

## **BTEX Removal from Water: A Comparative Analysis of Efficiency of Low Cost Adsorbents and Granular Activated Carbon**

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**Abstract :** The removal of BTEX (Benzene, toluene, Ethylbenzene and p-Xylene) from water by orange peel and eggshell compared to GAC were investigated. The influence of various factors such as contact time, dosage and pH on BTEX removal by virgin orange peel and egg shell were accessed using the batch adsorption set-up. These were also compared to that of GAC which serves as a benchmark for this study. Further modification (preparation of Activated carbon) of these virgin low-cost adsorbents was also carried out. The batch adsorption result showed that the optimum contact time, dosage and pH for BTEX removal by virgin LCAs were 180 minutes, 0.5g and 7 and that of GAC was 30mintues, 0.2g and 7. The maximum adsorption capacity for total BTEX showed by orange peel and egg shell were 42mg/g and 59mg/g respectively while that of GAC was 864mg/g. The adsorbent preference for adsorbate were in order of X>E>T>B. A comparison of batch and column set-up showed that the batch set-up was more efficient than the column set-up. The isotherm data for the virgin LCA and GAC prove to fit the Freundlich isotherm better than the Langmuir model, which produced n values >1 in case of GAC and n< 1 in case of virgin LCAs; indicating a more appropriate adsorption of BTEX onto the GAC. The adsorption kinetics for the three studied adsorbents were described well by the pseudo-second order, suggesting chemisorption as the rate limiting step. This was further confirmed by desorption study, as low levels of BTEX (<10%) were recovered from the spent adsorbents especially for GAC (<3%). Further activation of the LCAs which was compared to the virgin LCAs, revealed that the virgin LCAs had minor higher adsorption capacity than the activated LCAs. Economic analysis revealed that the total cost required to clean-up 9,600m<sup>3</sup> of BTEX contaminated water using LCA was just 2.8% lesser than GAC, a difference which could be considered negligible. However, this area still requires a more detailed cost-benefit analysis, and if similar conclusions are reached; a low-cost adsorbent, easy to obtain are still promising adsorbents for BTEX removal from aqueous solution; however, the GAC are still more superior to these materials.

**Keywords :** activated carbon, BTEX removal, low cost adsorbents, water treatment

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