THE FEASIBILITY STUDY OF USING LOCAL HEMATITE AS WEIGHTING MATERIAL IN AN OIL-BASED MUD SYSTEM

ISSHAM BIN ISMAIL,

Lecturer,
Department of Petroleum Engineering,
Faculty of Chemical & Natural Resources Engineering,
Universiti Teknologi Malaysia,
Jalan Semarak,
54100 Kuala Lumpur.

AHMAD KAMAL BIN IDRIS,

Lecturer,
Department of Petroleum Engineering,
Faculty of Chemical & Natural Resources Engineering,
Universiti Teknologi Malaysia,
Jalan Semarak,
54100 Kuala Lumpur.

ABSTRACT

This paper discusses the prospect of utilising local hematite as weighting material in an oil-based mud system. The discussion is based on laboratory experiments, which were performed at the Faculty of Chemical and Natural Resources Engineering of Universiti Teknologi Malaysia.

In this study, the performance of local hematite was evaluated by comparing it to barite, a conventional weighting material used in the oil industry. All the tests were performed according to the API standard procedures.

The preliminary results from this study reveal that the local hematite has the potential to be used as weighting material in oil-based drilling fluid.

INTRODUCTION

Petroleum industry is one of the main contributors to Malaysia economy. In the petroleum industry, before oil can be produced from a reservoir, an oilwell has to be drilled first in order to furnish a conduit between the reservoir and surface. When an oilwell is being drilled, drilling mud has to be used in order to carry drill cuttings to surface, to cool the drilling bit and also to provide sufficient hydrostatic pressure across the high pressure zones. Practically, the hydrostatic pressure has to be 250 psi (1,724 kPa) to 450 psi (3,103 kPa) higher than the formation pressure. Failure to furnish sufficient hydrostatic pressure across the zones will cause influx of formation fluids, and this phenomenon may lead to blowout if the influx couldn't be stopped in a relatively short time.

In drilling an oilwell, barite is normally added into the mud system in order to obtain the mud weight required which in turns will yield the predetermined overbalance pressure across the sandface (Simposium, 1985). The current consumption of barite in Malaysia is around 20,000 tonnes/year and it is locally produced. With the expected increase in drilling activities and dwindling of reserves, it has been anticipated that the supply of barite, which has been used as the principle material for weighting muds, may fall short in the foreseeable future. Therefore, there is a need to look for an alternate local weighting meterial.

Hematite is one of the local materials which is being studied by the Department of Petroleum Engineering presently. Generally, hematite is an iron-based minerals (Haaland and Tuntland, 1981) and can be found abundantly at many locations in Malaysia.

MATERIAL DAN LABORATORY TEST

The raw hematite sample used in this study was ground to meet the *API specification* set forth for hematite. Two types of oil-based muds were prepared with mud A utilising local barite and mud B utilising local hematite as weighting agents. The range of mud density under study was from 8.5 ppg (1,018 Kg/m^3) to 13.0 ppg (1558 Kg/m^3).

The static fluid properties namely apparent viscosity, plastic viscosity, yield point and gel strength, were measured by using the *Baroid Rheometer*. Whilst the density of muds were measured via a mud balance.

The solid content of those two samples used were also measured via the conventional method.

All the tests were performed according to the *API* standard procedures.

RESULT AND DISCUSSION

Generally, the preliminary results reveal that local hematite has the potential to be used as weighting material, as shown by Figures 1 to 5.

Figure 1 shows the relationship between mud density and solid content. It is found that the oil-based mud sampel with hematite gave lower solid content compared to barite sampel. This phenomenon is due to the hematite's specific gravity which has higher value than barite (Hurbult, 1958). Generally, in the

drilling operations, drilling mud with low solid content can increase the drilling rate which in turns will reduce the rig time required (Gatlin, 1960).

Figure 2 reveals the relationship between mud density and apparent viscosity. The result produced by hematite sample was found to be comparable to the barite sampel's viscosity curve. The relationship between mud density and plastic viscosity which is depicted in Figure 3, reveals that at lower mud densities, it is found that the hematite sampel gave higher plastic viscosity than barite sample. But at higher densities, the plastic viscosity of barite sample was found to be higher than the results produced by hematite sample. This fenomenon might be due to the large amount of suspended particles present in the barite sample. The collision among those particles has increased the plastic viscosity drastically and these effects can only be realised significantly at higher densities.

Figures 4 and 5 show the relationships between mud density and yield point, and between mud density and gel strength respectively. From those two figures, it is found that the hematite sample gave higher yield point and gel strength readings compared to the results obtained from the barite sample. This might be due to the iron-based character of the hematite itself which had to undergo mixing process when preparing the mud sample.

