

# Unmodified, and Iron and Magnesium Modified Biochars Derived from Coconut Shells for Phosphate Removal from Water

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Biochar is a low-cost material that can be used as an adsorbent to remediate contaminated water. Generally, the surface of biochar is negatively charged, which restricts its affinity for phosphate anion adsorption. In this study, biochar was produced by pyrolyzing coconut shells at 400 °C and modified with iron (Fe) and magnesium (Mg) to remove phosphate from water. To evaluate the performance of Fe- and Mg-modified biochar on phosphate removal from water, batch adsorption tests were conducted. The optimum time, dosage, and pH for phosphate adsorption were determined for both unmodified and modified biochars. The pH of the unmodified and modified biochars were 7.35 and 3.66, respectively. The Electrical conductivity of the unmodified biochar was 900  $\mu\text{S cm}^{-1}$  while that of the modified biochar was 600  $\mu\text{S cm}^{-1}$ . The overall effect of modified biochar materials on phosphate adsorption was significantly higher than that of unmodified biochar materials ( $P < 0.05$ ). When the modified biochar dose reached 10 g/L, the phosphate removal efficiency increased to a maximum of 97.80%. Modified biochar exhibits 72.14% adsorption after 10 minutes and then increased to a maximum of 81.89% after one hour. Hence, the optimum time period for the adsorption of modified biochar is one hour. The phosphate adsorption capacity of modified biochar was unaffected by pH. But at pH 9, unmodified biochar samples exhibited a small increase in phosphate adsorption. According to these findings, it can be concluded that Fe- and Mg-modified biochar can be used as a low-cost adsorbent to remediate eutrophic water.

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