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The use of Coupling Process for Salt Water Treatment

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ABSTRACT

Seawater desalination, with its multiple processes as reverse osmosis, distillation, electrodialysis is presented as a solution for the green and sustainable development, given its economic, production and environmental protection, seawater desalination should be based to be a viable solution as an energy-saving and efficient separation technology. Electrocoagulation (EC) is already known as an effective process for removing organic pollutants, and is an attractive method for producing drinking water. It can be advantageous, in many respects, to use this technology as a means of pre-treatment with membrane processes. At present, various pressure-driven membrane separation technologies such as ultrafiltration (UF), reverse osmosis (RO), nanofiltration (NF) have been successfully applied in the field of water treatment. This work. Is based on coupled electrocoagulation and nanofiltration to explore the possibility of reducing energy consumption by lowering trans-membrane pressure, while at the same time ensuring lasting and constant membrane permeability to reduce the phenomenon of membrane clogging in water desalination.

Keywords: Seawater desalination, Electrocoagulation, membrane process, membrane clogging.

1 Introduction

All desalination techniques are highly attractive in terms of their performance. At present, however, desalination is unable to meet the freshwater needs of the world's poorest populations, due to its high energy costs. However, techniques are constantly being developed, which will enable production costs to be lowered, and perhaps enable some of these countries, which are experiencing major water shortages, to equip themselves to secure their drinking water supplies [1].It is also important to note that current techniques generate a certain number of environmental problems, which remains an obstacle to their wider development. The ECprocess is already known as an effective process for eliminating organic pollutants, and is an attractive method for producing drinking water. It can be advantageous, in many respects, to employ this technology as a means of pre-treatment with membrane processes. The increasing scarcity of fresh water and energy poses a growing threat to sustainable human development, attracting global attention for fresh water production [2].

The electro dissolution of anode electrode causes metal concentration in water sources to rise and finally precipitates as electrocoagulation flocs where the organic pollutants act as a ligand. Aluminium hydroxide coagulants also operate as a charge shield in the charge neutralization mechanism that aims in compressing the double layer of pollutants and favouring the formation of aggregates and eventually, precipitation [3].

The performance of NF membranes is between reverse osmosis and ultrafiltration. The current commercial NF membranes, mostly interfacial polymerized polyamide membranes, were designed for desalination. These membranes are too tight for salt passage, especially for multivalent salts. Therefore, these membranes are hardly used for fractionating dyes with smaller molecular weights from salts. In addition, the majority of commercially available NF membranes have negatively charged surfaces. According to the separation mechanism of NF membranes, electrostatic effects play critical roles in ionic molecule separations [4].

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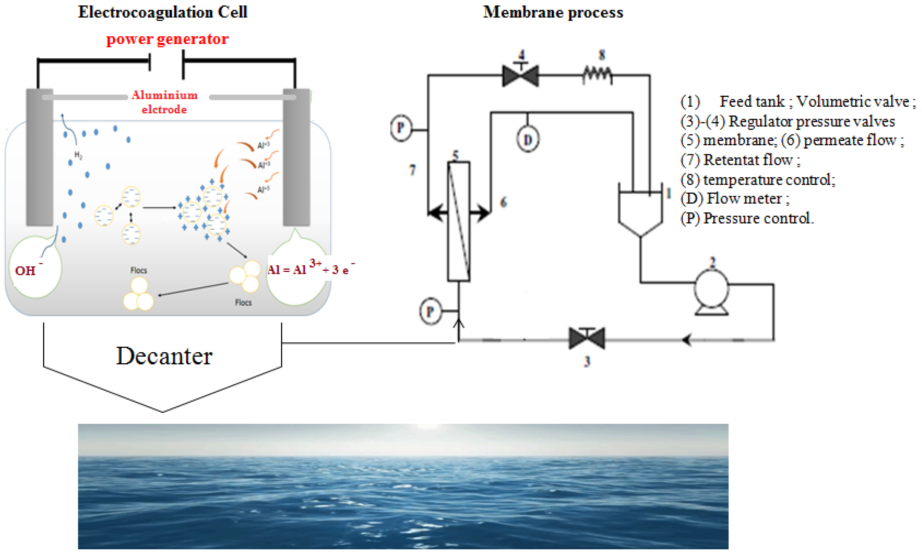
2 Experimental

The experimental setup of Electrocoagulation coupled to nanofiltration is shown in the diagram

Description of experimental device



3 Results and Discussion

The results obtained during coupling are very satisfactory, but require an improvement in the geometric configuration of the electrocoagulation reactor to enable the membrane process to handle sufficiently high loads to be economically viable. For our study, we treated seawater with an average conductivity of around 45mS/cm and a pH of around 7.8. A batch reactor is used for electrocoagulation, with aluminum electrodes having an active surface area equal to 10cm². Current intensity and electrolysis time were the main factors studied during this first part of the treatment. In the second stage, we took the samples after electrocoagulation and passed them through a negatively charged polysulfone organic membrane with an active surface area equal to 0.37m². In this second stage, we studied the influence of transmembranous pressure and filtration time on ionic retention.

4 Conclusions

In the light of the coupling of these two processes, we observed an overall ionic retention of the order of 20% for a working pressure of 3bars and an electrolysis time of 1 hour. This study shows that the geometry of the electrochemical reactor and the increase in pressure will further improve ionic retention.

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