CONCLUSION

Based on this preliminary studies, the following conclusions can be made:

- Local hematite has the potential to be used as weighting material in drilling mud.
- The rheological properties of hematite mud sample are found to be comparable to the results produced by barite mud sample.
- The hematite mud sample is found to give lower solid content than barite.

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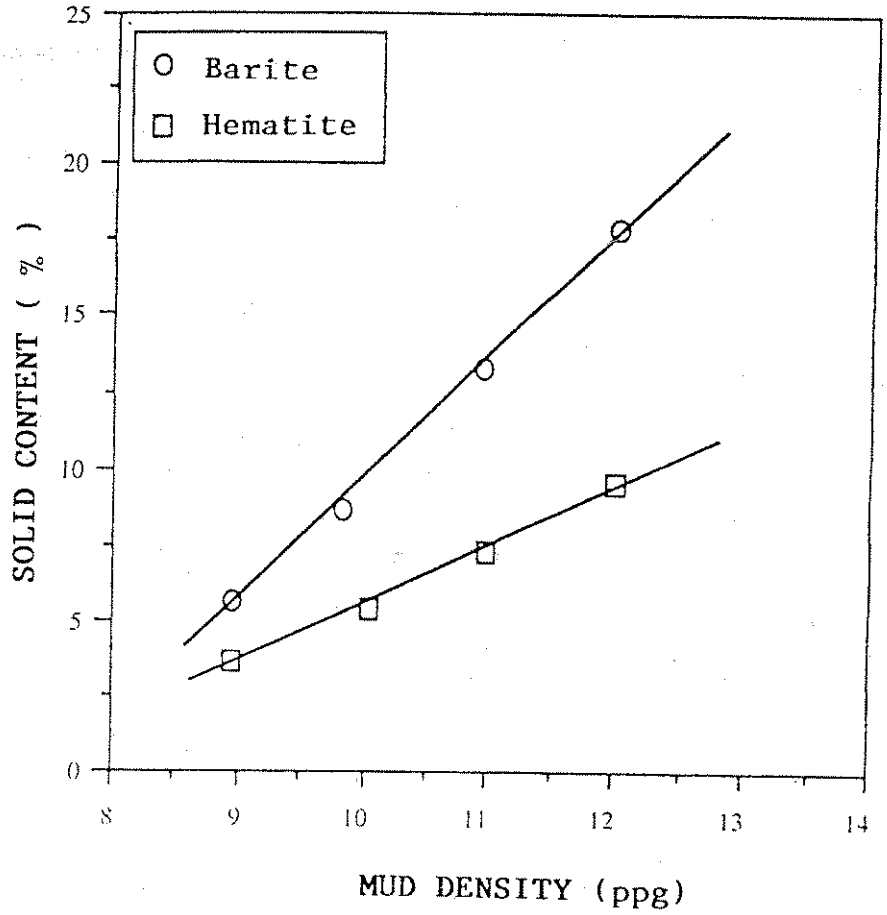

