Effects of hydrogen bond donors (HBDs) and hydrogen bond acceptors (HBAs) on CH_4 hydrate

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Using hydrate inhibitors is a well-known method to decrease hydrate formation in oil and gas pipeline plugging. One of the major estimated reason for hydrate inhibition is hydrogen bonds. Small molecules like amino acids or ionic liquids may interrupt hydrogen bonds between water molecules, and decrease onset temperature. In this study, we investigated hydrate inhibition abilities of selected HBDs/HBAs using both high pressure micro-differential scanning calorimeter (HP μ-DSC) and high pressure autoclave. We used ramping method to determine the onset temperature of each inhibitor, and compared the inhibition performances of each inhibitor. Furthermore, we used COSMO-RS (COnductor like Screening MOdel for Real Solvents) software to monitor how the HBD and HBA structures (charge density) affect hydrate inhibition performances by measuring the σ-profile and σ-potential of water and inhibitors. These experimental and computational results will set a brief milestone to find the clear mechanism of hydrate inhibitor, and help to find effective inhibitors much easier.