

Plant Extracts as "Green" Corrosion Inhibitors: A Mini Review

Biljni ekstrakti kao „zeleni” inhibitori korozije: Kratak pregledni rad

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Abstract

Plant extracts represent an alternative to conventional corrosion inhibitors, primarily due to their low cost and biodegradability. This review presents the results of 35 relevant studies from the Scopus and Web of Science databases in order to evaluate the application of plant extracts in this area. The analysis of the work shows that the most effective extracts are those containing high content of phenols, flavonoids, tannins, alkaloids and saponins. These compounds contain heteroatoms (N, S, O) and aromatic systems, which are easily adsorbed on metal surfaces and thus form a protective film. It is described in scientific papers that the inhibitory effect is most often attributed to physical and chemical adsorption, which is confirmed by Langmuir/Freundlich adsorption models and changes in electrochemical behavior and surface morphology. The effectiveness of the inhibition itself depends on the type of plant, extraction method, extract concentration, temperature and exposure time; thus, in most studies, the corrosion efficiency is over 70%, while under optimal conditions it exceeds over 90%. However, for plant extracts to be used in industry, it is necessary to determine whether they remain effective on a large scale and over a long period of time.

Keywords: adsorption; carbon steel; green corrosion inhibitors; plant extracts; protective film

Izvod

Biljni ekstrakti predstavljaju alternativu konvencionalnim inhibitorima korozije, pre svega zbog svoje niske cene i biorazgradivosti. U ovom preglednom radu su predstavljeni rezultati 35 relevantnih studija iz baza podataka Scopus i Web of Science kako bi se procenila primena biljnih ekstrakata u ovoj oblasti. Analiza rada pokazuje da su najefikasniji ekstrakti oni koji sadrže fenole, flavonoide, tanine, alkaloidne i saponine. Ova jedinjenja sadrže heteroatome (N, S, O) i aromatične sisteme, koji se lako adsorbuju na metalnim površinama i tako formiraju zaštitni film. U naučnim radovima je opisano da se inhibitorsko dejstvo najčešće pripisuje fizičkoj i hemijskoj adsorpciji, a koja se potvrđuje Langmuirovim/Frojdndlihovim modelima adsorpcije i promenama u elektrohemijomskom ponašanju i morfologiji površine. Efikasnost same inhibicije zavisi od vrste biljke, metode ekstrakcije, koncentracije ekstrakta, temperature i vremena izlaganja; tako je u većini studija efikasnost korozije preko 70%, dok pod optimalnim uslovima prelazi preko 90%. Ipak, da bi se biljni ekstrakti koristili u industriji, potrebno je da se utvrdi da li ostaju efikasni u velikom obimu i tokom dužeg vremena.

Ključne reči: adsorpcija; biljni ekstrakti; zaštitni film; ugljenični čelik; zeleni inhibitori korozije