



Removal of micropollutants and nutrients in household wastewater using organic and inorganic sorbents

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ABSTRACT

The efficiency of five organic and five inorganic sorbents in removing 19 organic micropollutants (MPs), phosphorus, nitrogen, and dissolved organic carbon (DOC) was tested in a two-week column experiment using household wastewater spiked with pharmaceuticals ($n = 6$), biocides/pesticides ($n = 4$), organophosphates ($n = 3$), a fragrance, a UV-stabilizer, a food additive, a rubber additive, a plasticizer and a surfactant. Two types of granular activated carbon (GAC), two types of lignite, a pine bark product, and five mineral-based sorbents were tested. All the organic sorbents except pine bark achieved better removal efficiencies of DOC (on average, $70 \pm 27\%$) and MPs ($93 \pm 11\%$) than the inorganic materials (DOC: $44 \pm 7\%$ and MPs: $66 \pm 38\%$). However, the organic sorbents (i.e. GAC and xyloid lignite) removed less phosphorus ($46 \pm 18\%$), while sorbents with a high calcium or iron content (i.e. Polonite[®] and lignite) generally removed phosphorus more efficiently ($93 \pm 3\%$). Ammonium-nitrogen was well removed by sorbents with a pH between 7 and 9, with an average removal of 87%, whereas lignite (pH 4) showed the lowest removal efficiency (50%). Some MPs were well removed by all sorbents ($\geq 97\%$) including biocides (hexachlorobenzene, triclosan and terbutryn), organophosphates (tributylphosphate, tris-(1,3-dichloro-2-propyl)phosphate and triphenylphosphate) and one fragrance (galaxolide). The pesticide 2,6-dichlorobenzamide and the pharmaceutical diclofenac were poorly removed by the pine bark and inorganic sorbents (on average, 4%), while organic sorbents achieved high removal of these chemicals (87%).

Keywords: Micropollutants (MPs); Synthetic substances; Sorbents; On-site sewage facilities (OSSFs)

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