gives the most efficient value.

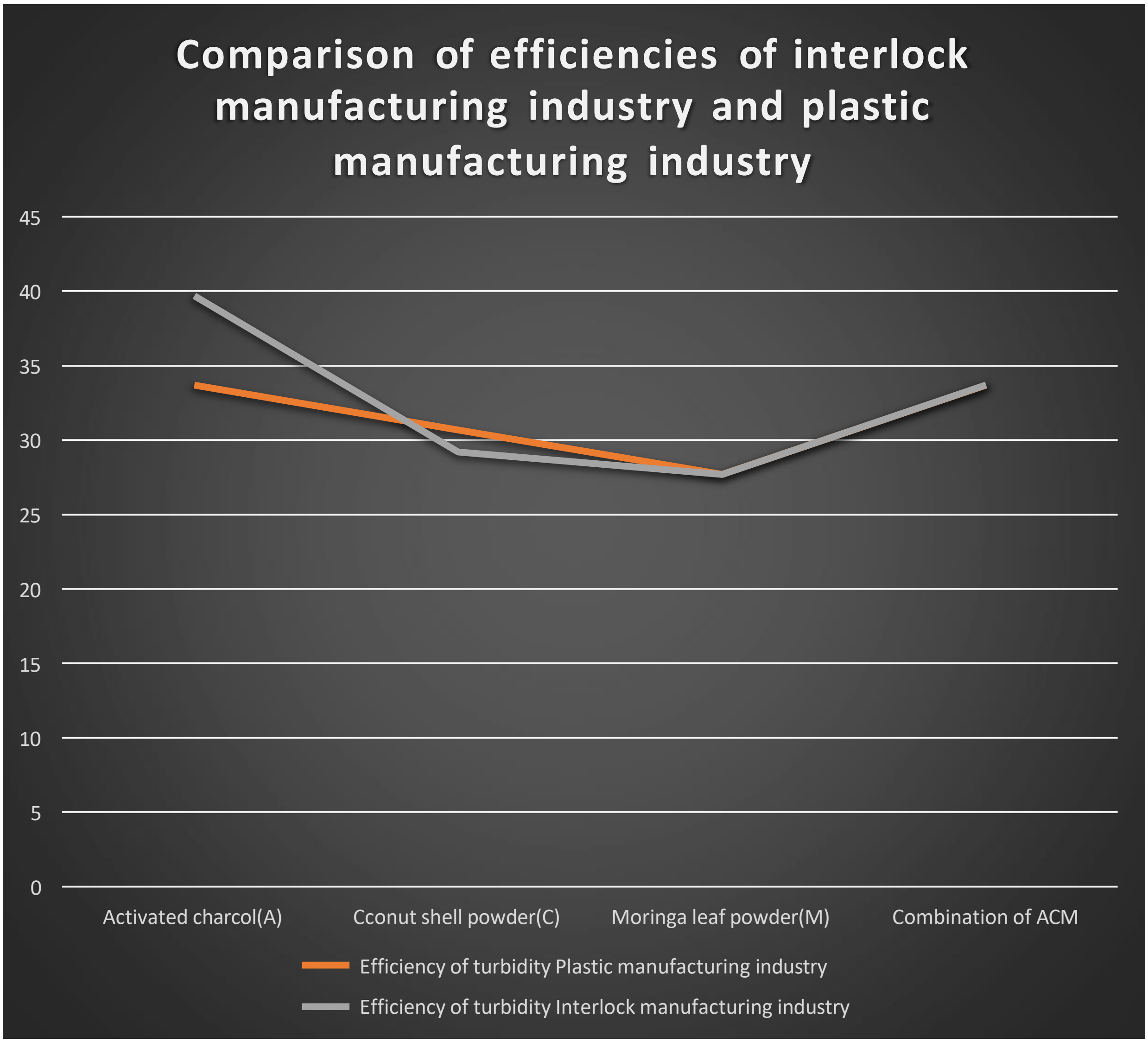

Fig 4.28 Turbidity efficiency comparison of plastic manufacturing industry and interlock manufacturing industry water

4.4.11 Efficiency of Magnesium

As we compare the magnesium efficiency values of two industries with different adsorbent layer,moringa leaf powder filtration in plastic industry gives the most efficient value

