Methane Hydrate Formation and Dissociation Behavior in the Presence of Selected Amino Acids

Pandey, Jyoti Shanker; Daas, Yousef Jouljamal; von Solms, Nicolas

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1. INTRODUCTION

Industrial-scale capture, storage, and transport of gases and gas mixtures, such as natural gas, CH4, and CO2, in the form of gas hydrate is an attractive and feasible solution. However, low formation rate and low water-to-hydrate conversion make it challenging to adopt at commercial scale. Selection of an appropriate chemical as hydrate promoter is crucial to the success of such technologies. Amino acids are seen as potential chemicals to use in such applications due to their environment-friendly nature. However, there are uncertainties around their behavior and classification, since their thermodynamic and kinetic effects on gas hydrates are not widely studied. In this study, we have identified the thermodynamics and kinetics of select amino acids (L-valine, L-methionine, L-histidine, and L-arginine) in methane hydrate formation and dissociation.

2. BACKGROUND STUDIES

L-valine, L-methionine, L-histidine, and L-arginine are selected based on the difference in their hydrophobicity, molecular weight, structure, and polarities. L-valine is known to have one of the highest hydrophobicity while L arginine is known to have lowest hydrophobicity. They show significant variation in terms of hydrophobicity and polar character. Rocking cell allow to use multiple system at similar pressure and temperature condition thus reducing overall experiment time while calorimeter allow us to study the dissociation behavior of methane hydrate in presence of amino acids. Collective information from both experiment could provide insights about methane hydrate formation behavior in presence of environment friendly amino acids. Selection of appropriate amino acid for methane hydrate formation, storage could be beneficial for natural gas storage and transport industry.

3. EXPERIMENTAL MOTIVATION

3.1 Experimental Setup

Hydrate Formation

Rocking Cell Apparatus

Rocking Cell

Differential Calorimeter

4. RESULTS & DISCUSSION

4.1 Formation Studies

4.2 Dissociation Studies

5. REFERENCES