Performances of a seawater desalination plant made up of a sand filter, ultrafiltration and reverse osmosis membranes during a planktonic bloom.

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Résumé

The production of salubrious seawater is required for aquaculture and desalination fields even in case of micro-alga blooms. The present work investigates the performances (selectivity and production ability) of filtration plants with respect to dissolved and particulate (toxins, cells, etc) organic pollution coming from micro-algae rich seawater. The granular filtration of Heterocapsa triquetra cultures containing 10 000 to 17 000 cells.mL-1 is carried out using a bilayer sand filter with bed depth of 1100 mm, in constant flow-rate experiments. The average removal rate of micro-algae cells are 90% and 68% for 5 m.h-1 and 10 m.h-1 respectively. The turbidity is removed by more than 71% for 5 m.h-1 and 57% for 10 m.h-1. By increasing the superficial velocity, the retention probability by diffusion remains negligible, while interception increases from 84.6 to 91.5%, and gravitational contribution decreases from 14.5 to 7.85%. The ultrafiltration (UF) at 100 L.h-1.m-2 on PVDF membrane (0.03 μm) of the colloid and soluble parts of suspensions, the particle part would be removed by sand filter pre-treatment, induces high membrane residual fouling (20% of total fouling) and fouling velocity (50.108 m-1.min-1). Nevertheless, the permeate could feed a spiral-wound reverse osmosis membranes. The rejection rates of the total organic carbon, aromatic compounds and carbohydrates are equal to 45%, 48% and 60% respectively. The pristine or fouled UF membrane did not much retained the Paralytic Shellfish Poisoning (PSP) toxins of Alexandrium minutum culture contrary to the SW30 reverse osmosis membrane even in case of pronounced ageing.

Mots-Clés: Granular filtration, Ultrafiltration, Reverse Osmosis, Desalination, Micro, alga, Toxin, Remediation

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