Geophysical Research Abstracts
Vol. 19, EGU2017-494, 2017
EGU General Assembly 2017

Biochars made from agro-industrial by-products remove chlorine from water and wastewater

Andreas Tzachristas (1), Ioannis D. Manariotis (2), and Hrissi K. Karapanagioti (1)

(1) Department of Chemistry, University of Patras, 26504, Patras, Greece, (2) Department of Civil Engineering, University of Patras, 26504, Patras, Greece

Chlorination is the most common disinfection process for water and wastewater. For the industrial use of water in food production, chlorine can add undesired taste and odor to the final product. For this reason, dechlorination is desired for food industries that use municipal tap water. For treated wastewater discharge or reuse, chlorine can be toxic to the receiving aqueous systems and to the irrigated plants. In both the above cases, dechlorination is also required. Traditionally activated carbon has been used as the ideal material for the removal of chlorine. The main mechanisms that describe the interaction between activated carbon and HOCl or OCl- are described by the following equations (AWWA, 1990): HOCl + C* → C*O + H+ + Cl- (1), OCl- + C* → C*O + Cl- (2) Where C* and C*O represent the activated carbon surface and a surface oxide, respectively. The present study proposes the use of agro-industrial by-products for the production of biochars that will be used for dechlorination of tap-water used for food-industry production. Different raw materials such as malt spent rootlets, coffee residue, olive and grape seeds, etc. are used for the production of biochar. Various temperatures and air-to-solid ratios are tested for optimizing biochar production. Batch tests as well as a column test are employed to study the dechlorination kinetics of the different raw and biochar materials as well as those of commercial activated carbons. The removal kinetics are faster during the first hour; then, removal continues but with a slower rate. Most of the biochars tested (with 3 mg of solid in 20 mL of chlorine solution at initial concentration Co=1.5 mg/L) demonstrated removal efficiencies with an average of 9.4 ± 0.5 mg/g. For the two commercial activated carbons, removal efficiencies were 11.4 ± 0.2 mg/g. The first-order constant k1 ranged between 0.001 and 0.014 (min-1) for the biosorbents and the biochars and it was equal to 0.017 (min-1) for the commercial activated carbons. Consequently, the half-life time ranged between 50 and 700 (min) for the biosorbents and the biochars and it was equal to 41 (min) for the commercial activated carbons. The column experiment also showed positive results; A breakthrough for concentrations higher than 10(AWWA) 1990 Water quality and treatment, a handbook of community water supplies, Fourth edition, American Water Works Association Fourth edition.