IV Scientific-Technological Symposium

CATALYTIC HYDROPROCESSING IN OIL REFINING

APRIL 26 - 30 2021 / ONLINE

INVESTIGATION THE INFLUENCE OF ADDITION THE HEAVY N-PARAFFINS ON THE EFFECTIVENESS OF DEPRESSANT ADDITIVE ACTION

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Relevance

The climate of the main Russian Federation territory determine the high level of demand for diesel fuel of winter and arctic brands. A promising direction in the production of low-freezing diesel fuels is the use of depressant additives, the effectiveness of which largely depends on the composition of the fuel. The presence of n-paraffins in the composition of straight-run diesel fuels significantly deteriorate their low-temperature properties, however, formation of the first n-paraffins crystals triggers the action of depressant additives.

Goal

The aim of this work is to study the effect of adding heavy n-paraffins on the effectiveness of the depressant additive.

Input data

The object of research in this work is a straight-run diesel fuel sample (DT), heavy n-paraffins (P), separated from vacuum gas oil by freezing, and commercial depressant additive. The depressant additive was used at a concentration of 0.26 ml per 100 ml of diesel fuel (the concentration recommended by the manufacturer). The characteristics of straight run diesel fuel sample are presented in Table 1 (ρ is the density at 20 °C; ν_d is the dynamic viscosity at 20 °C; ν_{to} is the kinematic viscosity at 20 °C; $T_{10\%}$, $T_{50\%}$, $T_{95\%}$ – distillation temperature 10, 50, 90 % vol .; CFPP – cold filter plugging point; T_p – pour point).

Table 1 – Characteristics of straight run diesel fuel sample

ρ, kg /m³	ν_d, mPa · s	ν_{to}, mm²/s	Sulfur content, mg /kg	Fractional composition, °C			Low temperature properties, °C	
				$T_{10\%}$	$T_{50\%}$	$T_{95\%}$	CFPP	T_p
833.0	3.4553	4.1480	3911	183	263	348	-5	-16

Separation of n-paraffins

The sequence of the n-paraffin separation steps is shown in Figure 1.