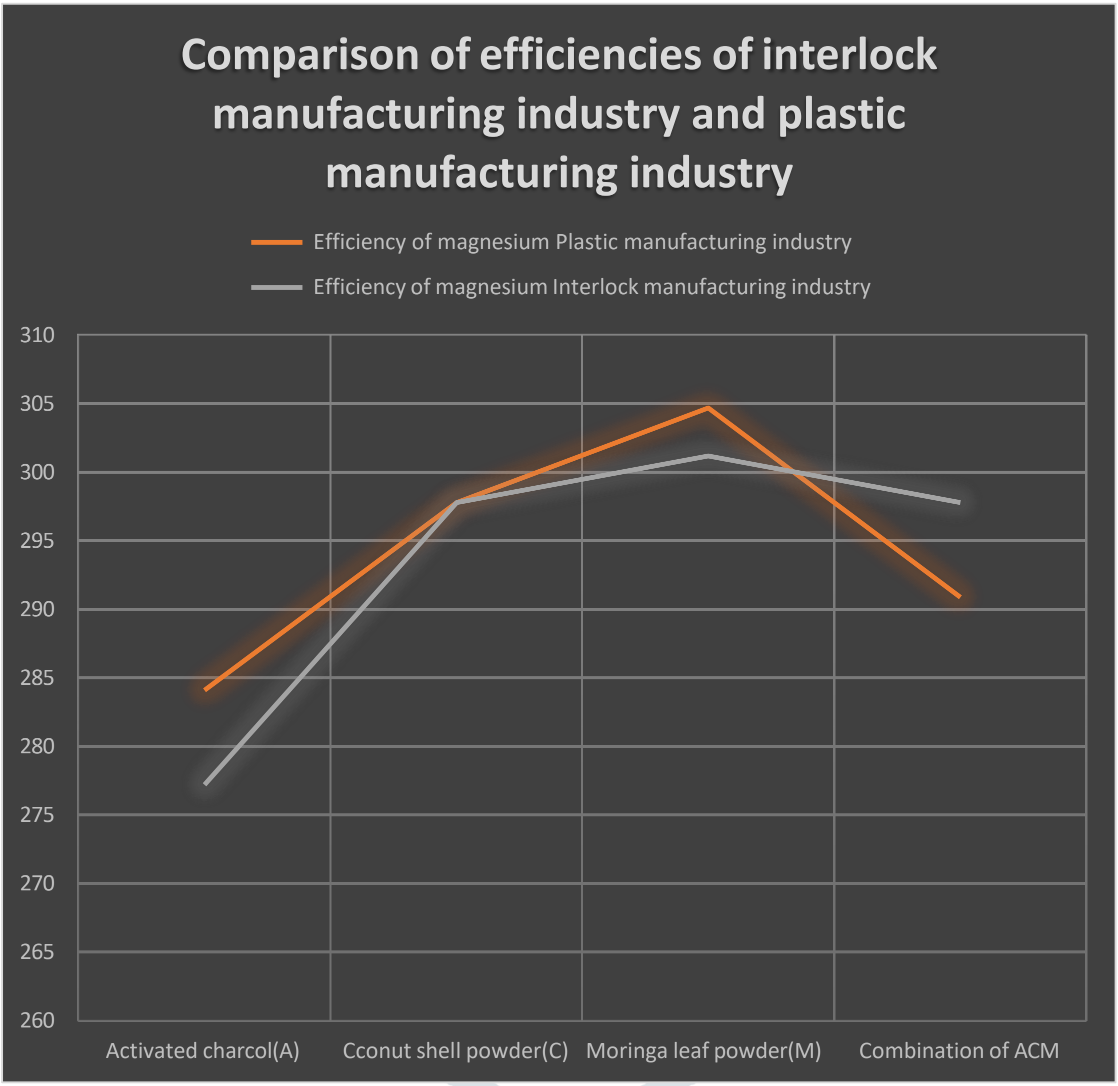

Fig 4.29 Magnesium efficiency comparison of plastic manufacturing industry and interlock manufacturing industry water

4.4.12 Efficiency of Phosphate

As we compare the phosphate efficiency values of two industries with different adsorbent layer,moringa leaf powder filtration in plastic industry gives the most efficient value

