UNIVERSITI TEKNOLOGI MARA

PLANT-BASED CORROSION INHIBITOR FROM EXTRACTS OF *CERBERA ODOLLAM*: STUDY OF INHIBITION EFFICIENCY ON MILD STEEL IN VARIOUS ELECTROLYTE CONDITIONS

NUR ADRYNA BINTI MOHD ROSLI

Thesis submitted in fulfillment
of the requirements for the degree of
Oil and Gas Engineering

Faculty of Chemical Engineering

July 2018

ABSTRACT

Mild steel has been greatly used for pipeline and machinery application in oil and gas industry, where exposal to corrosive environment is anticipated. Type of metals influenced by environmental properties such as existence of corrosive gas, has increased the possibility for corrosion to occur even faster. Thus, corrosion inhibitors in various types were introduced. Previously, researchers were using inorganic and synthetic corrosion inhibitors. Other than having high manufacturing cost, their high environmental toxicity threatening marine life. Hence, researchers' attention shifted to organic inhibitor from plant extracts. However, the finding of active ingredients and its efficiency is still at scarce. In this experimental study, efficiency of oil extracts from sea mango (*Cerbera Odollam*) seeds was investigated in terms of its corrosion inhibition potentials via weight loss measurements and potentiodynamic Tafel polarization technique. It was found that sea mango oil reduced corrosion rate and increased inhibition efficiency as inhibitor concentration and pH test solution increased from 2 to 7. Structural characterization of active corrosion compounds in oil samples was analysed using FT-IR and GCMS. Phytochemical screening tests were performed to detect the presence of saponin, phenol, steroid and tannin. The inhibitive properties of these extracts were likely due to the presence of oxygen and nitrogen atoms, which have evidenced from FTIR and GCMS. The adsorption of sea mango oil was found to best fit Langmuir adsorption isotherm.

ACKNOWLEDGEMENT

I would like to thank and express my gratitude to my supervisor Dr. Nor Roslina Rosli who have been consistently helping me throughout all phases of this work as well as giving guidance and insight during the completion of this thesis. I am also grateful to the Department of Oil and Gas Engineering, Faculty of Chemical Engineering for offering the facilities, materials and equipment to complete this thesis.

I would like to thank Assoc. Prof. Dr. Junaidah Jai on giving insight on corrosion inhibitor. Also, my thankfulness to Assoc. Prof. Dr. Noor Fitrah Abu Bakar for her kindness in giving permission to use her AutoLab equipment and to Mr. Shafiq from FSG, a humble being, thank you for sharing knowledgeable experience on corrosion. Lastly but definitely not least, I would like to give my sincere appreciation to my parents and friends for their endless encouragement and support.

TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

1.1 Research Background

Over the years, substantial efforts have been deployed to seek the best metal material for oil and gas industry application. Due to exhausting conventional reserves and inconsistent petroleum prices around the globe, economically viable material has become the prime aspect. Mild steel, also known as plain steel has become a stealing praise for its versatility and cost effectiveness, which most can deliver good performances for many applications [1].

Mild steel has become one of the most reliable metals to be used in oil and gas industry from exploration, production and processing to transportation and distribution of refined petroleum products. Despite the glorious side, mild steels prone to have week corrosion resistance. Industrial processes such as acid cleaning, pickling, and descaling use extensive acid-bearing fluids that results in exposing metal surfaces to corrosion [2]. Sulfur and hydrogen sulfide from production stream are common sour substances that induce corrosion to pipeline, causing main problem in transportation of crude oil. Deterioration of metal by chemical attack or interaction of metal with environment are the constant circumstances that need practical attentions to prevent damage of steel.

Previously, researchers have made studies on cathodic protection and the use of corrosion inhibitor on steel. Among these two methods, the use of corrosion inhibitor is more economical, practical and convenient compared to cathodic protection [3].

Corrosion inhibitor contains compounds that control metal surface dissolution and acid consumption [4]. These compounds displace water, adsorb on metal surface, and forming protective barrier. It interacts with anodic or/and cathodic reaction sites to decrease the oxidation and reduction of corrosion reactions. [5]