APPLICATION NOTE

STABILITY OF PETROLEUM OIL

Crude oils and heavy fuels are complex colloidal mixtures containing high added value products such as fuel but also many by-products (water, minerals, asphaltenes, *etc.*). These latter can cause various problems during the oil transformation (aggregation, pipe blockages, emulsion formation, *etc.*). To overcome these technical issues, chemical additives are used. It is therefore interesting to have a technique that can help identify the most suitable additive, but also to measure accurately the stability of oil or emulsions.

Application 1: Efficiency of additives for de-emulsification

Water is inevitably incorporated in the crude during the extraction. It can also be used to decrease the viscosity of the crude oil and to allow an easier pumping during extraction and transport. However, once the crude has been extracted, water is no longer required and need to be separated from the valuable hydrocarbon part. This process has to be quick but can be significantly delayed due to the presence of surface-active compounds in the crude or various additives used during the extraction (*e.g.* asphaltenes, corrosion inhibitors).

× **Common method:**

Bottle tests are used to monitor the efficiency of additives on the de-emulsification of crude oil. They are easy to perform but can take a long time waiting for the full separation and are subject to the judgement of the experimenter who measures the thickness of the phases and in some cases their relative opacity.

Bottle tests are a tedious and subjective exercise that is time consuming.

× **Turbiscan® method:**

The Turbiscan® enables to replace bottle tests efficiently with its scanning device and its two detectors in transmission and backscattering. Detection of phase separation is therefore much quicker and objective than visual observation. The thermoregulation (up to 60°C) can be used to accelerate the phenomenon even more. Moreover, the opacity or transparency of the phases can be quantified optically and not left to human appreciation. Different samples can be easily compared *via* kinetics of phase separation.

The Turbiscan® enables to measure the efficiency of additives used for de-emulsification as it sees instabilities much more rapidly and accurately than the eye. This analysis is objective, enabling to compare samples easily.

Application 2: Efficiency of dispersants for asphaltenes

Asphaltenes are causing major loss of money in the extraction process as they can block pipes or even the entire well when aggregating and settling. Moreover, the problem is also becoming more and more important in refineries as crude oils are getting less stable regarding asphaltenes. In addition, their complex and variable nature makes them difficult to control and to model theoretically.

× **Common method:**

Few techniques enable to measure the efficiency of dispersant in preventing asphaltenes to settle and block pumps or pipes during crude oil extraction. Among them, one can find the bottle test previously mentioned, the spot test and various theoretical models trying to explain the phenomenon, but none of them is totally satisfying because they are not reliable enough and are too time consuming.

× **Turbiscan® method:**

The Turbiscan® can measure the dispersion state (asphaltenes well dispersed, flocculated or settled in crude oil or heavy fuel) when visual observation is tricky due to the darkness of the sample. Kinetics of flocculation and sedimentation can be drawn to compare samples easily and objectively. Velocity of migration can be computed.

Using the Turbiscan®, the efficiency of dispersant on asphaltenes stability can be monitored objectively in less than 30 minutes. General information on the stability of crude oil and heavy fuel stability can also be obtained.

These tests concern R&D labs that develop new molecules for improving various processes of oil extraction and production, but also salesmen and services companies for showing the efficiency of their additives on the field (portable instrument). Finally, oil companies can use them in the field or in refineries in order to check their oil (stability of crude oil or heavy fuel, compatibility of crude, *etc.*). They can also be applied to any similar applications, such as sedimentation of minerals (calcium or barium carbonate, *etc.*).