

Enhanced Removal of Nitrate from Water using Amine-grafted Corncob

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Increasing level of nitrates poses threat to human health and the aquatic environment. Among the nitrate removal technologies, adsorption is an attractive method because of its cost-effectiveness. The objective of the study is to investigate the nitrate removal from representative synthetic water containing nitrate using low-cost amine grafted (AG) corncob (particle size of 300-600 μm). Synthetic water was used as feed with the nitrate concentration (as N) in the of 20 mg N/L. Modified corn cobs were packed in adsorption columns and the filtration velocity was maintained at 5 m/h. The corn cobs were found to adsorb nitrate content from feedwater. It was confirmed by the Energy Dispersive X-ray Spectrometry data which showed an increased N content in the corn cobs from 94 to 141 mg/g after amine modification. The unmodified corn cob and had a zero point of charge (ZPC) of a pH 3.0 whereas it had ZPC greater than pH 8.5 after AG. The breakthrough curves for the unmodified adsorbent reached the adsorption saturation faster (2 h for the corn cob) than the those of AG adsorbent (12 h for AG corn cob). The regeneration of the adsorbent was carried out by leaching the adsorbed nitrate from the bed using 1 M KCl solution to desorb the nitrate from the adsorbents and determine whether the adsorbents can be reused. Four adsorption-desorption cycles confirmed that the 94-100% of the adsorbed nitrate was desorbed. Therefore, it can be concluded that the AG adsorbent was effective for removing nitrate from representative synthetic water containing nitrate. The exhausted adsorbent can be used as fertilizer and the nitrate in the desorbed solution which can be used in fertigation to supply nitrogen to plants. The potassium in the desorbed solution will also benefit plants.

Keywords: Nitrate, Agricultural Waste, Adsorption, Reuse