Influence of poly (stearyl acrylate *co*-behenyl acrylate) as flow improvers on the viscosity reduction of Malaysian crude oil

Basem Elarbe, Ibrahim Elganidi, Norida Ridzuan, Norhayati Abdullah, Kamal Yusoh
Faculty of Chemical and Process Engineering Technology, Universiti Malaysia Pahang, 26300 Gambang, Pahang, Malaysia

ABSTRACT

Pipelines are the most appropriate means of transporting crude oils in different parts of the world. Nevertheless, the high viscosity of crude oil at low temperatures is one of the main challenges when transporting crude oils through the pipeline, which needs adequate and expensive methods of transporting crude oil, and wax depositions in the pipeline that is caused by high viscosity of crude oil. Therefore, several ways have been investigated to boost the mobility of crudes in stimulating pipeline transportation. In this study, poly (stearyl acrylate *co*-behenyl acrylate) (SA-*co*-BA) pour point depressant PPD copolymer was synthesized as flow improvers for reducing the viscosity of crude oil to improve the flowability. SA-*co*-BA copolymer has been synthesized by using free-radical polymerization method and characterized by FTIR. The viscosity of blank crude oil increases with decreasing temperature after the addition of (SA-*co*-BA) copolymer to the blank crude oil at various concentrations. The results exhibited that the mass ratio (1:2) at a concentration of 1000 ppm was the highest performance of viscosity reduction by 90.57% from 70 mPa.s to 6.6 mPa.s at 5 °C of crude oil temperature. The influence of the (SA-co-BA) copolymer was clearly seen on the viscosity reduction of crude oil at different conditions, because of the acrylate groups which have a long alkyl chain. It is observed that a major reduction in the viscosity of the crude oil sample was observed at low temperatures, which makes it a reasonable recommendation for offshore applications. The results of characterization revealed that FTIR characteristics showed absorption peaks at 2914.86 cm^{-1} and 2848.09 cm^{-1}, respectively, as typical absorption peaks of CH3– and –CH2-. The ester group's sharp absorption peak C = O was recorded at 1731.71 cm^{-1}. Therefore, SA-*co*-BA copolymer recorded an appreciable minimization in the viscosity of crude oil.

KEYWORDS

Crude oil; Viscosity reduction; SA-co-BA copolymer; Pour point depressant; Flow improvers

ACKNOWLEDGMENTS

The authors hope to express their gratitude to Universiti Malaysia Pahang, the Faculty of Chemical and Process Engineering Technology, College of Engineering Technology for ongoing supporting the necessary lab facilities and financial assistance under grants postgraduate research scheme (PGRS1903102 & RDU170352). The authors also hope to express their appreciation of Petronas Penapisan Terengganu, Malaysia's assistance in supplying crude oil samples used in this study.