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DEVELOPMENT AND APPLICATION OF TECHNOLOGIES FOR SODIUM CHLORIDE SOLUTION PREPARATION FROM CONCENTRATED SEAWATER BY MEMBRANE

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The large-scale emission of concentrated seawater, which is the by-product of seawater desalination process, has drawn worldwide attention for its potential threat to the marine ecological environment. In this paper, the preparation of aqueous sodium chloride solution from concentrated seawater by nanofiltration and selective electrodialysis were conducted with 1000 m³/d and 300m³/d demonstration projects respectively, and the optimized operating conditions were achieved with high liquid salt quality and low power consumption. In the test of the concentrated seawater treatment by nanofiltration, the effects of influent flow, brine recovery, and operating pressure on ion rejection, sodium chloride recovery, and energy consumption were investigated, and a continuous operation test of 1000m³/d pilot was performed. The results show that the rejection rates of SO₄²⁻, Mg²⁺, and Ca²⁺ can reach 99.5%, 97.0%, and 86.0%, respectively, that is, the total concentration of impurities in the liquid salt decreases from 5.82 g/L to 0.14 g/L. The power consumption is 1.8 kWh/m³, and the total recovery of sodium chloride reaches 59%. In the test of the concentrated seawater treatment using selective electrodialysis, the influence of voltage, concentration of sodium chloride in liquid salt on recovery of sodium chloride and the electricity consumption are investigated, and the continuous operation test of the 300m³/d pilot was conducted. The results indicate that when the NaCl concentration in the liquid salt is concentrated from 35.0 g/L to 180.6 g/L and the NaCl recovery is 50.0%, the power consumption is only 195.9 kWh/t (100% NaCl).

Biography

Professor Yuan is the dean of materials and chemical engineering institute in Quanzhou Normal University. He is the director of Engineering Research Center of Seawater Utilization Technology of Ministry of Education, and Hebei Collaborative Innovation Center of Modern Marine Chemical Technology. He had directed and completed 1 International Cooperation Project, 5 Scientific Research Project at nation level, 4 Provincial and Ministerial Project, 20 other Key Project, and another Industrial Project more than 30. He has been prized 'National Science Technology Invention third class', the first class at provincial level once, and the second class at provincial level twice. Meanwhile, he has published more than 110 academic papers and 24 issued patents. Professor Yuan's research interests embrace various aspects of seawater resources utilization and environmental protection. The focus of his current research is on seawater decalcification, extraction of potassium from seawater, CO₂ capture, mineral carbonation, seawater desulfuration, electrodialysis, nanofiltration, ultrafiltration and the treatment of flue gas, the treatment of wastewater and garbage.

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