

Plasma treated Spanish Broom cellulose fiber for the removal of petroleum hydrocarbons from polluted water

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In recent decades, due to rapid industrialization, organic pollutants released into the environment, such as total petroleum hydrocarbons (TPHs) and other hydrophobic organic compounds (HOCs) have increased significantly, causing severe effects on marine flora and fauna and, subsequently, on human health, due to their strong tendency for bioaccumulation in the food chain. Most of the existing technologies for the treatment and removal of this type of pollutants from water reservoirs are ineffective, not easy to implement and very expensive especially when the hydrocarbon concentration is very high (above 100 mg/L).

The present work shows a novel approach for the remediation of hydrocarbon polluted water by using Spanish Broom (SB) cellulose fiber treated in fluorinated plasmas. Fluorine functionalization turned the fiber into super-hydrophobic, thus improving its affinity towards water dispersed hydrocarbons.

Batch experiments were performed with the aim of studying kinetic and thermodynamic aspects of the adsorption process, as a function of the initial total hydrocarbon load and of the adsorbent amount. The kinetics data showed that the fiber removal efficiency ranged between 80-90% after one minute of contact time, in dependence of the initial hydrocarbon/fiber weight ratio (20-240 mg/g). A maximum adsorption capacity larger than 270 mg/g was estimated, thus demonstrating that the functionalized fiber is capable to perform a significant hydrocarbons removal action if compared to other cellulosic materials reported in the literature.