SPE Brazil Flow Assurance Technology Congress
Rio de Janeiro, Brazil, November 06 – 08 2024

Cargo-Treatment: A solution for enhancing the cold Properties of Brazilian crudes

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Abstract (Arial 12, bold)
Since Q1 2022, the crudes exchange market has greatly evolved, and the stream of crude oils deeply reshuffled. Among the cargoes now flowing to Europe are the Brazilian crude oils. One associated hurdle to overcome is to ensure that, with the cold temperature conditions during the Winter season, it is possible to maintain the flowability so that the cargoes can be pumped off the Oil tankers carrying them and to prevent the waxes from forming solid deposits in the pipes. To do so, the use of Pour Point Depressant Additives that can be added during Cargo-Treatment operations that could occur at Load Port, at Discharge Port or even 'en-route' can be considered. This study focused on defining the efficiency of some Pour Point Depressant Formulations. The results show that the use of Pour Point Depressants can easily lower the pour point easily below 0°C and meet the requirement of most oil terminals across Europe during the Winter season.

Keywords
Cargo-Treatment, Flow Assurance, Pour Point

Introduction

Since Q1 2022, the crudes exchange market has greatly evolved, and the stream of crude oils deeply reshuffled [1]. The consequence is that a lot more crude oils from the Americas are flowing to the European Market while a lot more Russian is going to Asia.

Among the cargoes now flowing to Europe are the Brazilian crude oils. One associated hurdle to overcome is to ensure that, with the cold temperature conditions during the Winter season, it is possible to maintain the flowability so that the cargoes can be pumped off the Oil tankers carrying them and to prevent the waxes from forming solid deposits in the pipes [2-7].

Overcoming this problem is no easy task as crude oils are composed of very complex blends of materials that may impact the flowability, especially at low temperatures. The main components that could have an impact are the waxes. Waxes are alkane type molecules with very high molecular weight and can have branched, linear or cyclic structures. Obviously, linear alkanes are the most susceptible to generate solid particles which can eventually build up to form deposits [8-10].

During the production process, when the temperature and pressure drop when the oil exiting the well, this could create precipitation of wax and then deposition of waxes which needs to be dealt with by the operator. Usually, the use of production chemicals such as Wax Inhibitors and Pour Point Depressants is involved [11-13]. This would solve the situation and prevent the deposits from building up in the production asset.

However, while this would be solving the issue of the production facility, this may not be enough for the find end-user especially if the latter needs to pump such a crude under much colder conditions than those met at the production site. This is typically the case in this study which focuses on three crude oils produced in Brazil and for which cargoes reaches Europe: MERO, IRACEMA and LAPA.

Methodology

During this study, samples of MERO, IRACEMA and LAPA crude oils were used to define their Pour Points measured according to the ASTM D97 method as well as the efficiency of some Pour Point Depressant Formulations involving various polymers.

It is to be noted that the sample preparation is of great importance to avoid erratic results when testing Pour Point Depressants. Indeed, the thermal past experienced by the samples can have a major impact on the Pour Point result. This is linked to the fact that some crystals may be present in the sample before launching the tests. Based on TotalEnergies experience; to avoid such an impact, the sample must be heated at a temperature above

the Wax Appearance Temperature (WAT) for at least one hour and shaken before the test is started. In most cases, a temperature of 45 to 60°C is advised. In case the WAT is unknown, the sample should be heated at 60°C.

Three different Pour Point Depressant formulations were tested during this study. Their composition is proprietary and will not be disclosed in details in this study. However, they involve the use of different polymers including polyesters, EVA copolymer and terpolymers dispersed in aromatic solvent.

This protocol was systematically followed throughout this study.

Results and Discussion

The results obtained during this study are shown in Fig. (1) for MERO, Fig. (2) for IRACEMA and in Fig. (3) for LAPA. Each figure presents the evolution of the Pour Point according to the treatment rate of the various Pour Point Depressant Additives.

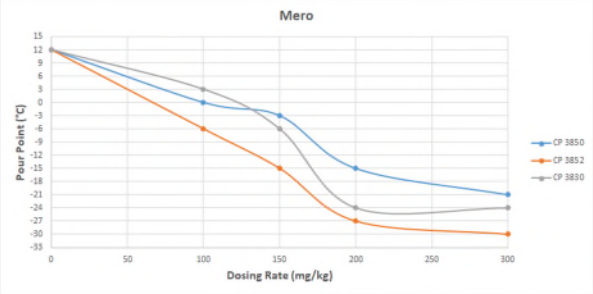

Figure 1. Evolution of the Pour Point of MERO crude oil treated with Pour Point Depressant Additives

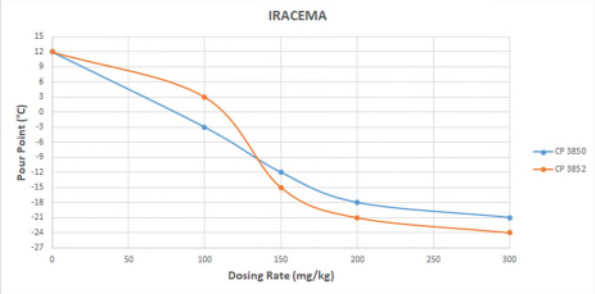

Figure 2. Evolution of the Pour Point of IRACEMA crude oil treated with Pour Point Depressant Additives

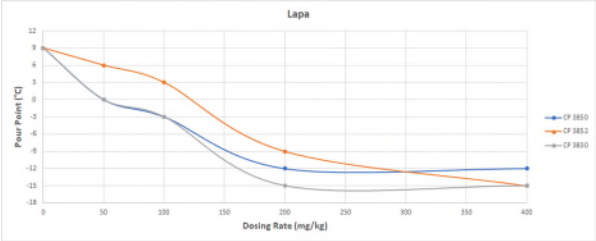

Figure 3. Evolution of the Pour Point of LAPA crude oil treated with Pour Point Depressant Additives

As can be noticed on all the above figures, the use of Pour Point Depressants can lower the pour point easily below 0°C. With MERO, it was possible to lower the Pour Point as low as -30°C. With IRACEMA, it was possible to lower the Pour Point as low as -24°C. And with LAPA, it was possible to lower the Pour Point as low as -15°C.

For cargoes of these crude oils exported from Brazil to Europe, the use of these additives during Cargo-Treatment operations will in every case enable the import of these crude oils in most of European countries, even during the coldest season. Just Lapa in Northeastern Europe could remain a challenge during the coldest months of January & February.

Conclusions

During this study, the cold properties of three crude oils produced in Brazil have been studied in detail. The main objective was to understand how these crude oils could be imported in Europe during the Winter Season.

The results obtained show that the use of Pour Point Depressant Additives at low dosing rates (between 100 and 200 ppm w/w) can lower the pour point of these oils down to way below 0.

These additives could be added during Cargo-Treatment operations that could occur at Load Port, at Discharge Port or even ‘en-route’.

Responsibility Notice

The authors are the only responsible for the paper content.

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