Adsorption of N-Nitrosodimethylamine onto Activated Carbons from Pecan Shells and Soft Wood Barks

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Background/Objectives. N-Nitrosodimethylamine (NDMA) is a probable human carcinogen contaminating groundwater and drinking water. Some states in the U.S. limit the concentration of NDMA in water to the low part per trillion (ng/L) range. Current treatment for NDMA in contaminated groundwater is UV photolysis, an expensive and energy-intensive process for large-volume and long-term treatment applications. The objective of this work is to evaluate the feasibility of using chars and activated carbons produced from locally-available agricultural/forest residues to adsorb NDMA at treatment-relevant concentrations.

Approach/Activities. Chars and activated carbons were produced from locally-sourced pecan shells, pine bark, and Douglas fir bark using a range of pyrolysis temperatures (400-900°C) and activation treatments including potassium carbonate impregnation. Equilibrium adsorption isotherms of NDMA onto the prepared adsorbents were acquired using ^{14}C-labeled NDMA, 48-hour exposure times in water, and NDMA concentrations ranging from 5 to 10,000 ppt (ng/L). Liquid scintillation counting was used to quantify NDMA concentrations before and after exposure. Adsorption capacities were compared to that of a commercially-available coconut shell-derived activated carbon used for removal of organic contaminants from water.

Results/Lessons Learned. All biomass-derived treatment methods reduced the NDMA concentration in the water samples. Pecan shell adsorption results showed that K_2CO_3 activation at temperatures greater than 800°C achieved levels of adsorption closest to the commercial activated carbon.