UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF EPOXIDIZED PALM OIL COATING FROM WASTE COOKING OIL TOWARDS CHEMICAL RESISTANCE

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ABSTRACT

Epoxidation from plant oil recently received a big attention as an alternative to replace Bisphenol A in the formulation of a more eco-friendly epoxy coating. At the same time, there were reports on the increasing waste of cooking oil. Therefore, this study was conducted in order to develop a new coating material from used cooking oil towards the performance of coating on its chemical resistance. Three formulation of coating with different ratio of Epoxidized palm oil to Diglycidylether Bisphenol A (10:90, 20:80 and 30:70). Then, the coating was tested its performance on chemical resistance by referring to ASTM standards (ASTM G20, ASTM 5402). Then, the results were evaluated based on ASTM610. Three different solution were used in the chemical immersion test, firstly, in Sulphuric Acid solution, where formulation 30:70 and 20:80 were the fastest to peeled off from surface compared to 0:100 and 10:90 formulation. While in Sodium Chloride solution, at the 5^{th} day of immersion there were rust spots at the edges for all metal coupons. Lastly, immersion in Sodium Hydroxide solution where all of the coating formulation of 10:90, 20:80 and 30:70 were totally peeled off from the surface. However, the coating formulation of 0:100 still adhere to the metal. After 15 days of immersion, the degree of rusting was evaluated, where the degree of the coupons immersed in H_2SO_4 were all 0 since the coating totally detached off from surface. In NaCl coating of 0:100 ratio give a better degree of rusting compared to formlation ratio 10:90, which is 6s for 0:100 and 4s for 10:90 ratio. For solvent rub test the highest thickness loss from formulation of 30:70 was obtained at 20% and 9% for Methyl ethyl ketone and acetone respectively. The best formulation out of all formulation is 0:100 which do not contain EPO. This result shows coating has fail to protect the metal from corrosion due to non existence of epoxy ring detected on FTIR analysis in the Epoxidized Palm Oil. Thus, the method of epoxidation needs to be improvised for future enhancement.

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CHAPTER ONE

1 INTRODUCTION

1.1 Research Background

Steel is one of the most valuable and preferred to be used in industries among of other structural materials such as aluminium. This is due to its properties that are mostly have a better performance at low price [1]. However, at atmospheric condition steel will tend to corrodes and which may cause to other problems such as operation disruptions, accidents and low quality of products. Corrosion is a common phenomenon in metals and the best method in corrosion prevention is not yet discovered but, the most widely used method for metals protection against corrosion is the application of coating or paints [2].

Coatings is any liquid material that were applied on the surface of a substrate, which is then form a thin solid film for the substrate's protection. Epoxy is known as the best barrier-coating material in industry due to their flexibility, high resistance to chemical and toughness[2]. Other than it has outstanding adhesion to any types of substrates, durable at high and low temperature. Good properties of epoxy resins are obtained by treating the epoxy resin with suitable curing agents such as cycloaliphatic amine and amine acid. Most of the epoxy coating used in industries nowadays are based on diglycidyl ether Bisphenol A epoxy resin. The high performance characteristics of the resins are also coming from the characteristic of the Bisphenol A that have good chemical resistance, high rigidity and adhesive properties [3]. However, Bisphenol A is produced from the petroleum that is a non-renewable source.

As shown in Figure 1, the reaction of epichlorohydrin (ECH) and Bisphenol A (BPA) will produce diglycidyl-ether bisphenol A (DGEBA) and Bisphenol A is produced from petroleum. Besides it is from a non-renewable resource, DGEBA also gives bad impact to human health. Therefore, many researchers did a study on how to replace or minimized the use of DGEBA in epoxy coating production.