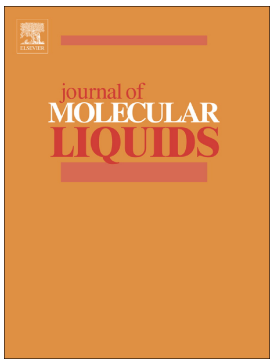

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Effects of chemical modification of PVA by acrylamide, methacrylamide and acrylonitrile on the growth rate of gas hydrate in methane-propane-water system

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Abstract

In this work, two different series of modified polyvinyl alcohols (PVAs) were synthesized for evaluation of their performance as novel inhibitors of hydrate growth. In the first series, three monomers including acrylamide (AM), methacrylamide (MAM), and acrylonitrile (AN) were grated onto PVA to produce graft copolymers. This series of modified PVAs which contains PVA-g-AM, PVA-g-MAM, and PVA-g-AN, decreased the growth rate of methane-propane hydrate, although their performance was weak in comparison with a well-known kinetic hydrate inhibitor such as polyvinylpyrrolidone (PVP). Among the graft copolymers, PVA-g-AM had the best performance. The second series of modified PVAs including PVA-AM, PVA-MAM, and PVA-AN were synthesized by functionalization of PVA with three demonstrated monomers. Some of these modified PVAs decreased significantly the hydrate formation rate and had superior performance, such that PVA-AM showed even better performance in comparison with PVP and decreased the hydrate growth rate to 75%. Also, the inhibition effects of some other functionalized PVAs were significant. The adsorption of synthesized polymers on hydrate surface was also evaluated by zeta potential measurement for better understanding of the modified PVAs performance as inhibitor of hydrate growth. In addition, surface tension measurement of modified PVAs solutions, investigation of molecular structures, and analysis of some probable mechanisms for inhibitory effects of modified PVAs showed that functionalized PVAs have high potential for application as novel inhibitors of hydrate growth.

Keywords: Gas hydrate; Growth rate; Kinetic inhibitor; Modified PVAs; Molecular structure.