

UNIVERSITI TEKNOLOGI MARA

**QUANTIFICATION AND
CHARACTERIZATION OF
INTERACTION BETWEEN
NANOPARTICLES AND FINES
SUSPENSION**

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ABSTRACT

This research was conducted to study the effect of using nanoparticles on the migration of fines through the pore throat in the reservoir formation. A different types of nanoparticles were used to find the most effective nanoparticles among them to be applied in the real situation in future. A laboratory work such as static adsorption test, zeta – potential, FESEM – EDX analysis and soaking test were performed to analyse the samples. Static adsorption test is important to know the stability of the samples (glass beads) with nanoparticles. FESEM – EDX analysis was used during this experiment to visualize the real effect of using nanoparticles in term of their ability of attachment with nanoparticles which lead to fines migration prevention. Zeta potential was measured by using zeta potential analyser whereas soaking test experiment was conducted by using bentonite and different concentration of nanoparticles to measure the rate of adsorption hence to find the most effective nanoparticles that can be used to prevent the movement of fines in the pore throat. From the experimental results, MgO with 1.0% became the most effective nanoparticles used to prevent fines movement due to higher adsorption rate from soaking test experiment.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

The use of nanotechnology in the petroleum industry is not a new thing. From the previous recent project, it has shown that nanotechnology has the potential in solving and managing several problems in the petroleum industry. In recent years, it already used in the oil and others sector for many times. For example, the rheological properties in drilling mud technology can be improve by using nano-sized clay particles and under extreme downhole conditions, nanomaterial can be used as a sensors for imaging processes (Mokhatab, Fresky, & Islam, 2006). One of the most general or common used of nanotechnology application is in the phase of Enhanced Oil Recovery (EOR). Due to the recent global rise in energy demand nowadays, EOR became an important choice in order to increase the productivity rate in the petroleum industry. There are a few types of nanoparticles that are commonly used including Aluminium Oxide, Zinc Oxide, Magnesium Oxide, Iron Oxide, Zirconium Oxide, Nickel Oxide, Tin Oxide and Silicon Oxide. Table 1 shows the properties of some nanoparticles.

Table 1.1 The Properties of Some Nanoparticles

No.	Type of Nanoparticles	Particles size(nm)	Surface area(m ² /g)
1	Aluminium Oxide	40	~60
2	Magnesium Oxide	20	~50
3	Iron Oxide	20 – 40	40 – 60
4	Nickel Oxide	100	6
5	Tin Oxide	50 – 70	10 – 30
6	Zinc Oxide	10 – 30	90
7	Zirconium Oxide	20 – 30	35
8	Silane Treated Silicon Oxide	10 – 30	>400
9	Hydrophobic Silicon Oxide	10 – 20	100 – 400

In the industry, many studies have been done in order to know the ways to control and prevent the migration or movement of fines in the reservoir formation hence