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Removal of organobromides from water using spent coffee grounds (SCG)

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Coffee is considered the most popular beverage in the world. However, this results to the production of million tons of relevant wastes, i.e. plastic cups, aluminium capsules (Nespresso) and spent coffee grounds (SCG), all thrown untreated in landfills. It is estimated that 1 kg of instant coffee generates around 2 kg of wet SCG; a relatively unique organic waste stream, with little to no contamination, that is collected separately to other waste in containers next to the espresso machines. SCG are considered a valuable, rich source of bioactive compounds (e.g. phenolics, flavonoids, carotenoids, chlorogenic and protocatechuic acid, melanoidins, diterpenes, xanthines, vitamin precursors, etc.) and a useful resource material for a variety of other applications (e.g. soil improver and compost, heavy metals remover, biochar, biodiesel, pellets, health care, food and deodorization product). The use of SCG as a low-cost sorbent for the biosorption of heavy metals and organic compounds from aqueous solutions has also been investigated. In this study, the kinetics of removal of bromine derivatives of alkanes such as 2-bromobutane and 2-bromo-2-methylpropane in distilled water (1D) using espresso coffee residues as the sorbent material were studied. Organobromides or organobromines are organic compounds that contain carbon bonded to bromine. Most organobromine compounds, like most organohalide compounds, are relatively nonpolar. Bromine is more electronegative than carbon (2.8 vs 2.5). Consequently, the carbon in a carbon–bromine bond is electrophilic. Batch tests were employed to study the removal kinetics using different organic compounds [2-bromo-2-methylpropane (logPoct/wat= 2.53), 2-bromobutane (logPoct/wat= 2.65)]. The initial concentration of each single-compound solution was 100 μg/L, the mass of the sorbent was 3 mg, and the volume of the solution was 15 mL in 20 mL vials. Since these compounds are relatively volatile, we analyzed our samples with the headspace technique using GC-ECD Agilent 6890. Our samples included a blank sample with the organic compound solution only and a sample with the organic compound solution and the sorbent. The 1st order rate constant (k) and the half-life time for each compound were calculated in order to determine the compound with the fastest kinetics. According to theoretical calculations, the kinetics of this removal is affected by the solubility of the organic compound in the water. For the least soluble compound 2-bromo-2-methylpropane- the kinetics in our study were the fastest (logPoct/wat= 2.53) k=0.020 min-1 and for the 2-bromobutane (logPoct/wat= 2.65) k=0.018 min-1.

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