

Organic Materials the Effective Source for Activated Carbon Preparation and Applications of Prepared Activated Carbon in Water and Wastewater Treatment - A State of Art

Sagar M. Gawande¹, Anuja A Mane², Niharika S Belwalkar³

¹Professor, Anantrao Pawar College of Engineering and Research, Parvati (Savitribai Phule Pune University) Pune, India

^{2,3}Anantrao Pawar College of Engineering and Research, Parvati (Savitribai Phule Pune University), Pune, 411009, India

Abstract: Activated carbon is used to remove contaminants onto the surface of a filter. This method is effective in removal of particular organics from raw water as well as wastewater. The efficiency of activated carbon is depends on the nature of activated carbon used, constituents in water bodies, and application methods with operating parameters. There are activated carbon filters that can be designed for household, community and industry requirements. Activated carbon is prepared from various materials and it is used in removal of various contaminants from wastewater. The current paper discuss about the existing and new advancements in the activation and carbon technology and their applications in water and wastewater treatments.

Keywords: wastewater, activated carbon preparation, wastewater treatment, its efficiency

1. Introduction

The use of carbon has been used for many applications. For the preparation of activated carbon Charred wood, bones and coconut charcoal were used. Activated carbon is a material prepared having high degree of porosity and an extended surface area. During water filtration through activated carbon, contaminants adhere to the surface of these carbon granules or become trapped in the small pores of the activated carbon. This process is called adsorption. Activated carbon filters are efficient to remove unwanted taste and odours, micro-pollutants, chlorine, fluorine or radon, from drinking water or wastewater. Activated carbon filtration is commonly used at household level, to produce drinking water and in industries to treat effluents. It is also applied for the removal of micro-pollutants both in drinking water production and for the purification of treated wastewater before disposal. Activated carbon filters are widely used to treat industrial or municipal wastewaters. It is not efficient for disinfection and nitrates removal. Adsorption on activated carbon is a simple technology. It is based on materials such as fossil fuels and even agricultural waste (e.g. coconut shell, wood, etc.). To choose the most applicable type of activated carbon for a given application it is important to analyse the composition of the influent water previously.

2. Materials and Methodology

2.1 Preparation of Activated Carbon

The material for an activated carbon filter is typically petroleum coke, bituminous coal, lignite, wood products, coconut shell or peanut shell. The carbon medium is "activated" by subjecting it to a gas like water, argon or nitrogen and high temperature (800-1000°C) usually without oxygen. In sometimes the carbon may also undergo an acidic

wash or be coated with a compound to enhance the removal of specific contaminants from wastewater. Many pores and a high specific surface area produces in activation process. It is then crushed to form a granular or pulverised carbon product.^[10]

Vadivel Sivakumar, Manickam Asaithambi and Ponnusamy Sivakumar were examined the use of modified activated carbon derived from the seeds of available plant source of *Martynia annua* L and *Xanthium strumarium*. A series of activated carbon samples were prepared by subjecting the materials to various chemical processes. Adsorption studied with prepared activated carbon samples from batch tests.^[1]

Alau Kenneth K., Gimba Casimir E., Agbaji B. E. and Abechi Steven E studied to evaluate the adsorptive capacity of the neem (*Azadirachta indica*) seed and husk on hospital waste water. Neem seeds and husk activated with $ZnCl_2$ and H_3PO_4 . The wastewater was pass through the adsorbents bed. The filtrates were analyzed to determine the amount of components that have been adsorbed. The finding shows that the adsorbents had an excellent adsorption of nitrites (99.7%), chloride (100%) and phosphate (95%).^[2]

G. D. Akpen, I. L. Nwaogazie and T.G. Leton studied that Activated carbons (AC) were produced from seed shells of two varieties of mango (Local & Dausha varieties). Varying the impregnation ratio of the shells (impregnation ratios of 1:2 and 1:3 were used) with $ZnCl_2$ before carbonization is done. Their performance was evaluated through batch studies for the removal of colour (methylene blue) from wastewater.^[3]

Xiao-Juan Jin and Yue Mei Zhu studied that Preparation of activated carbons from wood fiber board waste which was nitrogen-enriched. Activated carbons were obtained with an impregnation ratio of 3 with 50 % potassium carbonate

solution in 800°C activation temperature carbonized for 1h. Optimum adsorption conditions were determined.^[4]

I.A.W. Tan, A.L. Ahmad, B.H. Hameed studied Activated carbon was prepared from coconut husk using physicochemical activation method. It consist of potassium hydroxide (KOH) treatment and carbon dioxide (CO₂) gasification. The effects of CO₂ activation temperature, CO₂ activation time and KOH: char impregnation ratio on the 2,4,6-trichlorophenol (2,4,6-TCP) uptake and activated carbon yield were investigated.^[5]

Mervette. El Batouti, Abdel-Moneim M. Ahmed studied The batch adsorption of Ni(II) onto activated carbon which was prepared from an agriculture applies to analyze adsorption data and were found to be applicable to these adsorption process. The reaction was effect of initial concentrations, adsorption dose, contact time and pH dependent .The latter to control efficiency of nickel removal was found. The adsorption kinetics of rice husk has been studied.^[6]

