

Polyalkylacrylates as components for pour point depressant for diesel fuel

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Abstract

Crude oil and products of its processing usually contain a large number of paraffins, which are a mixture of saturated hydrocarbons. Their crystallization occurs with a decrease in temperature, creating a network that captures the molecules of the liquid phase of hydrocarbons until the entire system loses its fluidity. The temperature at which this occurs is called the pour point. Obviously, reducing this parameter is the actual problem.

Many techniques to eliminate problems associated with the crystallization of paraffins in oil and products of its processing have been developed. Polyacrylates and polymethacrylates have proved to be one of the best polymer depressants for petroleum products. In this paper, we describe a method for the synthesis of mixture of polyalkylacrylates and further preparing depressant based on it, as well as their characteristics. The first stage of the synthesis was the preparation of mixture of esters of acrylic acid and higher alcohols with radicals containing from 14 to 16 carbon atoms, as a result of the transesterification reaction of ethyl acrylate. The second stage consisted in the polymerization of the resulting alkylacrylates in solution. Dinitrile of azoisobutyric acid was used as auxiliary reagent. All products were characterized by IR and PMR spectroscopy.

The prepared pour point depressant based on these polymers were tested for depressor activity for diesel fuel samples from the Antipinsky Refinery. It was found that the greatest effect of decreasing the pour point is observed for depressant containing a significant amount of heptadecylamine sulfate. This fact was analyzed.

References

- [1] S. Misra, S. Baruah, K. Singh. Paraffin problems in crude oil production and transportation: A review. *SPE Production & Facilities*. **1995**. Vol.10. No.1. P.50-54.
- [2] F. Yang, Y.S. Zhao, J. Sjoblom, C.X. Li, K.G. Paso. Polymeric wax inhibitors and pour point depressants for waxy crude oils: a critical review. *Journal of Dispersion Science and Technology*. **2015**. Vol.36. No.2. P.213-225.
- [3] P. Ghosh, D.K. Saha. Acrylate terpolymers as potential pour point depressant and viscosity modifiers for lube oil. *Petroleum Science and Technology*. **1995**. Vol.33. No.10. P.1126-1132.
- [4] M. Upadhyaya, P. Gosh, K. Dey. Acrylate-alpha-pinene copolymers as biodegradable multifunctional additives for lube oil. *Journal of Scientific & Industrial Research*. **2017**. Vol.76. No.5. P.303-307.
- [5] P. Ghosh, M. Hoque, G. Karmakar, M.K. Das. Dodecyl methacrylate and vinyl acetate copolymers as viscosity modifier and pour point depressant for lubricating oil. *International Journal of Industrial Chemistry*. **2017**. Vol.8. No.2. P.197-205.
- [6] W.L.F. Armarego, C. Chai. Purification of Laboratory Chemicals 5th Edition. *Cornwall: Butterworth-Heinemann*. **2003**. 608p.
- [7] Organic reactions. Digest 3. R. Adams, V. Bachman, J. Johnson, G. Snyder, L. Fizer. Ed. Koshechkova K.A. *Moscow: Publishing House of Foreign Literature*. **1951**. 461p. (russian)
- [8] GOST 20287-91 Petroleum products. Methods for determining the temperature of fluidity and hardening [Text]. Instead, GOST 25262-82 GOST 20287-74-typ. 1992-01-01. *Moscow: Ministry of Oil Refining and Petrochemical Industry of the USSR. Moscow: Standardinform*. **2006**. 9p. (russian)
- [9] R.A. Soldi, A.R. Oliviera, R.V. Barbosa. Polymethacrylates: pour point depressant in diesel oil. *European Polymer Journal*. **2007**. Vol.43. No.8. P.3671-3678.

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[10] J.B. Miller, S. Zhang, P. Kos, H. Xiong, K. Zhou, S.S. Perelman, H. Zhu, D.J. Siegwart. Non-Viral CRISPR/Cas Gene Editing In Vitro and In Vivo Enabled by Synthetic Nanoparticle Co-Delivery of Cas9 mRNA and sgRNA. *Angewandte Chemie - International Edition*. **2017**. Vol.56. No.4. P.1059-1063.