

UNIVERSITI TEKNOLOGI MARA

**THE EFFECT OF AGING ON
CRITICAL CARBON NUMBER
(CCN) DURING WAX DEPOSITION
ANALYSIS**

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ABSTRACT

The process of aging is a critical carbon number (CCN) exists in counter diffusion phenomenon. In the wax deposition phenomenon, the wax molecules with carbon numbers higher than the critical carbon number (CCN) will diffuse into the gel matrices and vice versa in aging process during experiments. The petroleum industry has major problem which is wax deposition that cause the hindrance in subsea pipelines. The experiment of aging of wax deposition was carried out with time and temperature by using cold finger device. Furthermore, the analysis of carbon number distribution was performed by Gas Chromatography-Mass Spectrometry (GC-MS) carefully. In this analysis, when the time increases from 2 to 24 hour, the higher carbon number and wax content in deposition was increases. The aging of wax deposition caused the increasing in the hardness of deposit. In addition, the higher temperature provide effective outcome on the wax content and little outcome on critical carbon number (CCN). The bulk oil temperature was used to determine the hardness of the deposit.

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CHAPTER 1

INTRODUCTION

1.1 Background Study

The petroleum industry is still dogged by a serious problem that occurs on the production and transportation subsea pipelines. The problems is involving the wax deposition evolution. Wax deposition that accumulate on the inner wall of subsea pipelines may causes the pumping power increases, the flow rate reduce and blockage of pipeline. The petroleum industry was loss billions of dollars yearly from this problem. The loss was based on the treatment cost, wells close in, incompetent uses of production quantity, production reduction, choking of stream lines, immature abandonment and increases labour (Yong, 1996). Wax deposition occurs due to the decrease in temperature and pressure during oil production operations which induces the precipitation wax crystals to form from crude oil and deposit into pipeline walls.

Crude oil is a mainly composed of various hydrocarbons such as paraffins, naphthenes, aromatics, asphaltenes and resins. It founds that hydrocarbons also known as n-paraffins are responsible for wax deposition formation. The gel oils alludes to n-paraffin particles that contain in wax deposition was ranging with carbon number from 10 to 50 (Roehner et al., 2002). The solubility of n-paraffins decreases with decreasing temperature and pressure. At the offshore reservoirs temperatures (70-150°C), the wax particles fully diffused in the blend and the crude oil acts as Newtonian fluid with low momentum. As waxy crude oil assent the reservoirs and moves through the ocean floor, the temperature begins to drops. The temperature decreases causes wax to deposit on the wall of pipelines and the wax deposition was formed.

Lately, the wax content in the deposit layer change with time is known as aging. The aging process lead the substantial n-paraffin elements dispersed inside the deposit lamina, while the light n-paraffin elements dispersed outside of the deposit lamina. The time changes causes the deposit lamina to harden. The highest n-paraffin elements dispersed outside of the deposit and called as critical carbon number (CCN). The harden deposit that causes by aging of wax deposition become troublesome to remove by pigging. Pigging is the most typical remediation method to rub off wax deposition. The