Figure 1: SOLID CONTENT vs MUD DENSITY

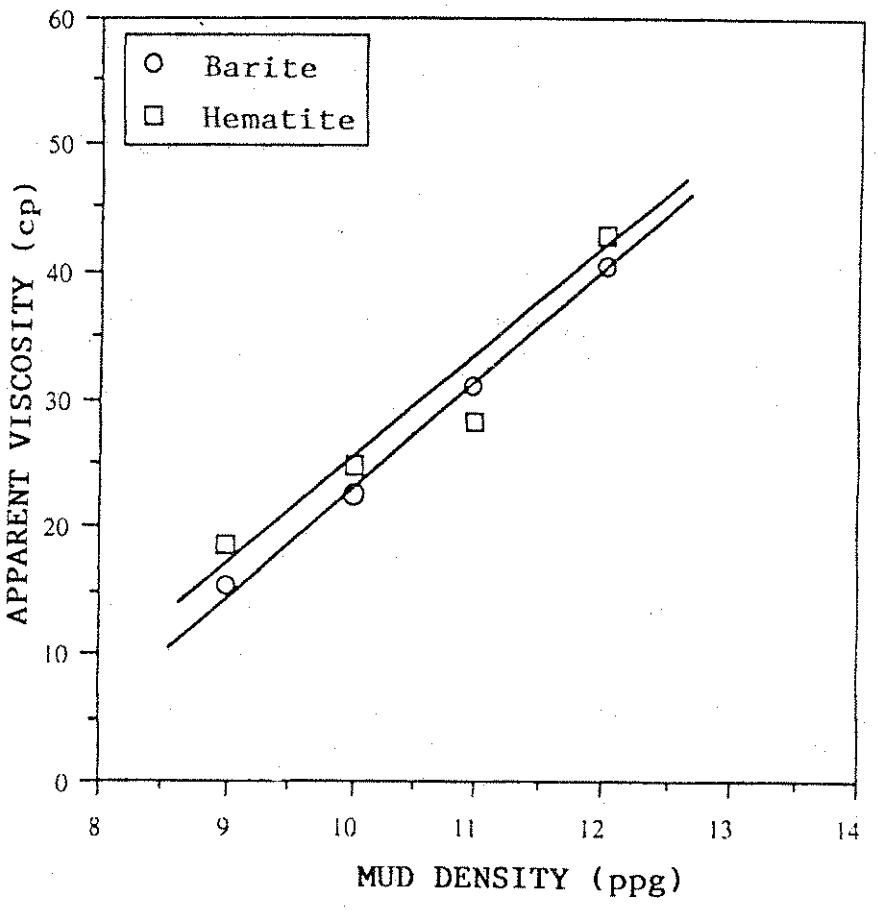

Figure 2: APPARENT VISCOSITY vs MUD DENSITY

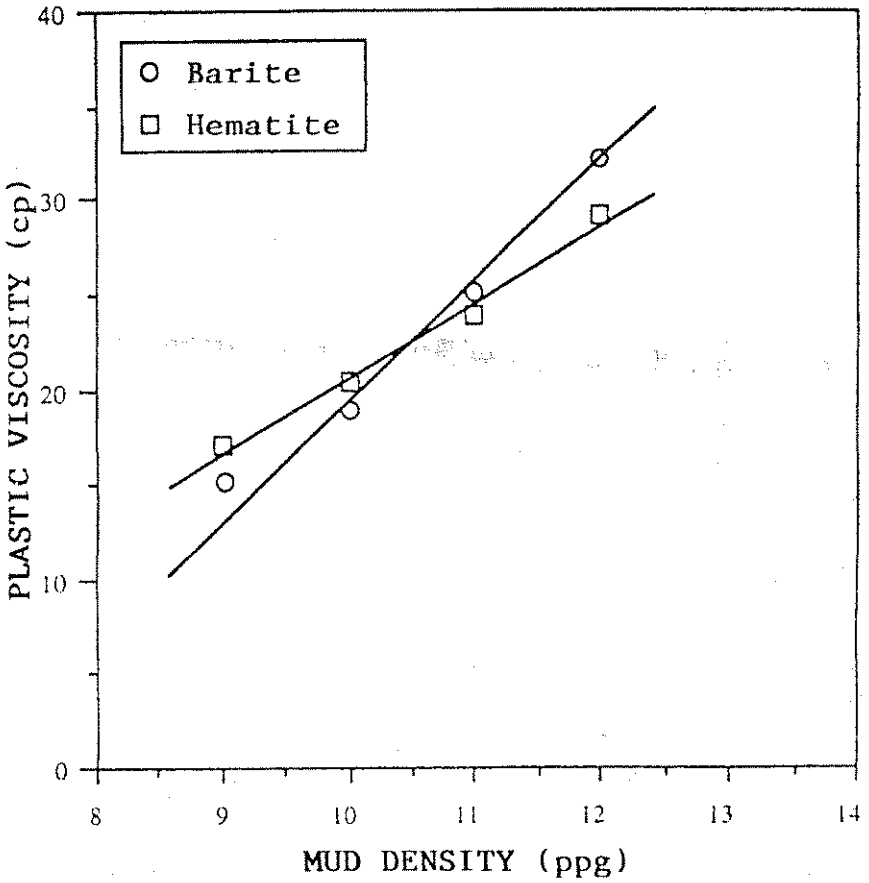

