ADSORPTION BEHAVIOUR OF CARBOXYLIC ACID IN COOKING OIL WASTE ON STEEL IN AQUEOUS SOLUTION

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Contents

2. Letter of Offer (Research Grant)

UNIVERSITI TEKNOLOGI MARA

PEMENANG Anugerah Kualiti Perdana Menteri 2008

Surat Kami : 600-RMI/ST/FRGS 5/3/Fst (105/2010)
Tarikh : 22 Mac 2010

Puan Junaidah Jai
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Y. Bhg. Prof/Prof. Madya/Dr./Tuan/Puan

KELULUSAN SKIM GERAN PENYELIDIKAN FRGS FASA 01/2010

Tajuk Projek	:	Adsorption Behaviour of Carboxylic Acid in Cooking Oil Waste On Steel In Aqueous Solution
Kod Projek	:	600-RMI/ST/FRGS 5/3/Fst (105/2010)
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Jumlah Peruntukan	:	RM 34,400.00
Ketua Projek	:	Junaidah Jai

Dengan hormatnya perkara di atas adalah dirujuk.

Sukacita dimaklumkan pihak Kementerian Pengajian Tinggi melalui surat JPT.S(BPKI) 2000/011/010 Jilid. 2 (19) telah meluluskan cadangan penyelidikan Prof/Prof. Madya/Dr./Tuan/Puan untuk di biayai di bawah Skim Geran Penyelidikan Fundamental (FRGS) Fasa 1/2010.

Bagi pihak Universiti kami mengucapkan tahniah kepada Prof/Prof. Madya/Dr./Tuan/Puan kerana kejayaan ini dan seterusnya diharapkan berjaya menyiapkan projek ini dengan cemerlang.

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Sekian, harap maklum.

"SELAMAT MENJALANKAN PENYELIDIKAN DENGAN JAYANYA"

Yang benar

MUSTAFAR KAMAL HAMZAH
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5.2 Enhanced Executive Summary

Mild steel is commonly used as constructional material in many industries due to its excellent mechanical properties and low cost. However, mild steel is easily corroded when exposed to a corrosive environment. Palm cooking oil waste (PCOW) was introduced as a new organic corrosion inhibitor due to its fatty acids content. The objective of this study is to investigate the corrosion inhibition behaviour of PCOW inhibitor (PCOWI) against corrosion. The corrosion inhibition and inhibitor adsorption processes of PCOWI on mild steel in 1 M HCl were investigated at 299, 323 and 343K by using weight loss test and potentiodynamic polarization test. The weight loss test had shown that the inhibition efficiency (IE) increased with increasing concentration of PCOWI at all temperatures under study. However, the IE decreased with increasing of temperature. The maximum inhibition efficiency 100% was observed in the presence of 0.25 M inhibitor at 299K. Potentiodynamic polarization studies revealed that PCOWI behaves as a mixed type inhibitor. The experimental data fitted into Temkin adsorption isotherms. PCOWI exhibits a very good performance as a corrosion inhibitor for mild steel in 1M HCl.

5.3 Introduction

5.3.1 Background to the problem/ Study

Mild steel is commonly used as constructional material in many industries due to its excellent mechanical and low cost. The nature and composition of mild steel that exposed to corrosive fluids on the process side of equipment might leads to corrosive attack [1]. Inhibitor is one of the ways to minimize the corrosive attack of metallic material that cause by aqueous solution and aggressive environments [2]. Corrosion inhibitors will reduce the rate of either anodic oxidation or cathodic reduction or both [3]. Inhibitors acts as a barrier layer between the metal and environment by adsorbing as a film over the metal surface or by precipitating a compound scale on the surface [4]. The effective corrosion inhibitor usually possess an active functional group such as nitro ($-NO_2$), hydroxyl (–OH), heterocyclic compound and π electron[3]. Most of the well known organic inhibitors contain nitrogen, sulfur and oxygen atoms [5].

In research on organic corrosion inhibitors, the mechanism of adsorption, relationship between inhibitor structures and inhibitor adsorption properties need to be considered [6]. The inhibition process works when water molecules at metallic surface are replaced by organic inhibitor molecules and inhibit corrosion on mild steel [7]. The usages of organic product or waste as corrosion inhibitor become a trend in corrosion inhibitor study, which are environmentally friendly, cheap and readily available [8]. The low grade oil such as cooking oil waste contain high free fatty acid (FFA) has become the main potential to produce new products [9].The cooking oil waste from palm oil contains saturated and unsaturated fatty acids which it rich with palmitic acid and linoleic acid, whereas oleic acid was the major component of cooking oil waste [8]. There are several reports on the application of frying cooking oil waste as biodiesel due to its high free fatty acids (FFA) content [9, 10]. The oleic and linoleic acid of the COW contains hydroxyl group which enhance the adsorption process of the cooking oil waste on the metal surface. The lateral interaction of long chain of carbon atoms due to Van der Waals forces can further facilitate formation of compact film of inhibitor on the metal surface [11]. Therefore, waste cooking oil has potential to become organic corrosion inhibitor.

Mild steel is widely used in various industrial processes; however the problem using mild steel is the dissolution of steel ion in acidic solution [12]. To overcome this problem, inhibitor should be added in the process as a film or protective barrier between metals and the corrosive fluids.

Inhibitor can be organic or inorganic compounds, and they usually dissolved in aqueous environment. Inorganic compounds such as chromate, dichromate, nitrite and nitrate are commonly used as corrosion inhibitors in several media and for different metals and alloys.