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Operation of gravity-driven ultrafiltration prototype for decentralised water supply

Morgane Boulestreau[a,*], Eric Hoa[a], Maryna Peter-Verbanets[b], Worrtes Pronk[b], Rachi Rajagopaul[c], Baris Lesjean[a]

[a]*Berlin Centre of Competence for Water (KWB), Cicerost. 24, 10709 Berlin, Germany*
Tel. +49 30 53653 811; Fax: +49 30 53653 888; email: morgane.boulestreau@kompetenz-wasser.de
[b]*Eawag, Swiss Federal Institute of Aquatic Science and Technology, Überlandstr. 133, 8600 Dübendorf, Switzerland*
[c]*Umgeni water, 251 Wiggins Rd, Durban, South Africa*

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ABSTRACT

The study aims at assessing in long-term trials a gravity-driven ultrafiltration pilot plant designed for a capacity of 5 $m^3 d^{-1}$. The unit was operated in South Africa with Ogunjini surface water and was run with restricted chemical intervention or maintenance (no backflush, no aeration, no crossflow and no chemical). Under South African environmental conditions and with direct filtration of the river water and only one manual drainage of the membrane reactor every weekday, the unit could fulfil the design specification in terms of water production (5 $m^3 d^{-1}$) as long as the turbidity of the raw water remained in a reasonable level (up to 160 NTU), with a filtration flux typically 4–6 l h m^{-2} (corrected at 20°C). This value was in the same range as the lab results and was consistent with the first phase results (around 5–7 l h^{-1} m^{-2} after biosand filtration). However, the flux dropped significantly to a range of 2–4 l h^{-1} m^{-2} after a rain event resulting in a turbidity peak over several days up to >600 NTU. This demonstrated that for variable raw water types with expected turbidity peaks above 100 NTU, a pre-treatment would be required for the system (biosand filter or other). The performance of microbiological tests confirmed the integrity of the membrane and the ability of the system to achieve advanced disinfection.

Keywords: Ultrafiltration; Low-energy; Decentralised water supply; Small-scale system (SSS); Gravity-driven; Drinking water

*Corresponding author.