

UNIVERSITI TEKNOLOGI MARA

**TREATMENT OF CRUDE OIL-
CONTAMINATED SAND: POROSITY
AND PERMEABILITY STUDY**

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ABSTRACT

Sand production remains as major issues in oil and gas industry. Current sand management in oil and gas is involved transportation onshore that is costly, time consume and required high amount of manpower. Improvement of this sand handling techniques such as treat and disposal sand offshore requires detail information of contaminated sand properties. Previous studies focused more on geotechnical properties of crude oil-contaminated sand but not in its chemical properties. This research of studies was undergone to gather more information on crude oil-contaminated sand characterization details on the porosity, permeability and chemical composition. For porosity, real sand sample has porosity of 67.1% and model sand sample has porosity of 46.6% calculated by lab manual calculation and later on, proved by observation on FESEM. Constant head sand pack permeability test was used to determine permeability of sand samples. Real sand sample value of coefficient, $k=0.23$ cm/sec with deionized water, and $k=0.14$ cm/sec with brine. Model sand sample value of coefficient, $k=2.04$ cm/sec with deionized water and $k=1.92$ cm/sec with brine. FTIR were used to identify compositions of real sand sample, model sand sample and contaminant. Sand samples consist of quartz, feldspar, clay and carbonate while contaminant has aromatic, alkane and ester. The composition of sand was rechecked by using EDX that was assembled to FESEM.

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CHAPTER ONE

INTRODUCTION

1.1 RESEARCH BACKGROUND

Sand is a loose granular material composed of rock and minerals particle that is form from weathering process. Sand also can be referring as a qualitative classification instrument, textural class of soil or soil type. Sand composition varies depending on the location of the sand, source of rocks and conditions during weathering. Sand is finer than gravel but coarser than silt. However, the range of sand size vary depends on certain departments and system. For instance, US Standard Sieves defines that sand particles have diameter between 0.074 and 4.75 millimetres (mm) [1]. Crude oil is defined as naturally occurring, unrefined petroleum product that composed of hydrocarbon deposits and other organic materials.

In oil and gas industry, sand production during production phase is really important. Sand production is the flow of formation sand together with the reservoir fluids to the surface. It is initiated when the rocks around perforation fail causing the loose grains to be carried by fluids into the borehole. This situation depends on several factors such as stress state, completion techniques and reservoir rock consistency. Sand production usually occurred when the reservoir rocks have low formation strength and tend to failure under the in-situ conditions and the changes of imposed stress during hydrocarbon production.

Sand production is the cause of serious problems in oil and gas industry. Sand production affects the production rates adversely by damaging equipment either subsea or downhole, damaging surface facilities and increase risk of failure [2]. The problems include pipeline erosion, failure of sand control completion, plugging of perforations, borehole instability, environmental effects and Increase in the cost of clean-up and remedial operations. Besides, produced sand costs the oil and gas industry tens of billions of dollar annually[3].

Sand control techniques were preferred to use in order to control sand production. However, the sand control techniques only can minimize the amount of