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**PhD Title: Studies on the development of selected carbon based materials and their application in water treatment**

**ABSTRACT**

Trace organic pollutants are emerging as a serious source of water pollution in recent times. Conventional methods of waste water treatment are unable to effectively remove these pollutants from water. Thus alternative methods of water purification have to be investigated. For the present study, four chemicals were selected as the target pollutant namely three pharmaceuticals Carbamazepine (CBZ), Naproxen (NPX) and Rantidine (RTN) and one plasticizer Bisphenol A (BPA). Firstly the process of adsorption was investigated. Graphene Oxide (GO) was considered to be one of the adsorbents due to its very high surface area, presence of functional groups on its surface, mechanical and chemical stability etc. Other than GO, an activated biochar, synthesized from rice straw and activated by Hummer's method were also used as an adsorbent. The activated biochar was named Activated Rice Straw Biochar (ARSB) and was considered to be a cheaper alternative of GO. Then, the process of photo-catalysis was also investigated with the aim of degrading the pollutants into benign end products.  $TiO_2$  was selected as the semiconductor for photo-catalysis due to its chemical stability, non-toxic nature and relative ease of availability. Then it was combined with the adsorbents GO and ARSB by a solvo-thermal method. The synthesized materials were characterized by different methods. The removal efficacies of the synthesized materials were investigated over a range of experimental parameters by virtue of batch studies and the process was further optimized by the Response Surface Methodology (RSM) study. The ability of the synthesized materials to remove the targeted contaminants by adsorption under a dynamic condition was investigated by a rotating packed bed (RPB) study. The process of Fenton oxidation was also utilized for removing the pollutants followed by adsorption with GO. From the result of the experiment it was observed that all the investigated methods were able to remove significant amounts of the targeted contaminants from there aquatic solution, some exhibiting more efficiency than the other. Lastly, the different water treatment techniques investigated so far was tested for the purpose of treating real waste water. Water sample was collected from two places, a lake in India with high pollutant load and effluent from an industry in south Kolkata, West Bengal. For the lake water, Fenton oxidation followed by adsorption with GO was most effective for reducing the Chemical Oxygen Demand (COD) whereas for the industrial effluent adsorption with GO was able to reduce the COD of the industrial effluent by the highest degree. Overall, in terms of treating real water, the effectivity of the different treatment processes varied, but still some techniques showed enough efficiency to be considered for future research.


  
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