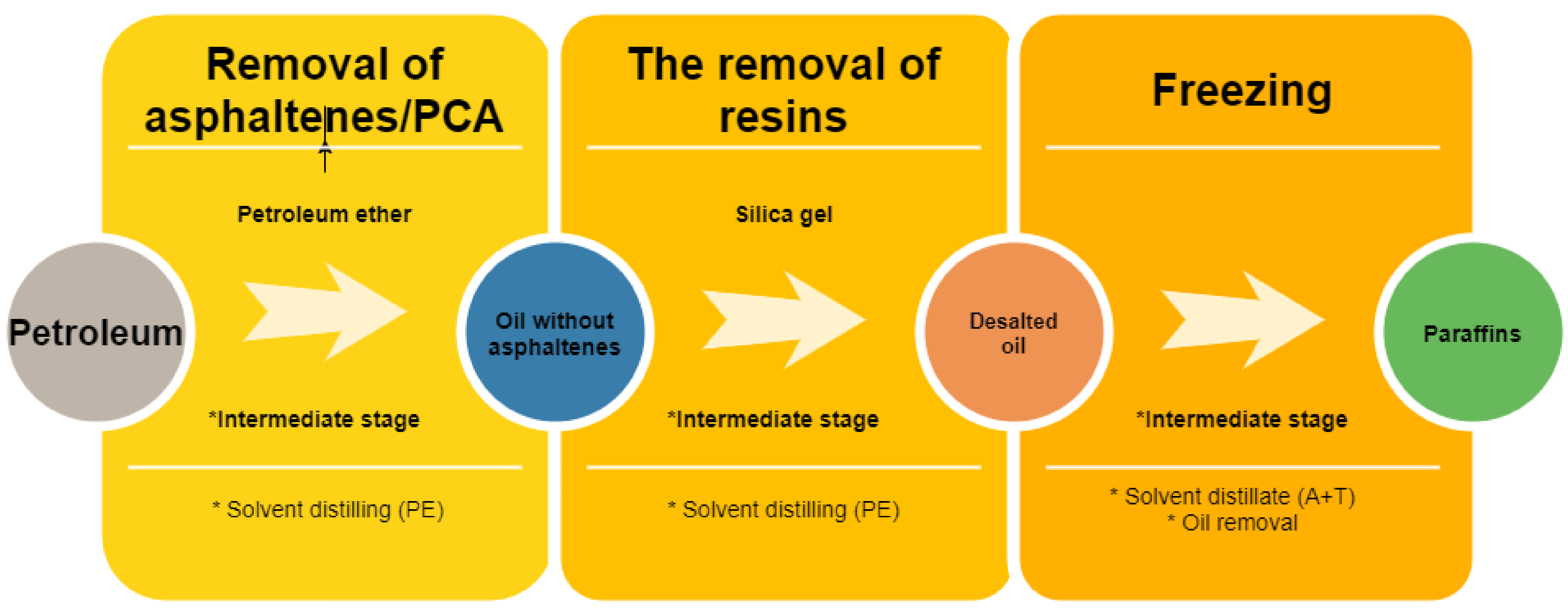

Figure 1 – Diagram of separation of n-paraffins from vacuum gasoil

The method consists of pre-removal of asphalt resin (for heavy oils) and polycycloaromatics (PCA) (for light oils) by extraction and adsorption techniques and the subsequent release of paraffin with a mixture of acetone and toluene at a temperature of -20 °C.

N-paraffins content

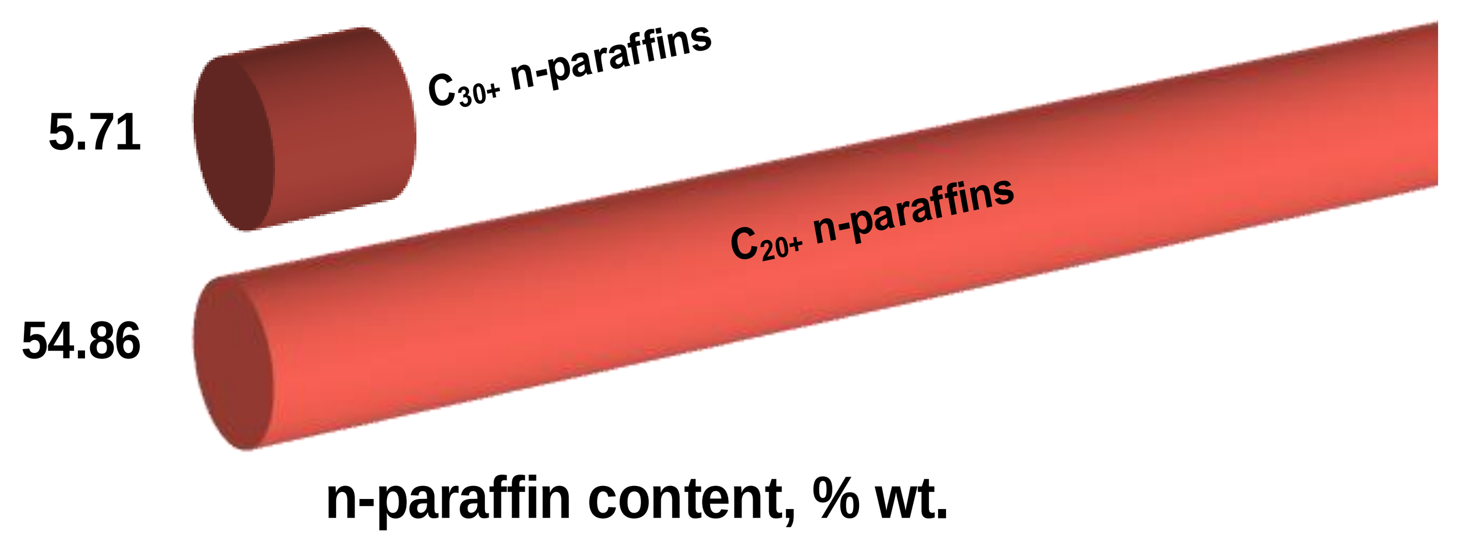

Figure 2 – The hydrocarbon composition of heavy n-paraffins

Figure 2 shows the hydrocarbon composition of the used heavy n-paraffins, which had been determined by gas-liquid chromatography method using a Chromatec-Crystal 2000 unit.