Chethana Krishna P studied that Cocoa pod husk represents between 70 to 75 % of the whole weight of the cocoa fruit. During activation, it creates millions of pores at the surface of the carbon thus increasing the total surface area. Results of the experiments show that cocoa pod husk is a material that can be used to produce activated carbon by chemical activation. ZnCl₂ showed to be the best chemical activation agent based on the highest BET surface area (780 m²/g in the best case) and pore volume (0.58 m³/g in the best case).^[7]

S. L. Pandharipandea, Y. D. Urunkarb, Ankit Singh The objective of the present work is to utilize waste materials like rice husk, saw dust & sugarcane baggasse by converting them into adsorbent and their comparative study for removal of colour agents from aqueous solution.^[8]

S. Tangjuank, N. Insuk , V. Udeye and J. Tontrakoon studied that Activated carbon prepared from cashew nut shells using potassium hydroxide which is activated at 850°C in N₂ and CO₂ atmosphere was used as an adsorbent. That activated carbon used for the removal of chromium ions from aqueous solutions. The adsorption of Cr(III) ions was studied. pH of initial concentration of Cr(III) solutions, contact time, dosage of adsorbent and initial concentration of Cr(III) solutions was investigated.^[9]

3. Conclusion

Activated carbon is easily prepared from various organic materials. This organic materials were easily available in the environment and having low cost. Carbon filters are relatively easy to install and maintain. The filter material need a backwash after some interval. Activated carbon is more effective in wastewater treatment and having good efficiency to remove various pollutants.

References

[1] Physico-chemical and adsorption studies of activated carbon from Agricultural wastes Vadivel Sivakumar*1, Manickam Asaithambi2 and Ponnusamy Sivakumar3 1Department of Chemistry, Sri Vasavi

College, Erode, TN, India 2Department of Chemistry, Erode Arts and Science College, Erode, TN, India 3Department of Chemistry, Arignar Anna Arts College, Namakkal , TN, India

[2] Removal of nitrite, chloride and phosphate ions from hospital wastewater using Neem (Azadirachta Indica) activated carbon *Alau Kenneth K., Gimba Casimir E., Agbaji B. E. and Abechi Steven E. Department of Chemistry, Ahmadu Bello University, Zaria, Nigeri

[3] Optimum conditions for the removal of colour from waste water by mango seed shell based activated carbon G. D. Akpen1, I. L. Nwaogazie2 and T.G. Leton2 1Department of Civil Engineering, University of Agriculture, Makurdi, Nigeria 2Department of Civil and Environmental Engineering, University of Port Harcourt, Port Harcourt, Nigeria

[4] Absorption of Phenol on Nitrogen-Enriched Activated Carbon from Wood Fiberboard Waste with Chemical Activation by Potassium Carbonate Xiao-Juan Jin* and Yue Mei Zhu MOE Key Laboratory of Wooden Material Science and Application, Beijing Key Laboratory of Lignocellulosic Chemistry, MOE Engineering Research Center of Forestry Biomass Materials and Bioener, Beijing Forestry University, Beijing, China

[5] Preparation of activated carbon from coconut husk: Optimization study on removal of 2,4,6-trichlorophenol using response surface methodology I.A.W. Tan, A.L. Ahmad, B.H. Hameed* School of Chemical Engineering, Universiti Sains Malaysia, Engineering Campus, 14300 Nibong Tebal, Penang, Malaysia Received 17 July 2007; received in revised form 30 August 2007; accepted 3 September 2007 Available online 6 September 2007

[6] Adsorption Kinetics Of Nickel (II) Onto Activated Carbon Prepared From Natural Adsorbent Rice Husk. Mervette. El Batouti, Abdel-Moneim M. Ahmed Chemistry Department, Faculty of Science, Alexandria University

[7] A REASERCH ON COCOA POD HUSK ACTIVATED CARBON FOR TEXTILE INDUSTRIAL WASTEWATER COLOUR REMOVAL Chethana Krishna P1 1Student, Department of Civil Engineering, Malnad College of Engineering Hassan, Karnataka, India

[8] CHARACTERIZATION AND ADSORPTION STUDIES OF ACTIVATED CARBON PREPARED FROM RICE HUSK, SUGARCANE BAGGASSE AND SAW DUST S.L.Pandharipandea, Y.D.Urunkarb, AnkitSinghc a Associate Professor, c- M.Tech Fourth semester, Department of Chemical Engineering, Laxminarayan Institute of Technology, Rashtasat TukdojiMaharaj Nagpur University, Bharat Nagar, Amravati Road, Nagpur,India. b- Assistant Professor, Department of Chemical Engineering, TatyasahebKore Institute of Engineering and Technology, Warananagar, India

[9] Chromium (III) sorption from aqueous solutions using activated carbon prepared from cashew nut shells S. Tangjuank1*, N. Insuk1, V. Udeye2 and J. Tontrakoon 3 1Program of Science, Faculty of Science and Technology, Uttaradit Rajabhat University, Uttaradit, 53000, Thailand. 2Department of Chemistry, Faculty of

Science, Naresuan University, Phitsanulok, 65000,
Thailand. 3Department of Physics, Faculty of Science,
Chiang Mai University, Chiang Mai, 50200, Thailand.

[10] <http://www.sswm.info/content/adsorptionactivatedcarbon>.

