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Biochar and Woodchips as Alternative Filter Materials for Pre-Treatment of Wastewater with Roughing Filter

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Abstract

Wastewater reuse could help to reduce the pressure from global water scarcity, especially in arid and semi-arid regions. Efficient and cheap water treatment technologies need to be developed, particularly in low-income countries where wastewater treatment is often lacking. Slow sand filtration (SSF) is a proper, efficient and well known technology to reduce the amount of pathogens and turbidity. However, an efficient use of SSF requires low water turbidity to prevent rapid filter clogging, which could be achieved by an upstream roughing filter (RF).

The focus of this study was on the evaluation of biochar and woodchips as alternative and locally available filter materials in RF as pre-treatment for SSF and low cost production of safer irrigation water for urban agriculture in developing countries.

The experimental setup consisted of nine glass columns, which were filled in triplicates with biochar, woodchips and gravel (grain sizes: 5–16 mm). Filters were fed with raw wastewater from the municipal treatment plant Ölbachtal (Bochum, Germany). Samples of influent and effluent were taken once per week and analysed for the fecal indicator bacteria (FIB) *E. coli* and intestinal enterococci, using the Most Probable Number (MPN) method and physico-chemical parameters (e.g. turbidity, chemical oxygen demand, electrical conductivity, pH).

FIB concentration of raw wastewater was in the range of 10^6 to 5×10^7 MPN 100 mL^{-1}. Removal rates for enterococci and *E. coli* were in the range of 0.5 to 1.5 $\log_{10}$ units MPN 100 mL^{-1}, which is similar to other published results with respect to RF. Influent turbidity was in the range of 60 to 360 NTU. Beside FIB, turbidity (effluent turbidity below 35 NTU) and COD (reduction up to 89 %) could be significantly reduced and effluent of all filter types were expected to be suitable for further treatment with slow sand filtration. Over the entire observation, biochar filter showed slightly higher removal rates than other materials. Overall, roughing filter seems to be a proper pre-treatment step for wastewater treatment with SSF.

Keywords: Biochar, BMBF-GlobE, roughing filtration, UrbanFood Plus, water reuse

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