

## Evaluation of Aronia Pomace Extract as a Green Corrosion Inhibitor

Anđela Simović<sup>1,\*</sup>, Aleksandra Ivanovska<sup>2</sup>, Jelena Bajat<sup>3</sup>

<sup>1</sup> University of Belgrade, Institute of Chemistry, Technology and Metallurgy, National Institute of the Republic of Serbia, Belgrade, Serbia

<sup>2</sup> University of Belgrade, Innovation Center of the Faculty of Technology and Metallurgy in Belgrade, Belgrade, Serbia

<sup>3</sup> University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

[https://doi.org/10.65614/uisk\\_yucorr.2025.26.ch24](https://doi.org/10.65614/uisk_yucorr.2025.26.ch24)

\*andjela.simovic@ihtm.bg.ac.rs

### Abstract

*In this study, the effectiveness of Aronia pomace extract as an environmentally friendly corrosion inhibitor for carbon steel in 1 M HCl was investigated. Electrochemical measurements, including electrochemical impedance spectroscopy (EIS) and polarization studies, revealed a significant reduction in the corrosion rate in the presence of the extract, with a maximum inhibition efficiency of 96.7% at the optimal concentration of 100 ppm after 24 hours. EIS results indicated an increase in charge transfer resistance over time for all tested concentrations and the formation of a stable protective film on the steel surface. Polarization measurements suggested that the extract acts as a mixed-type inhibitor, with a predominant effect on the cathodic reaction. Scanning electron microscopy (SEM) analysis showed a smooth and compact surface for the inhibited samples, while contact angle measurements confirmed increased compaction of the organic protective layer over time. X-ray photoelectron spectroscopy (XPS) identified the presence of organic functional groups from phytochemicals in the extract on the steel surface, confirming the adsorptive protection mechanism. These results demonstrate that aronia extract is an efficient, environmentally friendly inhibitor of carbon steel corrosion in acidic media, with potential applications in industrial processes and green metal protection technologies.*

**Keywords:** corrosion; carbon steel; green inhibitor; plant extract

### Izvod

*U ovoj studiji ispitivana je efikasnost ekstrakta aronije (Aronia pomace) kao ekološki prihvatljivog inhibitora korozije ugljeničnog čelika u 1 M HCl. Elektrohemijaska ispitivanja, uključujući elektrohemijasku impedansnu spektroskopiju (EIS) i polarizacione analize, pokazala su značajno smanjenje brzine korozije u prisustvu ekstrakta, sa maksimalnom inhibitorskom efikasnošću od 96,7% pri optimalnoj koncentraciji od 100 ppm nakon 24 sata. EIS rezultati ukazali su na povećanje otpornosti prenosa naelektrisanja tokom vremena za sve testirane koncentracije i formiranje stabilnog zaštitnog sloja na površini čelika. Polarizacione analize sugerisale su da ekstrakt djeluje kao inhibitor mješovitog tipa, sa dominantnim uticajem na katodnu reakciju. Analiza skenirajućom elektronskom mikroskopijom (SEM) pokazala je glatku i kompaktnu površinu inhibiranih uzoraka, dok su mjerenja kontaktnog ugla potvrdila povećanu kompaktnost organskog zaštitnog sloja tokom vremena. Analiza fotoelektronskom spektroskopijom rendgenskih zraka (XPS) identifikovala je prisustvo organskih funkcionalnih grupa fitohemikalija iz ekstrakta na površini čelika, čime je potvrđen mehanizam adsorpcije. Dobijeni rezultati pokazuju da ekstrakt aronije predstavlja efikasan, ekološki prihvatljiv inhibitor korozije ugljeničnog čelika u kiseloj sredini, sa potencijalnom primjenom u industrijskim procesima i zelenim tehnologijama zaštite metala.*

**Ključne reči:** korozija; ugljenični čelik; zeleni inhibitor; biljni ekstrakt