NEXT-GENERATION ANTI-FREEZE HYDRATE INHIBITORS BASED ON THE XYLOMANNAN COMPOUND

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ABSTRACT

Gas hydrates are a well-known setback to the fuel extraction process, and the current types of inhibitors, such as methanol or various forms of ethylene glycol, are deleterious to the environment. Studies have shown that certain types of cold-survival insect and fish species employ specific compounds that enable them to endure the cold by either slowing ice formation in their cells or by binding early-formed ice crystals and preventing water from joining the crystal lattice.

The most effective antifreeze compounds are protein by nature (AFP), but they can also be manifested in the form of polyols or sugars. However, a newly-discovered xylomannan compound was found in the freeze-tolerant Alaskan Beetle Upis ceramboideis. This antifreeze is unique because it exhibits a repetitive saccharine core structure associated with a fatty acid component, yet it boasts an activity comparable to the most active of AFP’s. Unlike AFP’s these xylomannan compounds are not limited by their sensitivity to denaturing factors such as temperature and buffer composition. In this study we investigate the effects of newly designed inhibitors based on the xylomannan compound on methane gas hydrate kinetics. Results were obtained using gas uptake and particle size analysis at temperatures ranging from 275 to 282 K and pressures up to 7 Mpa. Their performance was compared to that of polyvinylpyrrolidone (PVP) and Type I AFP.

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