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Pour Point Depressant Studies on Crude Oil of Western Onshore Region

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ABSTRACT

The capacity to transfer crude oil via pipelines without trouble from the wellhead to the refinery is referred to as midstream flow assurance. Crude oil deposits are found in reservoirs at high temperatures and pressures, creating significant changes in process conditions when extracted and transported through pipelines, resulting in a plethora of problems. Traditional treatments like electric, emulsification, and thermal insulation are exceedingly expensive and may require constant pigging in oil pipelines. PPD (Pour Point Depressant) is a key component in reducing pipeline transportation challenges in the midstream sector.One of the most modern and newest methods of applying PPD is gaining popularity over old procedures due to the easiness of managing different types of crudes. For this a number of PPDs are used to solve various difficulties. This research paper investigates the importance and necessity of PPD.

Keywords: Petroleum industry, pour point depressants, wax deposition

1.INTRODUCTION

The injection of pour point depressant flow improver additives appears to have the best chance of accomplishing the overall goals of operational safety and operating economy. Improvers should now be able to lower the pour point, viscosity, and yield stress in dynamic settings, as well as restart pumping with the available shew stress after a shutdown. Low improvers are ashless polymeric additives that reduce the pour point and viscosity of crude oil when added at 300-600 ppm.

- **Pour-point depressant mechanism**

The addition of a flow improver avoids or slows wax crystal agglomeration by altering crystal habit, size, or crystal interaction. During cooling, it lowers the gel formation temperature. The mechanism of PPD was not well known until recently, and it was somewhat disputed. PPDs are thought to work through a number of mechanisms, including nucleation, adsorption, co-crystallization, and enhanced wax dispersion. By any one or a combination of the above-mentioned mechanisms, these additives cause the creation of smaller wax crystals with a more regular shape.

- **Nucleation**

The production of paraffin crystals of crucial size (nuclei) that are stable in hydrocarbon fluid and facilitate crystal growth is known as nucleation. Certain PPDs operate as nucleation promoters, preventing wax particle aggregation. PPDs self-assemble into micelle-like aggregates with a crystalline core at temperatures higher than WAT. The growth of a single large wax crystal is slowed by the formation of a large number of sub-critical size wax nuclei. Wax particles are tiny enough to remain stable in the oil phase mobility after crystal size reduction.

- **Co-crystallization**

PPD alters the wax crystal structure and aggregation state by interfering with the crystallisation process. The molecular relationships and composition of wax crystals are altered when they are co-crystallized. It aids in the avoidance of wax formations that interlock. The shape of the crude oil wax crystal is deformed as a result of these interactions. These crystals are unable to go through the regular aggregation procedures once distorted, resulting in increased fluidity.

Materials and Methods

Crude oil sample was collected from the western Cambay onshore field. The PPDs are collected from industry. All chemicals are laboratory grade.

- **Characterization of the crude oil sample.**

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

✓ **Water content.**

It's the first and most crucial test performed on the crude oil sample. The equipment employed was the dean and stark apparatus distillation process, which followed the ASTM D95 test method. The oil sample is immediately co-distillates in this process. The water content of oil products is important for refining, purchasing, selling, and transporting items.

✓ **Density and API Gravity Determination**

This experiment was carried out using the ASTM 287 test method and a hydrometer. One of the most practical methods for determining the density or relative density (specific gravity) of liquids is to use this method. It's suitable for both thin and thick oils. The purpose of this experiment is to use a hydrometer to measure and study the density and specific gravity of various liquids. It will also provide sufficient information on light and heavy crude oils.

✓ **Pour Point Test**

The pour point of an oil is a critical quality; it is the temperature at which the oil loses its flow characteristics, i.e., when it becomes overly thick and loses flow. It has a lot of ramifications, especially inside motors, because it's used to determine what temperature the oil runs at.

The ASTM D97 standard is a manual method for determining the pour point of any gasoline-based oil. It shows the oil sample's ability to pump at various temperatures.

Results

- **Characterization of the crude oil sample.**

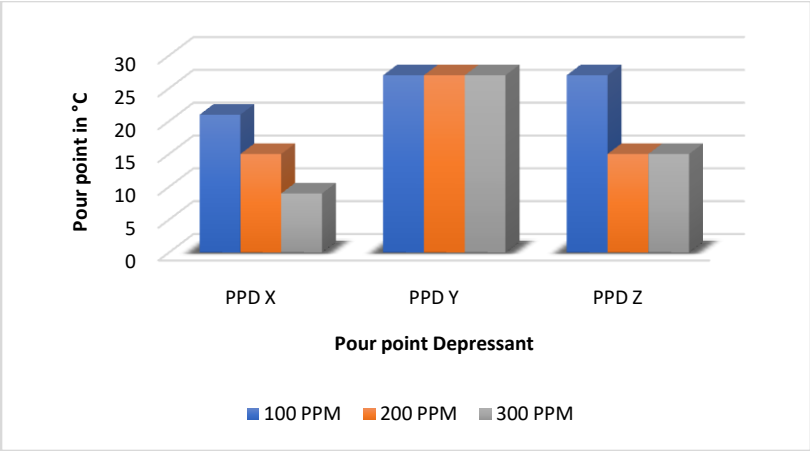
Table 1: Characteristics of crude oil

S.N.	Parameters	Result
1.	Density	0.8145 g/cm^3
2.	Specific Gravity	0.8153 g/cm^3
3.	API Gravity at 15°C	42.05

Table 2 : Pour Point Depressant studies on crude oil

PPD code	PPD dosage (ppm)	Blank crude oil Pour Point (°C)	PPD treated Crude oil Pour Point (°C)	Depression ΔT (°C)
X	**100**	**27**	**21**	**6**
	200	**27**	**15**	**12**
	300	**27**	**09**	**18**

Y	100	27	27	0
	200	27	27	0
	300	27	27	0
Z	100	27	27	0
	200	27	15	12
	300	27	15	12



Graph 1:

Conclusions

Following the results of the various experiments, the following conclusions were obtained.

- The API gravity of the crude oil sample indicates that it is light oil.
- The density of the crude oil sample is 0.8145 g/cm^3, the specific gravity is 0.8153 g/cm^3, the API Gravity is 42.05 at 15°C and the pour point is 27°C.
- A best pour point depression of 18°C was attained with PPD X at 300 ppm.
- PPD X has more ability to improve flow of the crude oil than the other PPDs.
- PPD Y does not make any effect on pour point of crude oil so, it's not necessary that every PPD work on every crude oil.
- PPD Z has an ability to improve flow of crude oil in limit, it decreases the pour point till 200 ppm than it makes no further effect on crude oil.

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