Ammonia, nitrite and nitrate separation from sweet water by nanofiltration

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ABSTRACT

The aim of this study is to show the use of nanofiltration to separate nitrogen compounds (ammonia, nitrate and nitrite) from water in recirculating aquaculture systems (RAS). In previous studies, we analysed the NF 270 membrane to separate nitrite, nitrate and ammonia from water separately. The best transmembrane pressure (TMP) was 15 bar. In the present study, the idea is to investigate the separation of all the N-compounds together, using the same membrane and TMP as before, but with a water hardness similar to that of RAS in Chile. The high concentrations of N-compounds used in the study were selected in accordance with dangerous limits for fish in RAS. Experiments using soft water with high concentrations of nitrite and nitrate (3.5 mg/L and 150 mg/L, respectively) and 1.5 mg/L of TAN (total ammonia nitrogen) showed there is no influence from nitrite and nitrate concentration on TAN retention, with a rejection percentage (%R) between 45 and 55% for all. Similar behavior is seen when TAN is 5 mg/L. However, when the nitrite and nitrate concentrations are low (0.5 mg/L and 5 mg/L, respectively), there is an important difference in TAN retention. In hard water, the retention of the membrane is different, and there are significant differences in the retention of the nitrogen compounds. With this data, a membrane process to separate the different nitrogen compounds using an NF membrane was proposed. In the proposed strategy, the separation must be focused on TAN retention. The %R for TAN is close to 80% when the nitrite and nitrate concentrations are low. In this case, the permeate of the membrane system can be returned to the fish tank to recycle the water.

Keywords: Ammonia; Aquaculture; Nanofiltration; Nitrate removal; Nitrite removal

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