Effect of Lime on Modified Oil Based Drilling Mud (OBM)

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Abstract
In this study, the effect of lime contamination from the formations on a modified oil based drilling mud(OBM) was investigated. Adding 0.5% surfactant (sodium dodecyl sulphate, SDS) substantially reduced the resistivity of the OBM. Contamination with lime not only increased the pH but also changed the electrical resistivity. With 2% lime contamination the electrical resistivity increased by over 1300%.

1. Introduction

Oil based drilling muds contain a mixture of an oil-base fluid and an aqueous-brine fluid and the typical ratio is approximately 3. Oil-based mud systems are widely used in many deep-water environments, particularly systems where unconsolidated sediments and swelling clay minerals are common. Main advantage of OBM over a water based mud is that the external phase (oil) coats and protects metal surfaces of the drilling equipment to minimize corrosion from H2S and CO2, Another important advantage is that free lime, Ca(OH)2, can be carried in an oil mud to neutralize an influx of these acidic gases (Garrett1988; Adebayo, 2011). Calcium salts are sufficiently soluble in water/drilling mud to cause problems with clay flocculation. The pH of the solution also affects the solubility of many thinners and divalent metal ions such as calcium and magnesium, and influences the dispersion or flocculation of clays (Chaney 1942). Maintaining an excess pH controlling agent is particularly important for some fluid system because these systems will lose all rheological properties if the pH was allowed to drop to less than 7 (Robert 2004). The control of many drilling fluid system properties is dependent on pH. Moreover, the pH of drilling mud is controlled in range of 8.5-10 for corrosion prevention of drilling device and good behavior.

2. Objectives

The overall objective was to investigate the effect of lime contamination on the resistivity of OBM. Also, the change in the pH of OBM with varying percentages of lime was investigated.

3. Material and methods

In this study, oil based drilling mud samples were prepared by mixing by vegetable oil, bentonite, water and Ca(OH)2. The ratio of oil to water was 4: 1. Five 4% of bentonite drilling mud samples were prepared. OBM without any additive was the control sample. The rest four samples were mixed by adding 0.5% surfactant and different amount of Ca(OH)2 under room temperature (Table1). And, the resistivity of all of samples was measured using a conductivity meter for one hour after mixing it for 60 seconds.

Table 1 Summary of the Test Results

Sample No.	Formulation				Measurement	
	Oil:Water (by Vol.)	Bentonite (% by wt.)	Surfactant(%)	Lime(%)	PH	Resistivity mean (Ω·m)
Sample 1	4	4.0%	0.0%	0.0%	8.2	43687.3
Sample 2	4	4.0%	0.5%	0.0%	9.5	30.8
Sample 3	4	4.0%	0.5%	0.5%	11.8	28.2
Sample 4	4	4.0%	0.5%	1.0%	12.3	68.1
Sample 5	4	4.0%	0.5%	2.0%	12.1	375.1

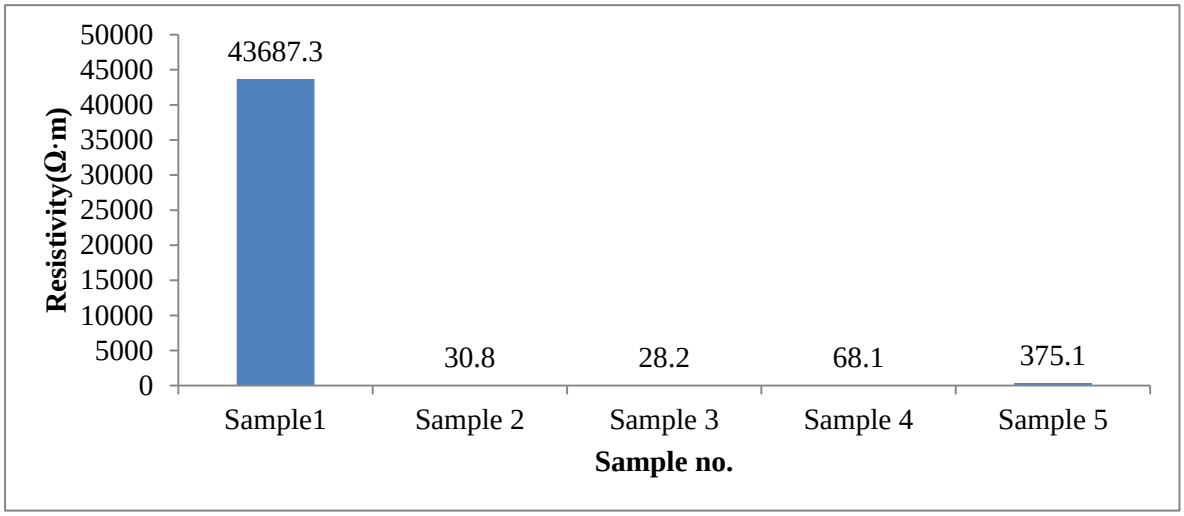

Figure 1. Relationship of pH and Resistivity of OBM with Surfacant and Lime

4. Results and discussion

As summarized in Table 1, for the Sample 1 with oil, water and bentonite, the mean resistivity was very high and was about 43687 Ω·m. Adding 0.5% surfactant (SDS), the resistivity of Sample 2 decreased sharply to 30.8 Ω·m. Also, surfactant changed the pH of OBM from 8.2 to 9.5. For Sample 2 and 3, the resistivity after contaminating with 0.5% lime were 30.8 Ω·m and 28.2 Ω·m respectively, and the pH changed from 9.5 to 11.8. It indicated a certain percentage of lime can control pH well in oil based mud as a pH agent. But the resistivity of Sample 5 increased with the addition of more lime (2%) compared to Sample 3 and 4. With 2% lime the modified OBM resistivity in Sample 5 was increased. From observation, Samples 5 had more free oil because aggregation happened, resulting in increase in resistivity.

5. Conclusion

Oil based mud (OBM) consistency was improved by adding surfactant (sodium dodecyl sulphate, SDS) and it reduced the electrical resistivity substantially compared to the sample without surfactant. Contamination of over 0.5% of lime increased the electrical resistivity of the OBM.

6. Acknowledgement

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7. Reference

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