

Properties of commercially available antiscalant and their impacts on discharge water of reverse osmosis

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Abstract

Usage of antiscalant is widespread in reverse osmosis plants as it has a great advantage in preventing the scale occurrence; thus, it improves the performance of the operation. However, studies evaluating the properties and impact of antiscalants on the environment and living organisms are not much inaugurated. From the reverse osmosis process, only 50 to 80% of water can be converted into drinkable quality, and an excess of 20 to 30% of water containing antiscalants and other chemicals are discharged to the environment. This study was to analyze the physical properties of pH, EC, TDS and DO and chemical properties of phosphate, sulphate, nitrate and chlorine of four various commercially available A, B, C, and D antiscalants and to assess their impact on the ecosystem when discharged into the environment. Most of the commercially available antiscalants are acidic with pH values vary from 2 to 4, however, antiscalants with an alkaline property also can be found, such as antiscalant B with 10.8 pH. When releasing the antiscalants into the environment, antiscalant A, C, and D mainly contain $18.2 \times 10^{-3} \text{ kg m}^{-3}$ of nitrate, $1.5 \times 10^{-3} \text{ kg m}^{-3}$ of sulphate and $1.40 \times 10^{-3} \text{ kg m}^{-3}$ of phosphate. These amounts are alarmingly high in comparison with International Water Quality Standards. Bioassay test was conducted using *Azolla pinnata* in synthetically produced discharge water contaminated with antiscalant. When the concentration of the antiscalants increases from 0.00 mL/L to 0.1 mL/L, the absorption value of chlorophyll extracted by 80 % of acetone was continuously fallen; thus, it shows that chlorophyll content will reduce with the increment of concentration of the antiscalants. Absorption reduction of antiscalants type A, B, C, and D was observed with their control 46.54%, 26.21%, 31.08%, and 30.22%, respectively. The absorption rate was decreasing throughout the observation period of four weeks, which proves that antiscalants are persistent for a long time in a water body. Biofouling test was conducted by using *Pseudomonas aeruginosa*. Cell density of *Pseudomonas aeruginosa* was increased in antiscalant A and antiscalant B. Therefore, antiscalants positively effect on RO membrane by microbial growth. Though the negative impacts of antiscalants on the environment and living organisms are significantly high, the need of antiscalants in reverse osmosis operation is inevitable.

Keywords: Antiscalant, *Azollapinnata*, Discharge water, Property test

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