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Søborg, Ditte Andreasen; Ramsay, Loren Mark; Breda, Ines Lousinha Ribeiro; Skovhus, Torben Lund

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The effect of filter media on start-up of drinking water biofilters

Søborg D. A., Ramsay, L. M., Breda I. L. & Skovhus, T. L.
Research Group for Energy and Environment, VIA University College, Horsens, Denmark
danis@via.dk, lora@via.dk, info@via.dk, tobi@via.dk

INTRODUCTION

Drinking water may be produced from anaerobic groundwater with the help of granular filters that remove iron, ammonium and manganese. In Denmark, this process has been used almost exclusively for more than 100 years. The filters often consist of washed, dried and sieved quartz sand, although various materials with different properties have been introduced. Examples of filter media in use include anthracite, calcium carbonate, manganese oxide, iron oxide, burnt flint, expanded clay and activated carbon. The start-up period of drinking water biofilters consists of a complex, interconnected set of processes in which new filter media matures into a fully functional biofilter coated with inorganic precipitates and biofilm. Different properties of the filter media (permeability, porosity, grain size, particle shape, surface area, catalytic capabilities and sorption capacity) determine the performance of the filters [1]. Improved knowledge and practical experience of these properties are required to better understand the chemical and bacteriological water treatment process during start-up of new biofilters [2]. This study examined the influence of different filter media on batch approach start-up of laboratory scale biofilters with specific focus on manganese removal and compared this effect with measured properties of the filter media.

METHODS

Laboratory scale setup of biofilters

RESULTS and DISCUSSION

Manganese was removed below drinking water criteria of 0.05 mg/L in all filters

RESULTS and DISCUSSION

There were significant variations between the different filter media properties

CONCLUSIONS

• Successful start-up of biofilters regarding manganese removal was shown for all filter media in laboratory scale using a batch approach.
• Manganese oxide and anthracite chemically removed manganese while quartz sand and calcium carbonate required development of biofilm containing manganese oxidizing bacteria.
• The sorption properties of the filter media was the most significant for the start-up process.
• Less than 1 month was required for start-up indicating potential for full-scale use of the batch approach.
• Further analyses are required to conclude which filter medium is the best for development of biofilm, and to what extent a particular medium can enhance growth of specific groups of bacteria.

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