Effects of ultrasonic extraction and reflux extraction on the properties of Macadamia integrifolia shell inhibitor

Gaofei Wei, Xianghong Li, Shuduan Deng*

College of Materials and Chemical Engineering, Southwest Forestry University, Kunming 650224, P.R. China

e-mail address: dengshuduan@163.com

Abstract *Macadamia integrifolia* (MI) are highly popular due to their sweet kernel and rich nutritional value, and they are an ideal raw material for woody edible oil. At present, the planted area of MI in China accounts for 60.92% of the total planted area in the world, ranking the first in the world. The corrosion inhibitor of *Macadamia integrifolia* shell extract (MISE) was prepared by ultrasonic extraction and reflux extraction. and the effects of the two extraction methods on the inhibition performance were investigated. The results showed that the corrosion inhibitors prepared by the two extraction methods showed excellent inhibition performance at 20-50 ^{o}C, and the reflux extracted inhibitor (RMISE) reached the highest inhibition efficiency of 93.6% at 50 ^{o}C when 200 mg L^{-1} of RMISE was added, while the ultrasonically extracted inhibitor (UMISE) reached the maximum inhibition efficiency of 93.1% at 40 ^{o}C. The inhibition efficiency of RMISE more than 90% when 60 mg L^{-1} was added. Nevertheless, UMIE must increase its concentration to achieve inhibition efficiency above 90%. The surface characterization revealed a significant reduction in surface roughness following the incorporation of two inhibitors. Additionally, the bonding of the active ingredient in MISE to Fe was detected by surface element analysis. In the future, we will also prepare *Macadamia integrifolia* shell-based plant inhibitors in more ways to further promote their efficient use in the field of metal corrosion inhibition.

Keywords: Corrosion inhibitor; *Macadamia integrifolia* shells; Reflux extraction; Ultrasonic extraction

Reference

[1] S. Somwongin, S. Sirilun, P. Chantawannakul, S. Anuchapreeda, A. Yawootti, W. Chaiyana, Ultrasound-assisted green extraction methods: An approach for cosmeceutical compounds isolation from Macadamia integrifolia pericarp, Ultrason. Sonochem. 92 (2023) 106266.

[2] S.Z. Salleh, A.H. Yusoff, S.K. Zakaria, M.A.A. Taib, A.A. Seman, M.N. Masri, M. Mohamad, S. Mamat, S.A. Sobri, A. Ali, P.T. Teo, Plant extracts as green corrosion inhibitor for ferrous metal alloys: A review, J. Cleaner Prod. 304 (2021) 127030.

[3] Y. Qiang, S. Zhang, B. Tan, S. Chen, Evaluation of Ginkgo leaf extract as an eco-friendly corrosion inhibitor of X70 steel in HCl solution, Corro. Sci. 133 (2018) 6-16.

[4] T. Xiang, J. Wang, Y. Liang, W. Daoudi, W. Dong, R. Li, X. Chen, S. Liu, S. Zheng, K. Zhang, Carbon dots for anti-corrosion, Adv. Funct. Mater. (2024) 2411456.

[5] X. Zhou, Q. Dong, D. Wei, J. Bai, F. Xue, B. Zhang, Z. Ba, Z. Wang, Smart corrosion inhibitors for controlled release: a review, Corros. Eng., Sci. Technol. 58 (2022) 190-204.

Acknowledgements

Funding support from National Natural Science Foundation of China (52161016), and Joint Key Project of Agricultural Fundamental Research in Yunnan Province (202101BD070001-017) are acknowledged.