

CHAPTER I

INTRODUCTION

In oil and gas production, corrosion is a major cause of failures in the production. These failures lead to security and environmental problems, decrease in production rate and high repair cost from leakage of crude oil due to CO₂, fire accidents, water resource, and environmental pollution. These damages are included in the cost of crude oil. On the other hand, the majority of the cost-savings for any oil and gas production facilities is prevention of failure in the production equipments.

Corrosion in oil and gas production can be classified into 2 general categories. First, the internal corrosion caused by the produced fluids and gases which can be generalized or localized, depending on the operating conditions. The second is external corrosion caused by exposure to groundwater or seawater and weathering offshore. Produced effluents in oil and gas production lead to internal corrosion composing of hydrocarbon (from C₁ to complicated long chains up to 25 or even longer), acid gas (H₂S and CO₂), nitrogen, water (in vapor and/or liquid phase) and sometimes various forms of mercury. In fact, crude oil without any dissolved gas at production temperature is corrosive by itself because it comes up in the form of water-in-oil emulsion. The formation water in oil and gas fields usually contains various salts, mainly NaCl, CaCl₂, MgCl₂, KCl, and carbonate at different concentrations. In the Gulf of Thailand, the amount of CO₂ can be varied from 18-54% mol whereas the rest is N₂ and hydrocarbons. Fortunately, the existence of H₂S is considered to be trace. Besides, mercury exists in the reservoir with the range of 3-6 ppm.

The selection of materials for being used as production tubing is emphasized on the mechanical properties, especially its strength, due to the high loading that it has to carry. Another concern is the corrosion resistance. Carbon steel is mostly used due to its advantages such as cost, availability, and strength (Lopez *et al*, 2003). However, in some conditions where carbon steel is not durable, stainless steel is more attractive as it provides better corrosion resistance. Chromium present in the steel forms chromium oxide known as a passive layer which can act as a

barrier in preventing material to be encountered with the aggressive solution, however, it is much more expensive than carbon steel. Smart design of appropriate type of steel for tubing of production well instead of unnecessary use the whole design with stainless steel could help for cost minimization.

In this work, two kinds of material were used for corrosion study in the natural gas production located in the Gulf of Thailand. The condition corresponding to the gas field was simulated. The factors such as temperature, P_{CO_2} , pH, chloride concentration, and mercury were investigated. The experiments were carried out using both immersion test and potentiodynamic polarization technique.