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Ellagic Acid as Green Corrosion Inhibitor: a Necessary Validation

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Corrosion of metals is an unavoidable but controllable process. Among techniques developed to slow down or prevent metal deterioration the addition of small amount of inhibitors directly in the corrosive environment is a quite common strategy. In particular, among organic compounds effectively used as adsorption inhibitors (thanks to N, O and/or S atoms that act as anchoring groups for metal surface) only a few percentage belongs to the so called "green inhibitor" class. In this field most of the studies employ plant extracts being rich in phytochemical constituents considered to be potential eco-friendly corrosion inhibitors. However, the often extraordinary complexity of crude extracts makes difficult the rationalization of the inhibition mechanism. So, from a purely academic point of view, the study of pure compounds is often encouraged.

Among potential green inhibitors our attention has been focused on ellagic acid (EA) that can be obtained by hydrolysis of ellagitannin contained in peels of pomegranate [1]. Ellagic acid is a polyphenol having four phenolic and two lactone groups that should act like two and one couples of equivalent sites, respectively, due to the C_{2h} molecular symmetry.

Up to know the corrosion inhibition properties of EA was only marginally studied in literature, both theoretically [2,3] and experimentally [3,4]. However some reported results need to be validated because of discrepancies concerning some fundamental chemical physical features of the target acid, like *i*) solubility in pure water (9 mg/dm^3 in [5] *versus* 1.2 g/dm^3 in [4]) and *ii*) pKa values for the two acid dissociation processes ([6] *versus* [7]).

For this purposes, using UV-Vis absorption spectroscopy, a mainly-aqueous medium was selected to assure homogeneity of the EA-based solution; after that the corrosion inhibition properties of ellagic acid toward mild steel was studied by weight loss measurements (according to ASTM G1 standard practice) and by electrochemical tests. Preliminary results performed in 1% v/v MeOH/H_2O mixture with HCl 0.05 M point to potentially interesting inhibition effect even working with $1.0 \cdot 10^{-5}$ M EA (*i.e.*, 3 mg/dm^3).

References:

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