International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Pour Point Depressant Studies on Western Onshore Field

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ABSTRACT

Crude oil transportation from well bore to refinery is herculean task especially in winter. Crude oil is transported to refinery through pipelines where the crude oil experiences various changes in its physical and chemical properties at low temperatures which result in flow assurance issues such as wax deposition. Many techniques including Mechanical, Thermal, Chemical and combination of these techniques are used to mitigate wax deposition. Chemical methods such as use of Pour Point depressants (PPDs) are found to be efficient method for prevention and mitigation of wax deposition. This paper represents effect of different Pour Point Depressants on Western Onshore Crude oil.

Keywords: Crude oil, Pour Point Depressants, Western Onshore Field, Crude oil transportation

1.Introduction

Crude oil is a complex mixture containing saturates (paraffins/waxes), aromatics, asphaltenes and resins as main components. Macrocrystalline waxes present in crude oil cause of wax deposition issues in pipeline systems during production and transportation of crude oil. Wax deposition is the one of the most critical problems that may occur during pipeline transportation due to a sudden drop in environmental temperature. During hydrocarbon production in the cold environment, these oil companies face an issue with wax deposition on wall of the pipe. When crude oil with a high wax content is chilled to temperatures below the wax appearance temperature (WAT), paraffin waxes separate from the crude oil, causing unique problems in crude oil pipeline transportation.Pour point depressants are being used as additives to cure this problem by decreasing the pour point and preventing wax deposition. They are typically large-scale polymers that modify the shape and interface of precipitated wax molecules through different methods, reducing wax deposition and improving flow. PPDs no longer have an effect on both the temperature at which wax crystallizes out of solution or the quantity of wax that precipitates. Rather, wax crystals form, PPDs co-crystallize at the side of the wax species found within the oil and alter the development of wax crystals. Furthermore, the wax crystals are stored apart from each other by means of the PPD backbone, and due to this steric hindrance, the wax crystals are no longer capable to frame into 3D structures that impede flow.

2.Experimental Work

2.1 Material

Crude oil sample was collected from the Western Onshore Field. The PPDs were obtained from chemical plants in order to study their effectiveness on the crude oil. All chemicals, apparatus, and glassware, were provided by the university lab.

2.2 Experimental Procedure

The characteristics of crude oil such as water content, density and API gravity, and pour point were determined using ASTM/IP methods.

2.3 Pour point test with PPDs

The pour point of an oil is a vital property, and it is the temperature below which the oil loses its flow attributes. ASTM D97 is a manual strategy used to decide the pour point of any petrol-based oil. It indicates the pump ability of the oil sample under different operating temperatures.

The oil sample was heated to 60℃ and transferred into the pour point tube.At this temperature, a volume of PPD was added into the sample for the different concentrations and continuously stirred for 5mins.The tube was put back in the water bath and removed after the temperature had reached above 60℃.The tube was allowed to cool at room temperature until 45℃ (a temperature was set in the tube) after which it was set in the pour point apparatus.After every 3℃ drops in temperature, the tube was removed to check the flow of the oil sample until the flow cease.

3.Results

3.1 Characterization of crude oil sample

Some important Physico-chemical parameters of crude oil sample are given in Table-1.

Table 1-Parameters of crude oil

Parameter	Result
Water content	Traces
Density (g/cm^3 at 15 ℃)	0.8141
Specific gravity (at 15 ℃)	0.8148
API gravity	42.1622
Pour point (℃)	27

3.2 Pour point tests with PPD solutions

The results showing effect of PPD – A, B and C are given in Table-2.

