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# NATURAL AQUEOUS EXTRACT OF ROOT PLANT AS GREEN INHIBITOR FOR CARBON STEEL CORROSION IN SEAWATER

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## *Introduction*

Corrosion of different metallic materials (e.g., carbon steel, mild steel, aluminum, copper) can be defined as the interaction of a metal with the different aggressive aqueous medium, causing a slow, irreversible deterioration and irreparable in the surface of metal, in both chemical and physical properties.
In the last years, extracts from different parts of plant (e.g., leaves, roots, seeds, flowers, fruits, peel, stem) have been widely used as "green" and "eco-friendly" inhibitors of corrosion metal in various corrosive environments. The protection of corrosion using inhibitors is one of the good, common, practical and cost-effective methods of controlling metallic corrosion. Moreover, the metal protection is based on economic gain and environmental sustainability, and the extracts of plant used as metal corrosion inhibitor must be inexpensive, readily available, renewable and environmentally friendly.

## *Materials and methods*

The inhibiting impact of natural aqueous extract of root plant ("green" inhibitor) for the corrosion of carbon steel in seawater was investigated by gravimetric (weight loss measurements) and potentiostatic polarization methods at room temperature.
All corrosion experiments were performed using small coupons of carbon steel, in seawater, in the absence and presence of different amounts of natural aqueous extract of root plant ("green" inhibitor) (1, 2 and 4 mL).
Gravimetric measurements were carried out in a glass cells that contain 50 mL of seawater (corrosive medium), with and without "green" inhibitor, where the carbon steel coupons were completely immersed for a period of 7 days. The cleaned carbon steel coupons were weighed before and after immersion in aqueous solutions.

Polarization measurements were carried out in a conventional electrolytic cell contains three electrodes, two carbon steel as the working electrodes (anode and cathode) and saturated calomel reference electrode. To obtain the potentiostatic polarization was used a digital multi-meter, a DC power supply and a rotary potentiometer. Corrosion current densities were obtained from the polarization curves by linear extrapolation of the Tafel curves.
The morphology of the surface of carbon steel samples before and after immersion in the aqueous solutions with and without natural aqueous extract of plant ("green" inhibitor) was performed using an optical metallographic microscope.

***Results and conclusions***
The corrosion efficiency of carbon steel in the absence and the presence of natural aqueous extract of plant ("green" inhibitor) was evaluated in terms of corrosion rate and percentage inhibition efficiency. Results obtained from gravimetric method (weight loss measurements) show for "green" inhibitor tested that the corrosion rate values decrease when the amount of natural aqueous extract of plant increases. The protection efficiency increased with the increase the amount of "green" inhibitor. The best value of protection efficiency was obtained in the presence of 4 mL of "green" inhibitor. The "green" inhibitor used in this study showed excellent corrosion inhibitor for carbon steel in seawater.
Results obtained from potentiostatic polarization method reveals the polarization curves shift toward more negative potential and lower current density values in the presence of "green" inhibitor.
The morphological images of carbon steel coupons were observed before and after corrosion test. The surface of carbon steel coupon immersed in the seawater without "green" inhibitor was damaged due to some small cracks and pits as a result of the attack of corrosive medium (seawater). In the presence of "green" inhibitor, micrograph showed the formation of thick film on the carbon steel surface. The film observed on the carbon steel surface is a protective layer which is responsible for the inhibition of corrosion.
The natural aqueous extract of root plant can be used as green corrosion inhibitor due to multiple advantages such as: inexpensive, non-toxic, biodegradable, environmentally friendly and ecologically acceptable, readily available and renewable, high corrosion rate.

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