Corrosion inhibition of bio-based melatonin on AA5052 aluminum alloy under negative pressure

Daquan Zhang [1,2]*, Zhiqiang Wang[1] , Zhuoran Zhang[1,2], Shifei An [1,2]

[1]*Shanghai Key Laboratory of Materials Protection and Advanced Materials in Electric Power, Shanghai University of Electric Power, Shanghai 201306, China*

[2]*Shanghai Engineering Research Center of Energy-Saving in Heat Exchange Systems, Shanghai University of Electric Power, Shanghai 201306, China*

Email: zhangdaquan@shiep.edu.cn

Abstract: Aluminum alloy heat exchange tube is attractive for the Low Temperature-Multi Effect Distillation (LT-MED) desalination device, for its low cost and excellent mechanical property. The corrosion damage is the key issue that influences on its service life. In this work, the corrosion inhibition of the bio-based melatonin (MEL) on AA5052 aluminum alloy in 3wt.% NaCl solution under negative pressure is investigated by the weight-loss method and the electrochemical measurements. The decrease of the operation pressure makes the corrosion potential of AA5052 aluminum alloy to move positively and decreases its corrosion rate significantly. The corrosion potential and the critical pitting potential shift to the positive direction in the presence of MEL under different pressure. The MEL inhibits the corrosion of AA5052 aluminum alloy in 3 wt.% NaCl solutions very well. The corrosion inhibition efficiency of MEL decreases evidently under negative pressure. The decrease of pressure can change the surface films of aluminum alloy and thus affects effectively the adsorption behavior of the MEL.

Keywords: Seawater desalination; Negative pressure; Corrosion inhibition; Aluminum alloy; MEL

References

[1] D D Macdonald, Review of mechanistic analysis by electrochemical impedance spectroscopy, Electrochimica. Acta, 35 (1990) 1509-1525.

[2] A.M. Abdel-Gaber, E. Khamis, H. Abo-ElDahab, S. Adeel, Inhibition of aluminium corrosion in alkaline solutions using natural compound, Materials Chemistry and Physics 109(2-3) (2008) 297-305.

[3] Zhang, Z., Gan, P., Zhang, D., & Gao, L.. Experimental and theoretical investigations of the anti-corrosion film derivated from bio-based melatonin on AA5052

aluminum alloy surface. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 691(2024) 133880.