



Closed hydroponic systems: a kinetic study for the adsorption of root exudates on GAC and SMC

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ABSTRACT

The present study deals with the characterization of reused nutrient solution (RNS) from a lettuce hydroponic company. Chemical analysis with GC-MS revealed the presence of eleven individual organic acids as a part of root exudates (acetic, acrylic, maleic, succinic, benzoic, phthalic, sebacic, myristic, palmitic, oleic and stearic acid). Based on these results, batch experiments were developed to determine the breakthrough time and the best kinetic model for adsorption of benzoic acid (as an indicator of these 11 organic acids) on two different types of carbon based adsorbents (GAC and SMC). The study revealed that SMC as a novel ordered mesoporous carbon is a promising alternative for the commercial GAC with regard to RNS recovery, leading to a higher quality and productivity. Pseudo first order, pseudo second order, intraparticle diffusion and Elovich models were employed to the experimental data to evaluate the adsorption kinetics. The pseudo-second-order kinetic model best represented the experimental data for both adsorbents at all dosages, exhibiting high linear correlation coefficients ($R^2 \geq 0.98$).

Keywords: closed hydroponics, root exudates, water treatment, sustainability, granular activated carbon (GAC).