Removal of chromium(VI) from waste water by using adsorbent prepared from green coconut shell

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ABSTRACT

In recent years, industrial effluents containing heavy metals have become a major problem. For the removal of heavy metals, several types of adsorbents have been developed economically from waste materials by different processes. In present work, “Green Coconut Shell,” which is waste material, was chosen for the development of adsorbent by treatment with orthophosphoric acid economically. This adsorbent was used for the removal of chromium (VI) in batch mode in concentration and temperature range of 10–100 mg/g and 10–80°C, respectively. The influence of contact time, temperature, concentration, adsorbent dose, particle size, and pH was studied. Langmuir and Freundlich isotherm models were fitted for equilibrium data with maximum adsorption capacity of 22.96 mg/g. Pseudo-second-order model also confirmed that the chromium(VI) uptake capacity of adsorbent was due to pore, film, and particle diffusion. To know the properties of adsorbent different analysis such as XRF, X-ray diffraction, scanning electron microscope, energy dispersive spectroscopy, and particle size distribution using Malvern analyzer were studied. The adsorption capacity of green coconut shell-based adsorbent achieved was greater than 90% for 10 mg/l solution and contact time of 30 min.

Keywords: Green coconut shell; Orthophosphoric acid; Adsorption; Concentration; Chemical activation; Hexavalent; Contact time

1. Introduction

The problems of the ecosystem are increasing with developing technology. Heavy metals pollution is one of the major problems. Therefore, the earth's water may contain various toxic metals. Drinking water is obtained from springs which may be contaminated by various toxic metals. The water contamination with heavy metal ions is a very severe problem all over the World [1–2]. So the motto of the present study was to develop the adsorbent from “Green Coconut Shell” economically, which should have best efficiency towards the removal of heavy metals from industrial effluent. The effect of various parameters that affect adsorption viz. Contact time, initial concentration, particle size, temperature, pH, and adsorbent dose were performed in batch experiment. To know the heavy metals