Table 2-Effect of pour point depressants on crude oil

PPD Code	Concentration of PPD (ppm)	Pour point of blankcrude oil (℃)	Pour point of crude oil with PPD (℃)	Depression ΔT (℃)
A	100	27	18	9
	200	27	15	12
	300	27	12	15
B	100	27	27	0
	200	27	27	0
	300	27	27	0
C	100	27	24	3
	200	27	18	9
	300	27	15	12

PPD A and PPD C gives pour point depression up to 12 ℃ at 200 ppm and 300 ppm doses. The best results are obtained with PPD A which reduces pour point up to 15 ℃ at 300 ppm dose. PPD B does not make any effect on pour point of crude oil. Both in PPD A and PPD C, lower

dosages could achieve only lower depression in pour point. Effectiveness of PPD was in proportion with the dosage.
The comparison of pour point depressant A, B and C were evaluated at different doses in fig.1.

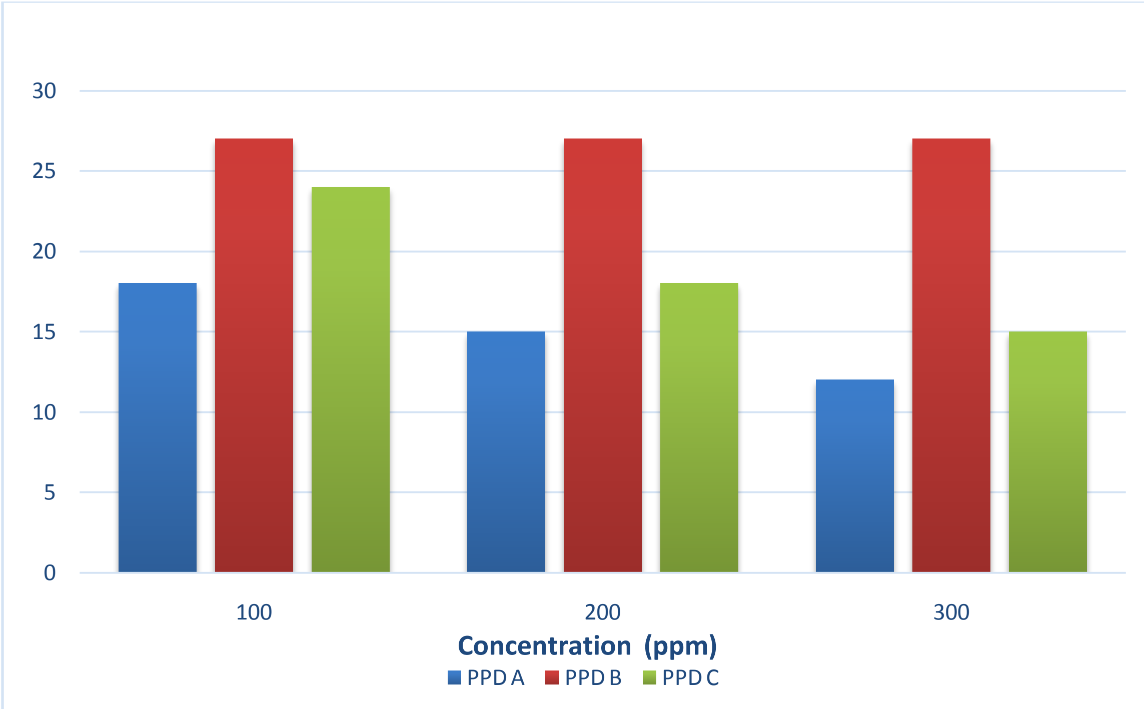

Fig.1-Comparison of effect of PPDs on crude oil pour point

Graph shows that effectiveness of the PPD was in proportion with dosage. And at 300 ppm dosage, pour point was lowered to the minimum.

4.Conclusions

- The sample of crude oil is light oil; it is indicated by API gravity.
- PPD A has more ability to improve flow of the crude oil. PPD B has no effect on crude oil. PPD C has limited ability to improve flow of crude oil.
- PPD A gives best result at 300 ppm dose. It reduces the pour point up to 12 ℃ than PPD B & PPD C.
- It is not necessary that every PPD works on all type of crude oil.

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