

Performance of MVR desalination system with variable operating conditions for wastewater treatment

Guangbin Liu^a, Xiaoyan Zhao^b, Qichao Yang^a, Yuanyang Zhao^a, Bin Tang^a,
Liansheng Li^{a,*}, Le Wang^c

^aCollege of Electromechanical Engineering, Qingdao University of Science & Technology, Qingdao 266061 China, emails: lianshengli@126.com (L. Li), lgbcomp@163.com (G. Liu), qichaoyang@163.com (Q. Yang), yuanyangzhao@163.com (Y. Zhao)

^bSchool of Information Science & Technology, Qingdao University of Science & Technology, Qingdao 266061, China, email: zhaoxiaoyan@qust.edu.cn

^cState key laboratory of compressor technology, Hefei General Machinery Research Institute, Hefei 230031, China, email: wangle4127@163.com

Received 23 April 2019; Accepted 28 September 2019

ABSTRACT

A complete mathematical model on the mechanical vapor recompression system considering the heat exchangers, pumps and compressor is developed and verified by experiment, by which the working process of the system is simulated and typical parameters are calculated. The treating capacity of system, distilled water temperature, power consumption influenced by feed temperature, feed concentration, discharge concentration, and circulation flow rate are analyzed. The results show that the increase of the feed temperature improves the treating capacity of system and reduces the distilled water temperature. Although more power is consumed by the system, the power consumption per ton of distilled water decreases. The mass flow rate of distilled water decreases with the feed concentration, but more feed solution flows into and discharge solution flows out of this system. The system consumes more power but only produces less distilled water for large feed concentration. The discharge concentration has little influence on the mass flow rate of distilled water despite the mass flow rates of the feed and discharge solutions decrease. The nearly constant power consumption for one ton of distilled water is obtained if the discharge concentration is larger than a certain value. The system performance is improved by increasing the circulation flow rate due to the better heat transfer effect.

Keywords: MVR; Desalination; Treat capacity; Power consumption

* Corresponding author.