Rheonova
Rheological Solutions for Industry

CASE STUDY
PETROL

Field rheometer for waxy crude oils

Objectives

Waxy crude oils have a complex rheological behaviour. The presence of wax leads to yield stress and shear-thinning properties, but also to a dependence on thermal and mechanical history. In situ measurements are the key to an enhanced characterisation of the oil as wax does not suffer the consequences of transport or changing environmental conditions. The effect of additives in reducing viscosity of crude oil can be on field controlled, in order to validate ASTM requirements (Figure 1).

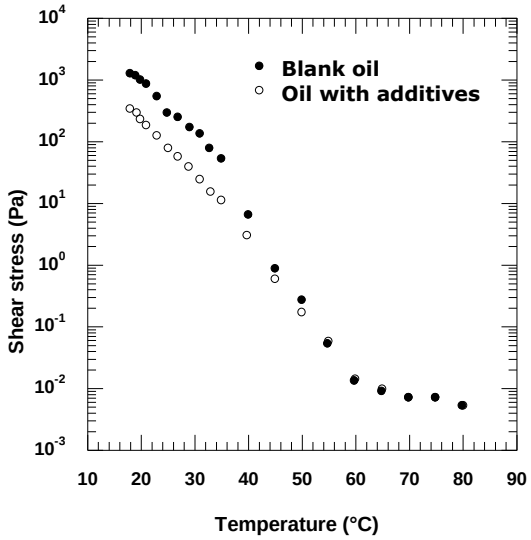

Figure 1: Influence of additive on the rheology of a waxy crude oil

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Design, manufacturing and validation

The figure 2 shows the new field rheometer.

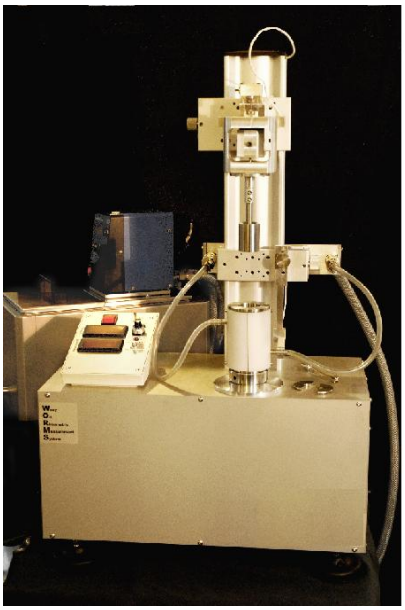

Figure 2: Complete view of the field rheometer for waxy crude oils

The main features of the designed field rheometer are:

- Thermal kinetics controlled by bath circulator to recreate the thermal cycles of the process
- Couette geometry allowing balance between necessary volume of sample, possible granularity and ease of use. An equipment designed with internal fluid circulation for temperature control
- A measuring head mounted on hard metal tips to provide great rotation without any classical air device
- A torsion bar allowing adjustable range of torque measurement,
- An easy-to-use software allowing temperature control, measurement settings and data acquisition.
- Manual or PC control (specific software was been developped),
- Shear rate range: 0.005 to 50 s-1,
- Two tests available:
    - Flow curve
    - Vane test (simple method for yield stress measurement).

The validation by comparing with data obtained with a conventionnal laboratory rheometer shows that the new field rheometer gives equivalent measurements (Figure 3).

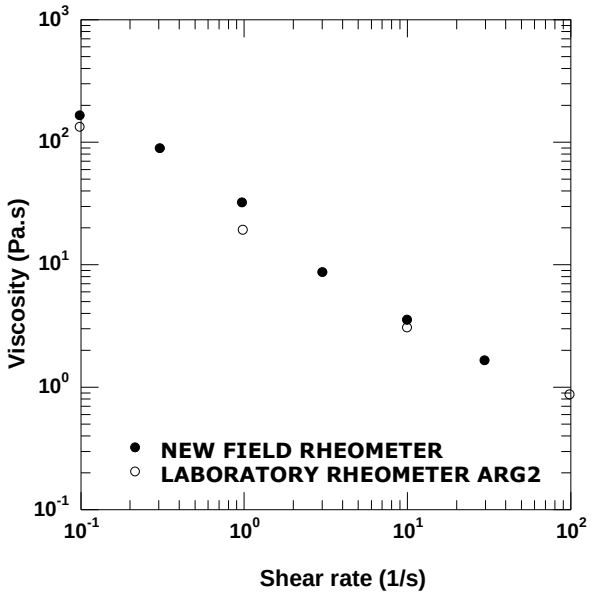

Figure 3: Comparison between viscosities obtained by the new field rheometer and by a conventional laboratory rheometer

Results

The rheometer has been installed in Africa near exploitation sites. The rheometer is now used on site and aimed to compare flow curves to ASTM methods. It appears that this new field rheometer is a well-adapted way to obtain valuable data based on rheological properties, which can be compared to ASTM method which is empirical. More over measuring rheological behaviour allows to study the influence of crude oils on the processes, and to adapt their settings if needed.

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