Results

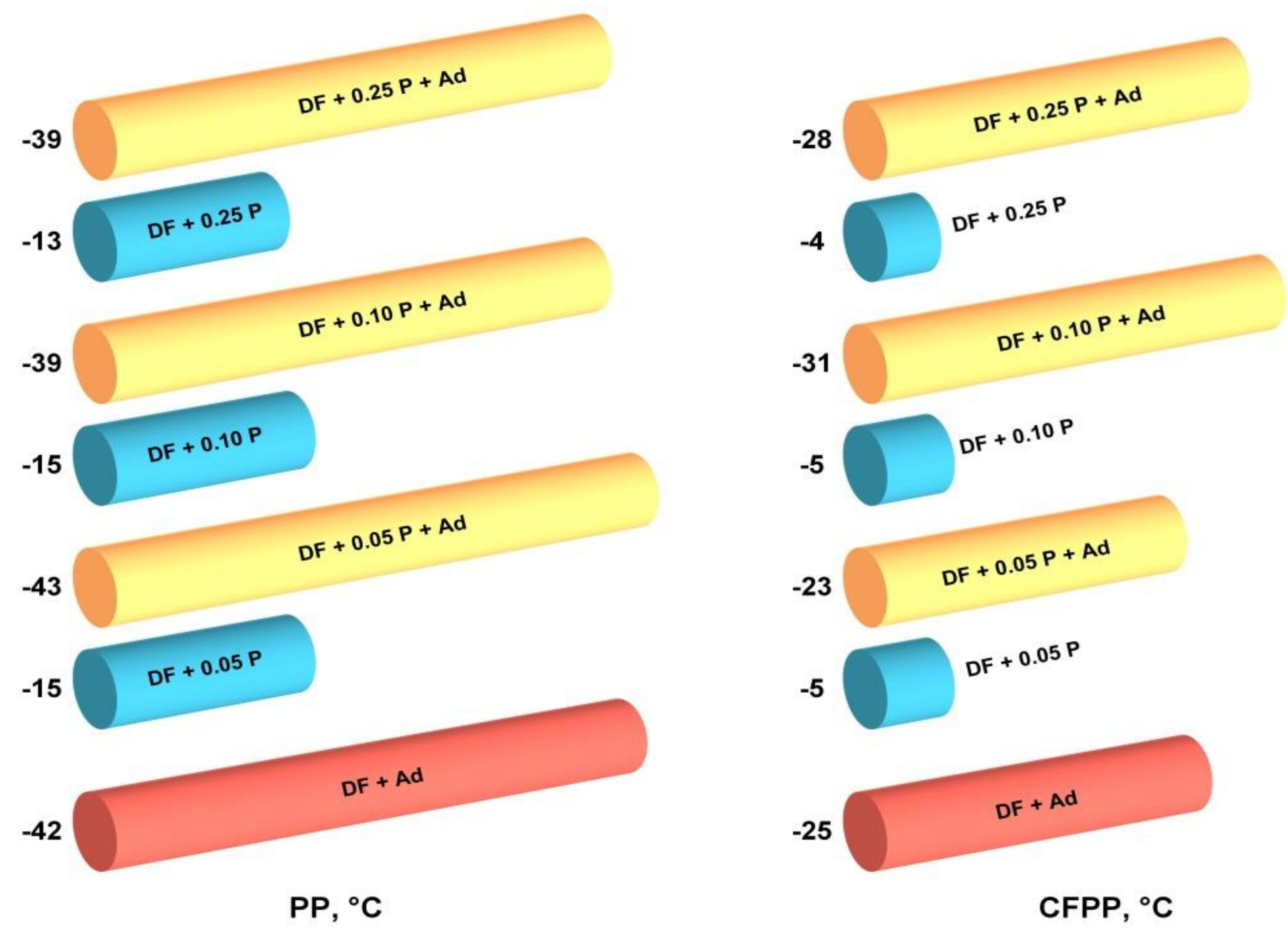

Figure 3 – Low temperature properties of the studied blends

As can be seen from the data, presented in Figure 3, the addition of a small amount (0.25-0.10 % wt.) of heavy n-paraffins increases the effectiveness of the depressant additive in relation to CFPP (by 3 °C and 6 °C, respectively). Thus, the addition of heavy n-paraffins is a promising way to produce the low-freezing brands of diesel fuel.

Conclusion

The addition of heavy n-paraffins has been shown to have an increasing positive effect on additives. This effect is explained in the mechanism of action of depressant additives – the additive only becomes effective when the first crystals of heavy paraffins are released. The presence of a small number of heavy n-paraffins triggers the action of the additive.

*The reported study was funded by RFBR and Tomsk region according to the research project No. 19-48-703025.