# Detecting the Quality of Oil-Contaminated Drinking water and Efficiency of oil removal by Nano-fluid using the Electrical Resistivity

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**Abstract**

In this study the efficiency of oil removal using a coconut oil based nano-fluid was studied using the electrical resistivity of the contaminated water as the indicating parameter. Two different percentages 33.25 % and 66.5 % oil contaminated water samples were studied. Crude-oil used for contamination was from the Chevron group. Coconut oil based nano-fluid had a concentration of 1% by volume. Electrical resistivity of the oil was > 1000 Ω-m and the nano-fluid was greater than that of oil. Water used for this test had an electrical resistivity of 24.7 Ω-m. After the contamination of 33.25 % and 66.5 %, the electrical resistivity of the water sample increased to 150 Ω-m and 273.8 Ω-m respectively. After the nano-fluid was introduced into the contaminated samples, electrical resistivity of the samples reduced to 37.3 Ω-m and 42.1 Ω-m respectively. Resistivity of the samples was monitored simultaneously and 5g of nano-fluid was found to be economic for both the samples. Efficiency of oil removal was found to be 0.87 after 15 min and 0.94 after 24 hours of addition of nano-fluid.

## 1. Introduction

When a hurricane crashes onto shore with destructive winds and deadly storm surge, its threat to clean water supply is a major concern. Consuming contaminated water can lead to serious health problems, including gastrointestinal illness and reproductive issues, according to the Centers for Disease Control and Prevention (CDC) [1]. Well owners affected by the storm are encouraged to test their systems and seek appropriate remedies as soon as possible. During and after flooding, water can become contaminated with microorganisms such as bacteria, sewage, heating oil, agricultural or industrial waste, chemicals and other substances that can cause serious illness [2].

## 2. Objective

The objective of this study was to quantify the efficiency of oil removal from water by nano-fluid using the electrical resistivity of water as the detecting parameter.

## 3. Materials and Methods

Crude-oil used for contamination was from the Chevron Corporation. A super-magnetic magnetite coconut based fluid was used in order to recover oil from the contaminated water samples. The OFITE API Electrical Resistivity device was used to monitor the water samples. 1000 mL beakers were used to prepare the samples for contamination with oil. Prior to the test, density and resistivity of the fluids being used in the test were measured. Two beakers were filled with water to 1000 mL, one being sample A and the other sample B. Sample A was contaminated with 332.5 g of oil and sample B with 665 g. Pipettes were used to collect the contaminated samples and measure the electrical resistivity. Electrical resistivity was measured for successive additions of 5 g of oil initially and 50g towards the end of the test. The nano-fluid (1% by vol.) was introduced into the contaminated water samples. The electrical resistivity of contaminated samples was measured for successive additions of 0.5 g of nano-fluid. The test was stopped when there wasn't any appreciable change in the electrical resistivity of oil-free water.

## 4. Results and Discussion

The density of nano-fluid and crude-oil were found to be 0.77 and 0.67 g/cc, compared to water of 1 g/cc. The resistivity of nano-fluid and crude-oil were found to be greater than 1000 Ω-m. Adding oil in to sample A and B increased the electrical resistivity of water from 24 Ω-m to 150.2 Ω-m and 273.8 Ω-m respectively. After addition of 5g of nano-fluid into the samples A and B, electrical resistivity of water decreased to 37.3 and 42.1 Ω-m respectively. Efficiency of oil removal ($\eta$) was calculated based on the equation (1)

$$\eta = \frac{\rho_{cw} - \rho_{fw}}{\rho_{cw} - \rho_{pw}} \quad \text{---- (1)}$$

$\rho_{cw}$ = Resistivity of contaminated water
$\rho_{pw}$ = Resistivity of pure water
$\rho_{fw}$ = Resistivity of contaminant free water

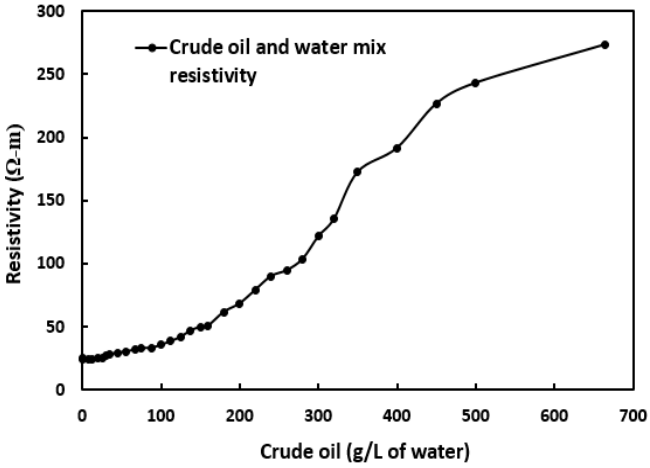


**Fig 1: Resistivity vs addition of crude oil into water**

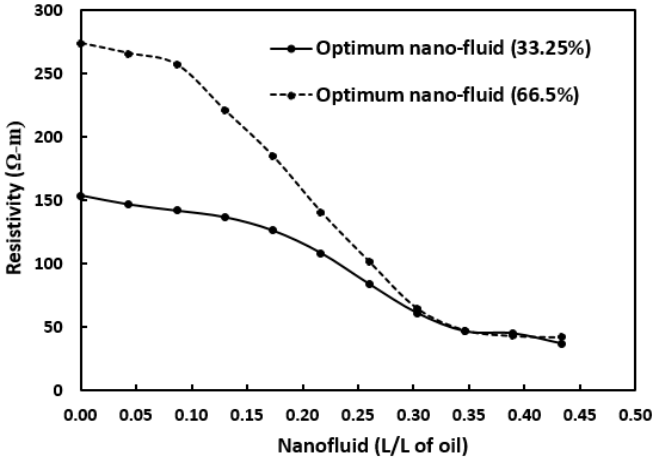


**Fig 2: Resistivity vs addition of nano-fluid**

Efficiency of oil removal was found to be 0.87 after 15 min and 0.94 after 24 hours of addition of nano-fluid.

## 5. Conclusions

a) Nano-fluid of 0.4 L/L of oil was found to be the optimum and economic amount of addition to get maximum quantity of oil removed from water.
b) Efficiency of the oil removal increased with time. It was 0.87 after 15 min of addition of nano-fluid and 0.94 after 24 hours.

## 6. Acknowledgements

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## 7. References

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