A green inhibitor derived from peony leaves and its performance for protecting carbon steel from aqueous corrosion

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**INTRODUCTION**
- Green corrosion inhibitors feature low cost, low environmental impact, and effective protection.
- The green compounds contain oxygen, nitrogen and sulfur which have high electron density, and can be readily adsorbed on the surface of metal.
- The adsorbed film forms a barrier against corrosive agents.
- Inhibition efficiency of adsorbed barrier layer depends on adsorption type and characteristics of the layer.

**OBJECTIVE**
- Corrosion behavior of carbon steel was investigated in the presence of a new green inhibitor derived from peony leaves via chemical and biological degradation processes.

**EXPERIMENTAL PROCEDURES**

**Materials:** C1010 carbon steel coupons were exposed to the 3.5% NaCl solution.

**Electrochemical analysis:** OCP, LPR, EIS and polarization

**Surface analysis:** Digital photo, FEM, EDS, XRD and XPS

**Liquid chromatography mass spectrometry (LC MS):** HPLC separation with ESI-MS detection

**Wettability of steel surface (contact angle):** The contact angle between the dropped water and the sample surface

**RESULTS**
- The main compounds of peony leaves derived solution (PLS) are Demethoxyisogemichalcone C, Ganodermic acid TQ, 1-docosanoyl-glycero-3-phosphate
- After a 16-day immersion period, the corrosion was less localized.
- PLS was a cathodic inhibitor and formed a protective layer on the surface of steel.
- The formed layer was composed of an adsorbed organic film and a $\gamma$-Fe$_2$O$_3$/$\gamma$-FeOOH film.
- The compactness of oxide layer was improved with the increase in green inhibitor dosage.
- PLS increased the hydrophobicity of steel surface.
- The standard free energy of adsorption was -21.7 kJ/ppm which shows that the adsorption type was physical.

**CONCLUSION**
- A peony leaves derived solution (PLS) provided an inhibition efficiency of 60-70% at 3 vol.% on the corrosion of C1010 carbon steel in simulated seawater over a 16-day immersion period.
- In the presence of green inhibitor the corrosion was less localized.
- PLS was a cathodic inhibitor and formed a protective layer on the surface of steel.
- The formed layer was composed of an adsorbed organic film and a $\gamma$-Fe$_2$O$_3$/$\gamma$-FeOOH film.
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