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Editorial

Removal of Chromium Ions from Drinking Water Using an Ultrafiltration Membrane

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EDITORIAL NOTE

The goal of this study was to see how effective a locally created Polyacrylonitrile (PAN) based Ultrafiltration (UF) membrane was at removing chromium ions from drinkable water. The hydrolyzed PAN membranes successfully rejected chromium ions in solution in the feed at concentrations ranging from 250 ppb to 400 ppm, with a rejection of 90% for pH 7 at low chromate concentrations (25 ppm) in feed. The Donnan exclusion principle was found to be very important in the rejection of chromium ions, whereas the size exclusion principle did not play a significant impact in the rejection of UF ions. The pH of the feed controlled the porosity of the membrane, which impacted the chromate ion retention behavior.

At low feed concentrations, cross-flow velocity and pressure had little effect on ions rejection. Concentration polarization became critical at higher feed concentrations (400 ppm) and lowered chromate rejection to 32% at low cross flow and high pressure. Using optimal model parameters, the Donnan Steric-Partitioning Model and Dielectric Exclusion Model (DSPM-DE) was used to analyses chromate ions transport *via* PAN UF membrane as a function of flux, and the estimated model corresponded well with results obtained. Researchers have always been interested in developing effective and cost-effective methods for removing chromium from drinking water and wastewater. Chromium is an essential component that ranks sixth in terms of availability in the earth's crust and is one of the fourteen most toxic heavy metals. In general, Cr (VI) and Cr (III) predominate in our environment, with chromate ions dominating in oxidizing conditions and chromite ions dominating in reducing ones. Because most surface waters and water streams are well aerated, chromium occurs as Cr (VI); yet, because ground water is more reducing due to less aeration, chromium exists as Cr (III). Because they are extremely soluble and mobile in eco systems, chromium (VI) ions are known to be highly hazardous when compared to other types of chromium salts. The Environmental Protection Agency (EPA) also found greater chromate ion concentrations in aquatic streams in various parts of the United States, Nepal, Indonesia, and India. Furthermore, the Central Pollution Control Board of India (CPCBI) observed chromate ion contamination in water streams that was 250 times greater than WHO acceptable levels.

Long-term exposure to chromate ions causes skin allergies and has been linked to cancer in living organisms4. Because of its vast industrial applications, chromate ion has become one of the most prevalent components in aquatic environments. Precipitation and reduction, ion exchange, or adsorption procedures are the most prevalent methods for separating chromium ions, and all of these methods have drawbacks such as low separation efficiency, high energy needs, and the formation of toxic sludge. Many researchers have recently looked at chromate ions (Cr (VI)) removal using adsorption and other approaches.

For the first time, the rejection of chromate ions from drinkable water was examined using an indigenously designed PAN-based ultrafiltration membrane. The morphological properties of the surface modified PAN UF membrane, as well as its rejection efficiency, were compared to those of the nanofiltration membrane. The DSPM-DE model was used to investigate the transport of chromate ions over a surface modified PAN ultrafiltration membrane in order to better understand the link between membrane characteristics, solutes, and their interactions.

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