Use of recycled tires crumb rubber to remove organic contaminants from aqueous and gaseous phases

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ABSTRACT

Tire crumb rubber (TCR) was used to remove poly-aromatic hydrocarbons (acenaphthene and phenanthrene) and gasoline components in aqueous phase and toluene in gaseous phase. The initial concentrations were below the solubility of each contaminant. To better understand the role of the main components of TCR, the removal was also evaluated using carbon black (CB) and styrene-butadiene polymer (SBP). The Scatchard plots suggested multiple interactions between adsorbates and TCR, whereas a single interaction became evident for CB and SBP. The removal of gasoline components, and toluene and o-xylene in gasoline was evaluated using total ion current mode and selective ion monitoring mode, respectively. A gas chromatographer was modified to evaluate the removal of gaseous toluene. Toluene was injected at a rate of 30 μL/h. The isotherm was elaborated using pressures between 2.5 and 40 psi. The maximum uptake capacities (K_f) for TCR calculated from Freundlich’s equation for acenaphthene and phenanthrene were 3.32 and 54.6 mg/g, respectively; for total gasoline, toluene and xylene in gasoline were 4.0, 0.55 and 1.87 mg/g, respectively; and for gaseous toluene was 0.54 ± 0.04 mg/g. Its proven sorption capacity and low cost make TCR a promising sorbent for organic contaminants in aqueous and gaseous phases.

Keywords: Waste tire; Crumb rubber; Sorption; Recycling; Water treatment; Scatchard plot

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