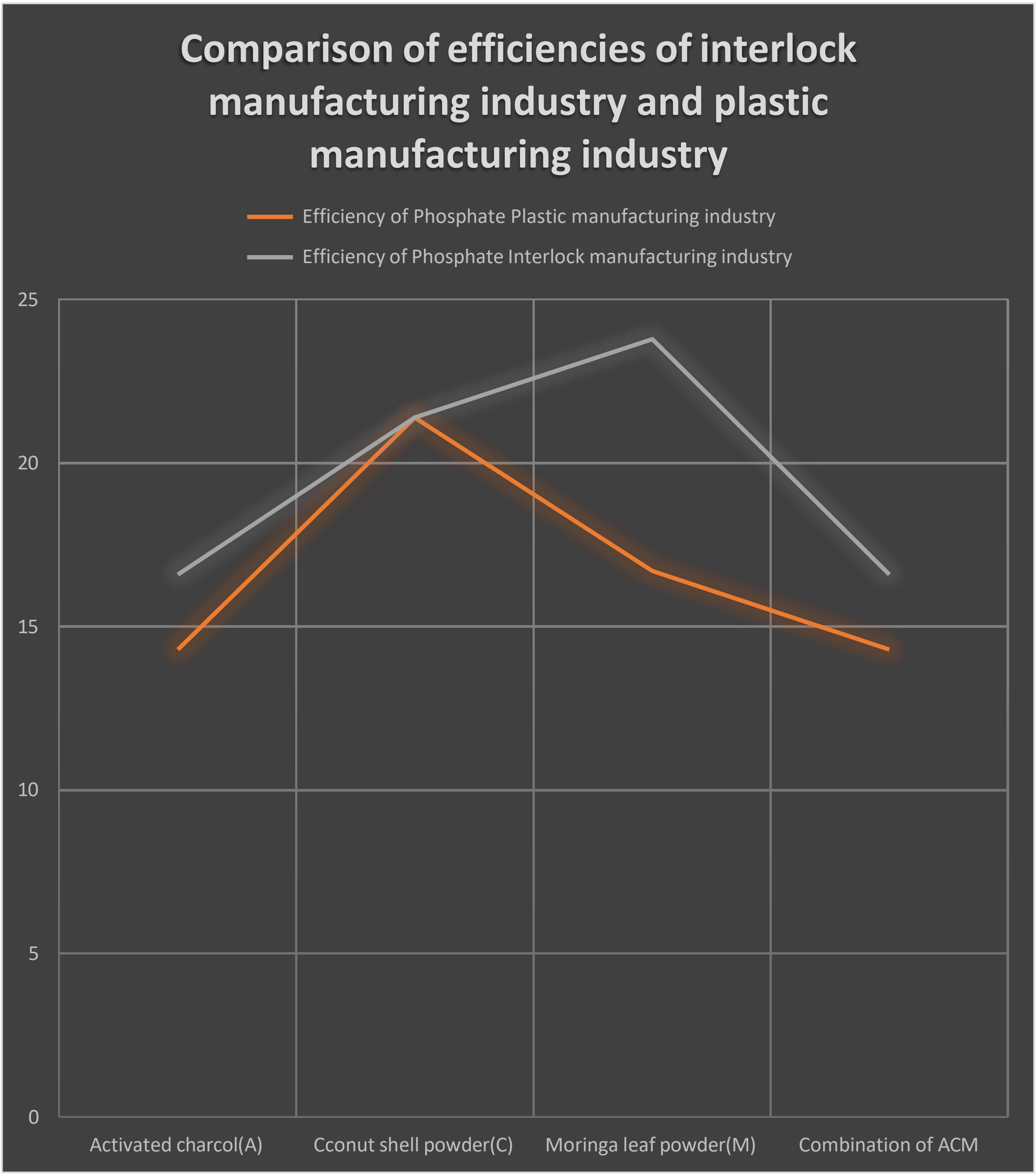

Fig 4.31 phosphate efficiency comparison of plastic manufacturing industry and interlock manufacturing industry water

5 CONCLUSIONS

- For interlock manufacturing industry, Initial water quality test results shows that turbidity,total dissolved solids ,magnesium hardness,nitrite,total coliforms and E.coli are within the limit . Their values includes 33.2 NTU,823 mg/L,60 mg/L,0.06 mg/L,42 mg/L,<1CFU/ml,<1CFU/ml respectively.
- For plastic manufacturing industry, Initial water quality test results shows that taste and odour,total dissolved solids,nitrite,phosphate are within the limit. Their values includes 6.96 µS/cm,44 mg/L,70 mg/L,aggreable,111 mg/L,0.18 mg/L,26 mg/L respectively.
- Comparison of quality parameters after filtration through ,coconut shell powder,moringa leaf powder,activated charcoal and their combination concludes that filtration with moringa leaf powder gives most feasible values.
- Comparison of results from interlock manufacturing industry and plastic manufacturing industry concludes that ,quality parameters of plastic manufacturing industry gives most feasible values.
- Comparison of efficiencies of parameters from two industries concludes that plastic manufacturing industrial water shows more efficiency.

That is higher efficiecy values includes

pH - 31.1%

Electrical conductivity -1%

Total alkalinity as $CaCO_3$ -7.7%

Total hardness as $CaCO_3$ -16.3%

Calcium hardness as $CaCO_3$ -22.2% Turbidity -33.7%

Phosphate -21.4%

5.1FUTURE STUDY

- Filtration by different adsorbent layers,and extra layers of adsorbants
- Filtration by varying the thickness of layers
- Filtration by taking more waste water from different industries
- Filtration by varying the surface area of experimental setup

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