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EFFECT OF POLYMETHACRYLATE-TYPE VISCOSITY MODIFIERS ON THE VISCOSITY-TEMPERATURE PROPERTIES OF SN 900 BASE OIL

Yusifova Aida Rafig [1], Yusifzadeh Gulshan Galib [1], Dadashova Tarana Adil [1], Maharramova Zakiyya Kamil [1], Mammadli Chinara Namig [1]

[1] Academician A. Guliyev Institute of Chemistry of Additives, Leading Researcher, Baku, Azerbaijan

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Abstract

This article investigates the effect of polymethacrylate-based viscosity additives Viscoplex 2–670 and Viscoplex 8–450 on the rheological properties of SN 900 base oil at various concentrations. The studies show these additives significantly improve the viscosity-temperature characteristics, increase the viscosity index, and ensure operational stability across temperature fluctuations. The results confirm their potential use in industrial and engine oil formulations.
Keywords: *Base oil, viscosity additive, polymethacrylate, rheological properties, viscosity index*

The rheological properties of oils are among the key indicators that determine their applicability under different temperatures and load conditions. Various functional additives, including viscosity modifiers, are added to base oils to enhance the operational qualities of engine and industrial oils. Viscosity modifiers improve lubricating performance and protect friction surfaces by maintaining oil viscosity during temperature fluctuations.

This article explores the impact of Viscoplex 2–670 and Viscoplex 8–450 viscosity additives on the viscosity-temperature characteristics of SN 900 base oil.

The Viscoplex series of polymethacrylate additives, produced by the German company Evonik, are used to enhance the viscosity-temperature properties of oils. These additives help retain oil flowability at various temperatures, supporting the production of high-quality lubricants.

The paraffinic SN 900 base oil, produced in the USA ('SN' – Saturated Naphthenic), is a high-viscosity and high-quality oil. It is mainly used in the lubrication systems of diesel engines and industrial machinery, helping to protect friction surfaces, reduce rust and corrosion risks, and ensure long-term effectiveness.

In this study, viscosity additives were used in concentrations of 1%, 2%, and 3% by weight.

The viscosity-temperature characteristics of the samples were investigated using an SVM-3001 Stabinger viscometer (Anton Paar) at 40 °C and 100 °C, and viscosity indices were calculated according to ASTM D2270. The initial SN 900 base oil without additives showed a kinematic viscosity of 90 mm²/s at 40 °C and 9.5 mm²/s at 100 °C.

Upon adding Viscoplex 2–670 and Viscoplex 8–450 additives to the base oil, the viscosity characteristics changed significantly. At 2% and 3% concentrations, the kinematic viscosity at 40 °C increased to 352.6 mm²/s and 388.9 mm²/s with Viscoplex 2–670, and to 358.82 mm²/s and 398.22 mm²/s with Viscoplex 8–450. At 100 °C, the values were 25.24 mm²/s and 27.6 mm²/s, and 25.53 mm²/s and 28.05 mm²/s, respectively, demonstrating improved high-temperature stability.

The viscosity index (VI) of the base SN 900 oil was 85. With the addition of viscosity additives, the VI increased significantly. For instance, with 2% Viscoplex 2–670, the VI rose to 98, and with 3% Viscoplex 8–450, it reached 105. This shows that increasing additive concentration improves oil stability across various temperatures.

Table 1.

Additive (% by weight)	Kinematic Viscosity at 40 °C (mm²/s)	Kinematic Viscosity at 100 °C (mm²/s)	Viscosity Index (VI)
0 (Base Oil)	280	20.5	85
1% Viscoplex 2–670	336	24.16	97
2% Viscoplex 2–670	352.6	25.24	98
3% Viscoplex 2–670	388.9	27.6	103
1% Viscoplex 8–450	342.2	24.81	97
2% Viscoplex 8–450	358.82	25.53	98
3% Viscoplex 8–450	398.22	28.05	105

The results of this study show that the addition of polymethacrylate-type viscosity additives Viscoplex 2–670 and Viscoplex 8–450 significantly enhances the viscosity-temperature characteristics of SN 900 base oil. Furthermore, these additives improve the oil's anti-friction and anti-wear properties, making it more efficient for engine and industrial applications.

Viscoplex 8–450 demonstrated higher efficiency compared to 2–670, which may be attributed to its molecular weight and structure being better suited to compatibility with the oil.

References

ASTM D2270 – Standard Practice for Calculating Viscosity Index from Kinematic Viscosity
Leslie R. Rudnick. "Lubricant Additives: Chemistry and Applications".
Evonik Oil Additives – Viscoplex Series Technical Data Sheets.
Krasnikov N. N. "Reologiya i tribologiya smazok". – Moscow, 2015.
URL: https://www.aktasgroup.com.tr/uploads/baxvlt0a4pkcscg8.pdf

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Contact: aidayusifova@mail.ru