Effect of Salt on the Electrical and Rheological Properties of a modified Ester based Drilling Fluid

R. Prasad[1], C. Vipulanandan[1],Ph.D.,P.E. and D. Richardson[2]
[1]Center for Innovative Grouting Materials and Technology (CIGMAT)
Department of Civil and Environmental Engineering
University of Houston, Houston, Texas 77204-4003
Email:raashi.r@gmail.com, cvipulanandan@uh.edu Phone: (713) 743-4278
[2]Program Manager – RPSEA, Sugar Land, Texas 77478

Abstract
In this study the effect of sodium chloride salt (NaCl) on the rheological properties and electrical resistance of a modified ester based drilling fluid (70% ester, 30% water) was considered. The rheological properties studied following API standards included the plastic viscosity and yield strength and the salt content in water was varied upto 30%. Salt had greater effect on the yield strength and electrical resistivity compared to the plastic viscosity with 10% salt, the resistivity increased 500 times. The yield strength increased by over 300% with 30% salt. Also, the electrical resistivity correlated to the rheological properties.

1. Introduction

Oil based drilling fluids have been used for a long time and the base was mostly mineral oil or diesel oil. (3). Due to strict EPA standards (Environmental Protection Agency) and environmental safety constraints, there is an urgent need to develop an eco-friendly drilling fluid which would cause less harm to the environment during and after its use while disposing. Ester based drilling fluids are very popular due to their high bio-degradability, low toxicity and also their excellent performance in the field. They are now being used extensively in Gulf of Mexico (2). Hence there is interest in better quantify the effect of salt contamination on the flow properties of the ester drilling fluid.

2. Objective

The objective of this study was to investigate the effect of sodium chloride salt on the rheological and electrical properties of an ester based drilling fluid (70% ester, 30% water).

3. Materials and Methods

The control sample of ester based drilling fluid had 30% water and 70% ester with an admixture of 0.2% additive by weight of the ester. The admixture was added to modify the electrical properties of the drilling fluid and reduce its resistance since the electrical resistance of the ester was of the order of Terra ohms. Salt was added as a % by weight of water content in the drilling fluid and was varied upto 30%. Viscosity of all the samples was measured using Baroid FANN Viscometer – Rheometer model 280; subjected to 300 rpm and 600 rpm as per API standards. The electrical resistance was measured by subjecting using a multimeter with the two probe method. All tests were performed at room temperature and pressure.

4. Results and Discussions

As shown in Fig.1, the electrical resistance increased by over 500% with 10% salt content, indicating that the salt was interacting with the ester. When the salt content was above 10% salt it also increased the yield strength and plastic viscosity, but had greater effect in the yield strength and electrical resistance. Yield strength increased by over 300% with 30% salt content in water. The plastic viscosity increased by over 50% with 30% salt. This can be seen in Fig.2.

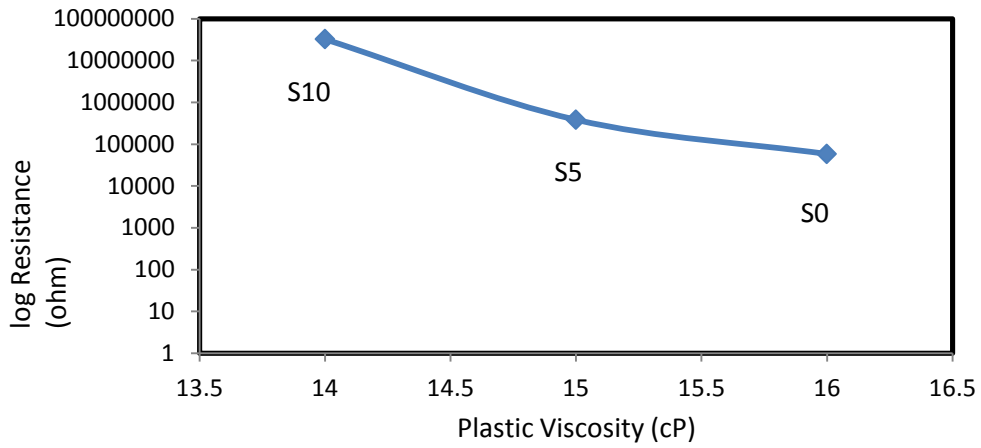

Figure 1. Variation of resistance (log) with plastic viscosity

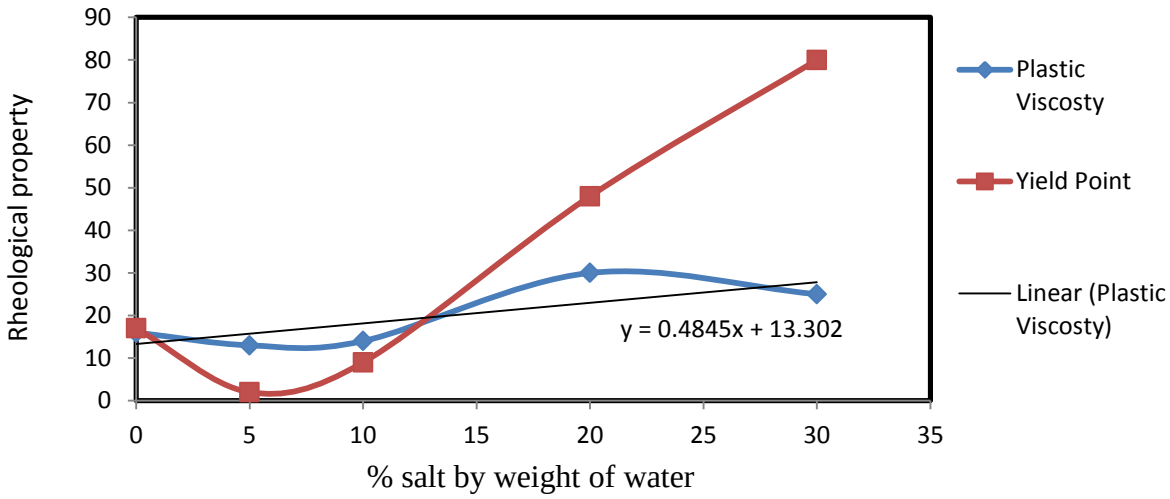

Figure 2. Variation of plastic viscosity and yield point with %salt

5. Conclusion

Salt affected the viscous parameters of the modified ester based drilling fluid. Sodium chloride contamination of the modified ester based drilling fluid had greater effect on yield strength than the plastic viscosity. Electrical resistance increased considerably with the addition of salt.

6. Acknowledgement

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7. References

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