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Tropical Tannin for Engineering Application: A Review

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EXTENDED ABSTRACT

There is a great concern to protect the steel surfaces from corrosion phenomenon in the environment of oil and gas industry. Several approaches have been proposed to introduce alternative new compounds in the paint which are green sources that can reduce environmental risks. Tannins in actuality are large and diverse family of phenolic compound with varying structure and widely distributed through the plant kingdom. It has myriad supplemental functions in a plant's life cycle, as protective tissue and defense strategies. The phenolic compound is consist of hydroxyl group bonded to an aromatic compound and has the properties to interact with aqueous solution. Phenolic compound is an active compound due to the lower bond dissociation energies of OH group and easier to lose H atom [1]. Hence, tannin containing enough hydroxyl group for encourage effective cross linking of other compounds. Tannin can be divided into two groups called condensed tannins and hydrolysable tannins. Hydrolysable tannins are hydrolysed by enzyme or acid and can be subdivided into ellagitannin and gallotannin while condensed tannins are not readily hydrolysable to simpler molecules and they do not contain a sugar moiety. Condensed tannin have the ability to synthesize mixtures of polymers and oligomers that makes their chemistry typically quite demanding. Tannin contain four flavonoid namely: catechin, epitechin, epigallocatechin and epicatechin gallate which is showed in Figure 1. Due to its flavonoid monomer, tannin have the prospective as corrosion inhibitors for steel in acidic environment [2].

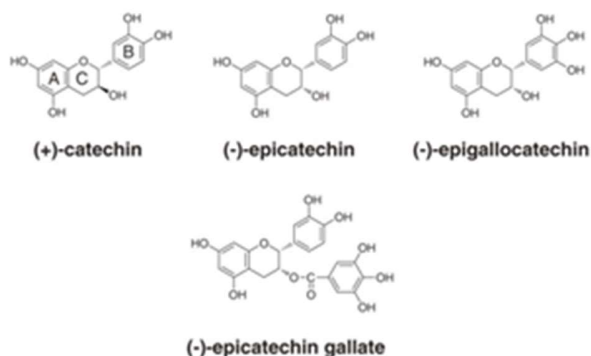


Figure 1: Chemical structure of flavonoid monomer of tannin

The use of inhibitor is of the best option of protecting metals as the environmental toxicity of organic corrosion inhibitors has prompted the search for green corrosion inhibitors as they are biodegradable and do not contain heavy metal or other toxic compounds. Moreover, as it being the ecologically acceptable, plant product is not expensive, readily available and renewable [3]. In

industry, corrosion is costly severe materials science problem and the most corrosion form is the corrosion of mild and carbon steel especially in acid solution. Corrosion can be described as the gradual destruction of material, commonly on metal, by chemical reaction with its environment and it occurs in the presence of moisture, where the oxidation reaction occurs on the energized area of the metal surface to elute metal as ion (anode) while the reduction takes place on the lower energy area (cathode). The hydroxyl and carboxyl groups through the molecule of tannins can adsorb on corroding metallic surfaces and it is suitable to be corrosion inhibitor [4]. A protective film forms due to adsorption of the inhibitor molecules will restrict either the movement of ions away from the corroding surface or the consumption of electrons. From Figure 2, it can be seen that the tannic protective layer are formed on the metal surface after the coating on the rusted structural steel for tannic acid treatment.

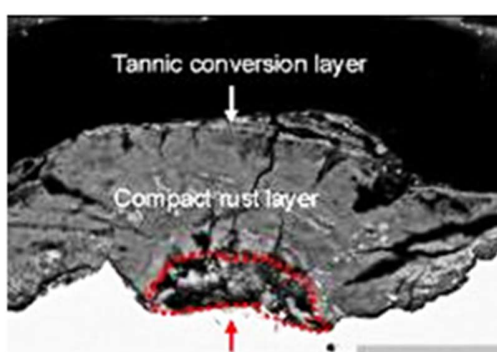


Figure 2: Cross-section morphology of the tannic layer [5].

The aim of this investigation is to compare different types of inhibitors from local and commercial tannin with commercial inhibitor. The tannin effect on the corrosion inhibition of mild steel will be investigated in 1 Mol HCl solution for 6 hour by using different types of inhibitors. The weight loss method and potentiodynamic polarization are applied to study the mild steel corrosion behaviour in the present and absent of different concentration of tannin (250, 300, 350) ppm. Tannin act as good inhibitor as corrosion inhibitor for mild steel in acid medium. As expected result, it shows that the addition of tannin in the acidic solution form a protective layer on the metal and it represents valuable environmentally friendly of inhibitor [6].

Keywords: Tannins; Inhibitor; Mild steel; Corrosion

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