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A REVIEW ON ACTIVATED CHARCOAL DERIVED FROM WASTE (ORGANIC AND PLASTIC WASTE)

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ABSTRACT

The global demand for activated carbon (AC) in water treatment and purification applications is increasing. Heavy metals, medicines, pesticides, natural organic matter, disinfection by-products, and micro plastics are among the water contaminants that have shown better removal effectiveness by AC. Because of their availability and carbonaceous composition, biomass wastes have a high potential for such materials. This, in turn, can lessen the negative environmental effects caused by improper trash disposal. The literature review reveals that the studies on "low cost Activated Charcoal" for the removal of pollutants from the environment whether from water or atmosphere has been done worldwide. Various research articles are present on Activated Charcoal prepared from waste plastic for the treatment of aqueous phase. Nonetheless, there is a need to explore 1) the effect of preparation pathways on the adsorptive properties of biomass derived AC, 2) sustainable production of plastic waste derived AC and techno-economic analysis, and 3) adsorption mechanisms of GAC for removal of contaminants of emerging concerns such as micro plastics and unregulated disinfection by-products.

Keywords: *Activated Carbon, Adsorption, Biomass waste, Plastic waste, Wastewater.*

Introduction

Adsorption is the occurrence of an excess concentration of one component (solid, liquid, or gas) on the surface of another component (usually solid or liquid). Non-renewable resources such as coal, lignite, and peat are commonly used in the commercial production of Activated Charcoal. These are useful as Activated Charcoal precursors due to their high carbon concentration, minimal mineral content, and high permeability. However, due to the associated environmental and economical difficulties, there is a growing interest in research to develop inexpensive waste from biomass feedstock, as well as inexpensive technologies for Activated Charcoal synthesis. Industrial and agricultural waste, especially in underdeveloped nations, hold enormous promise as raw materials for the manufacturing of Activated Charcoal. This is because they are widely available, cheap, and carbonaceous.

Freshwater reserves are the foundation of all life on Earth. Climate change and poor hydrological management have resulted in a significant decrease in readily available water. Long-term and frequent droughts can diminish stream and river flows and levels, significantly increasing the concentration of polluting chemicals in both surface and subsurface water. Furthermore, industrial effluents and intensive agriculture are sources of pollution that contribute to the poor condition of accessible water resources. In practice, natural water resources, particularly surface waters, are contaminated with a wide range of chemicals, metals, suspended debris, nutrients (nitrogen and phosphorus), pathogens, pesticides, and herbicides. Water pollution from these pollutants is a well-known major environmental issue with negative impacts on human and animal health.

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The quantity of effluent in water bodies has been exceeded due to growing industrial activity. Untreated wastewater discharge into bodies of water has significantly increased environmental risks, which is a serious concern. If lead particles are inhaled for an extended period of time and extra dangers, such as disposing of old lead acid batteries in water, are considered, the risk of liver cancer may increase even more. According to the literature review, studies on cheap production of Activated Charcoal for the removal of pollutants from the environment have been undertaken in the whole world.

Activated carbon is a word that refers to carbon-based materials that have a well-developed internal pore structure. AC is made from carbonaceous resources such as wood, coal, lignite, and coconut shell. The substantial surface area, large porosity, well-developed inner pore structure consisting of micro-, meso-, and macropores, and a broad range of functional groups available on the surface of AC make it an ideal material with numerous applications in many fields, most notably the environmental field. There are several studies available on Activated Charcoal derived from waste plastic for liquid phase treatment. Activated carbon (AC) has long been recognized as a popular and widely used adsorbent in the treatment of water and wastewater. The forerunner of modern activated carbon, charcoal, is the earliest known adsorbent in water purification.

There are three types of Activated Carbon mainly, Granular Activated Carbon, which has odd-shaped particles with diameters ranging from 0.2 to 5 mm and is employed in liquid and gas phase applications. Powder Activated Carbon is ground up coal with a predominant particle size of less than 0.18 mm. It is primarily employed in liquid phase applications and in the treatment of flue gases. In addition, pelleted activated carbon is homogenized using a hot extrusion process having roughly a diameter of 4 mm. Because of their minimal pressure drop, excellent mechanical strength, and low dust content, they are typically used in gas phase applications.

Multiple studies have demonstrated that porous carbon adsorbents produced from PET waste via carbonization and then chemical activation with KOH at different temperatures are extremely effective for adsorption of CO_2. Furthermore, the direct extraction of terephthalic acid from PET has no detrimental consequences, making PET an attractive candidate for up-cycling for CO_2 adsorption. Some fruits peels have also been discovered to be an excellent adsorbent for wastewater treatment, such as the removal of heavy metals and other organisms that alter the natural qualities of the water. Various adsorption parameters for Activated Charcoal generated from waste materials (Guinea Corn stem carbon, Maize cob carbon, used tyre carbon, coconut shell carbon) demonstrated that these are good adsorbents. The use of low-cost organic materials to make Activated Charcoal for wastewater treatment will be a better option than the expensive method, and by combining organic waste and waste plastic to prepare low-cost Activated Charcoal, organic waste stress in landfills might be reduced. It is the most effective approach to recycle waste plastic and lessen its impact on the environment. It would result in a more cost-effective and environmentally friendly method of adsorption.

Plastic trash has become a huge environmental issue; it is a main cause to worry because it is non-biodegradable and hence has a negative impact on the environment and living organisms. Not just plastic waste, but also industrial waste, pollutes the environment on a large scale. Dangerous contaminants, heavy metals, and deadly colours are present in these industrial wastes. As a result, it has a substantial environmental impact. As a result, these contaminated or dangerous materials must be eliminated before disposing of wastewater. Because of its high adsorbent capacity, activated carbon is commonly employed in water treatment. This chemical is widely used around the world for wastewater treatment, drinking water purification, gas purification, and as a catalyst support. Activated carbon is also commonly utilized in wastewater treatment. Activated carbon is typically made from lignocellulosic materials such as wood, coconut husks, rice, sugarcane bagasse, and others, and it has a vast porosity development that makes it one of the most adaptable adsorbents ever employed. However, due to its great effectiveness, adsorption with activated carbon is acknowledged as the best control technology for water treatment, therefore water purification is its primary use. The production of low-cost organic materials to produce cost-effective Activated Charcoal will be a superior alternative to the expensive method of treating drinking water, and the burden on waste dumps from biological waste may be decreased through merging organic waste with waste plastic for the manufacturing of Activated Charcoal. It is the most effective way to recycle waste plastic and reduce its environmental impact. It would result in a cost-effective, environmentally friendly adsorption process.

Conclusion

Despite the fact that many studies have been conducted recently to derive Activated Charcoal from plastic and organic wastes in order to reduce costs, no attempt has been made to obtain a

comparative overview of Activated Charcoal prepared from the combination of plastic and organic waste and other organic and biomass derived Activated Charcoal in terms of adsorption capacity, removal performance, and cost-effectiveness. Powdered activated carbon and granular activated carbon are the most commonly employed for wastewater treatment or making water drinkable, mostly for the removal of low molecular weight molecules. However, poor intra-particular diffusion in granular adsorbents, is one of the issues encountered in the application of adsorption methods to water treatment. Powder, on the other hand, has faster adsorption rates, but its difficulties in handling limits its commercial application.

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