Figure 3: PLASTIC VISCOSITY vs MUD DENSITY

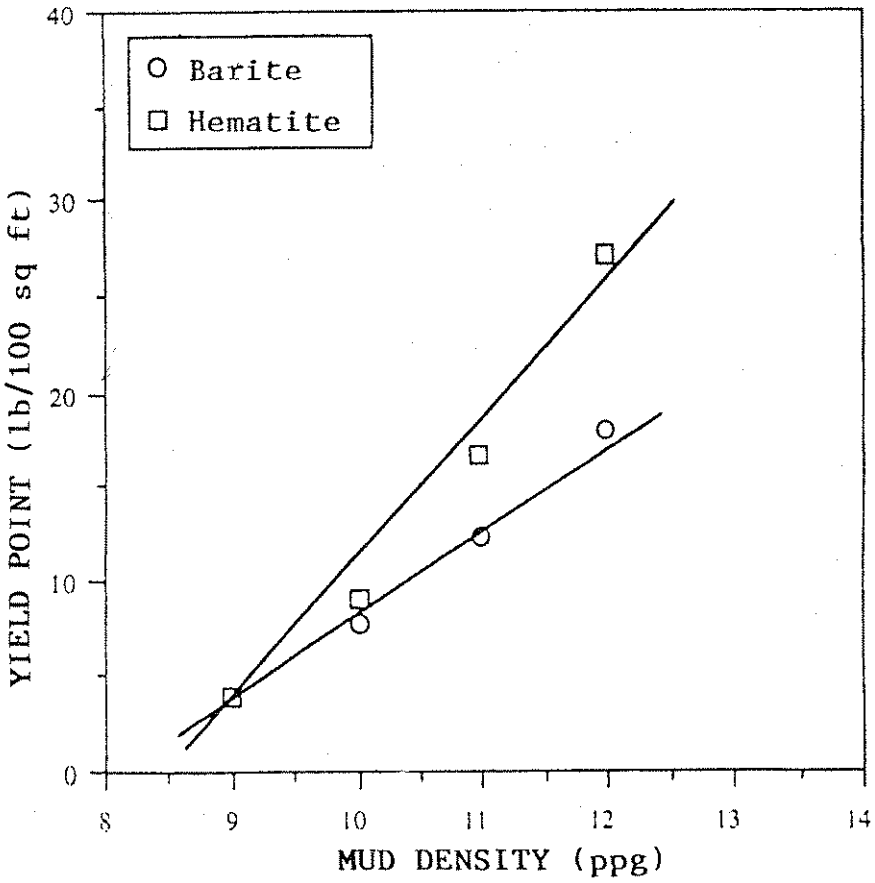

Figure 4: YIELD POINT vs MUD DENSITY

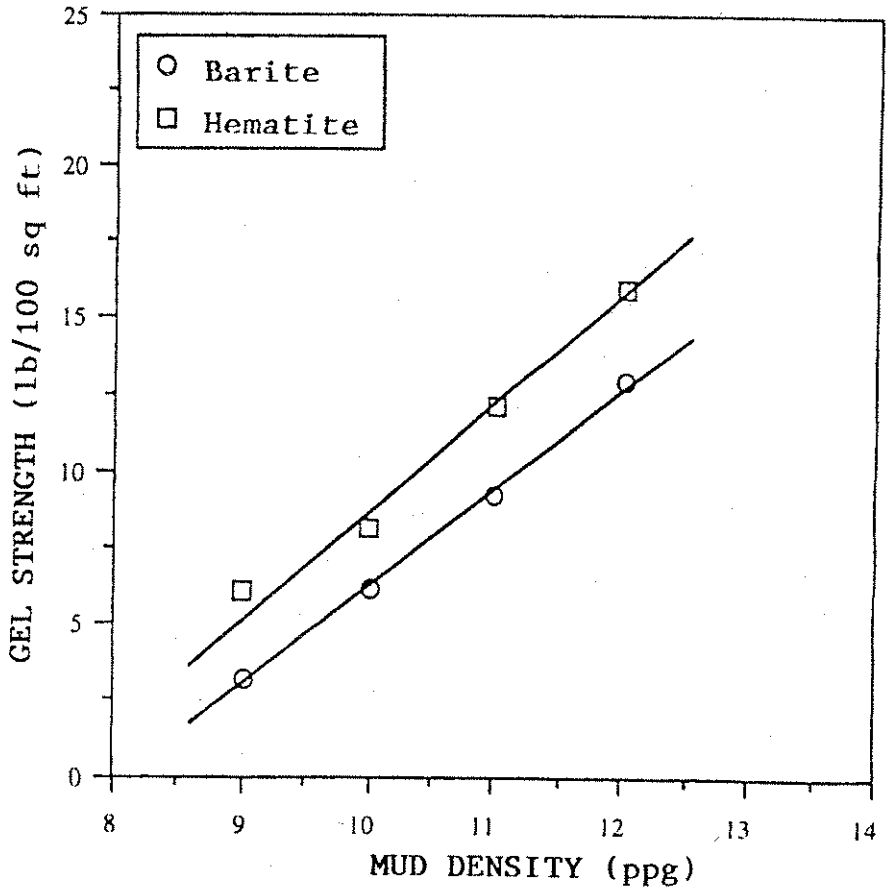

Figure 5 : GEL STRENGTH vs MUD DENSITY