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Experimental research on MVR system for industrial wastewater treatment

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ABSTRACT

Mechanical vapor recompression system is an energy-saving system for saline effluent treatment because nearly no external steam is required in the system. The combination of centrifugal compressor and falling film evaporator is more suitable for the large-scale industrial system. An experimental system is developed and tested in this paper. The results show that the treatment capacity of distilled water is 0.88–1.24 and 0.77–1.15 t h^{-1} with rotating speeds of compressor of 20,000 and 19,500 rpm, respectively. The compressor consumes about 3.1–4 kW shaft power if saturated temperature difference increases 1°C, and 24.8–28.7 kWh is consumed when 1 t distilled water is recycled. The compressor runs reliably, and the maximum shaft vibration amplitudes of compressor and motor are 12 and 19 μm, respectively. The average mass flow rates of feed water, discharge water, and distilled water are 1.07, 0.15, and 0.93 t h^{-1} in continuous 24 h experiment time. The power consumptions of compressor, vacuum pump, circulation pump, and distilled water pump are 75.9%, 10.4%, 4.1%, and 2.9% for the whole system. The maximum total dissolved solids of discharge and distilled water are 78,650 and 118 mg L^{-1}, respectively, and the maximum concentration ratio is 18.7 for the tested water samples.

Keywords: MVR; Treatment capacity; Power consumption; TDS

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