Living Lab Biobased Brazil
Education Research Innovation

Start- end date: **14-02-2022**		
Student name: **31-07-2022**		
Course in the Netherlands: **Water Management**		
Internship Department/Company: **Water Technology Research Group**		
Brazilian Professor/Supervisor: **Kleos Magalhães Lenz Cesar Junior**		
Dutch Professor/Supervisor: **Bart Letterie and Emma McAteer**		
Internship		

Problem / assignment

The growing interest in the reuse of wastewater caused the development of new technologies to obtain a better-quality treated effluent. In this context, the use of Membrane Bioreactors (MBR) in wastewater treatment has attracted considerable attention. Besides that, the smaller footprint provided by MBRs can upgrade existing wastewater treatment plants that have reached full capacity operation. Nonetheless, the fouling of the membranes is the main bottleneck of MBR technology. In hard water environments, the precipitation of metallic salts increases the scaling on membranes, reducing its performance and raising the costs. In order to control the fouling, chemical cleaning can be performed to recover the membrane efficiency. Therefore, this study aimed to define a cleaning protocol capable to remove the scaling of a ultrafiltration MBR employed in hard water environments. Hydropure has a standardized cleaning protocol available and in this research the protocol is optimized with respect to chemical dosing and cleaning duration.

Used methods / project phases

The MBR was operated at a constant pressure using an influent synthesized at the laboratory by mixing Na_2CO_3 and $CaCl_2$ allowing $CaCO_3$ to precipitate on the membrane, mimicking scaling. To correlate the concentration of each chemical compound and EC, calibration curves were made. Furthermore, a titration was carried out to understand the reaction of Na_2CO_3 with $CaCl_2$ in terms of pH and EC. During the scaling process the lab scale MBR was operated in these hard water environment, until the permeability of the membrane reached 100 L/m².h.bar. In order to remove the scaling on the UF membrane, citric acid 99,5% was used. For determination of the optimum concentration of citric acid two cleanings were performed and the strategy adopted was adding the acid until the pH stabilizes at a value of 4, when all carbonate is converted to H2CO3. However, in the first cleaning, the blower was not used, while the second cleaning was performed with the blower on. In the third and fourth cleaning, the concentration of citric acid defined before was added into the tank at once and the MBR was switched on every 20 minutes to check the permeability once the permeability achieve the desired value of >200 L/m².h.bar, the cleaning was completed and the total cleaning time was determined. These procedures were conducted to determine the time needed to clean the membrane. The results obtained from the four experiments were compared to the Hydropure protocol.

Results
The results obtained from the four experiments were compared to the Hydropure protocol and the appropriate cleaning protocol must recover the permeability, reduce the duration of cleaning, and consequently, minimize the costs. The results showed that the time of cleaning can be reduced using the blower during the entire procedure, and the citric acid concentration required is in the range of 2,58 to 4,81 g/L. Moreover, all cleaning performed presented an efficient performance on membrane permeability recovery.

Extra info / advice / link to final document and presentation
https://www.linkedin.com/in/giordannamisse/