A conceptual model for the understanding of fouling phenomenon when using triazine based \( \text{H}_2\text{S} \) scavengers

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Hydrogen sulphide (\( \text{H}_2\text{S} \)), known as sour gas, is a very toxic and pungent gas that causes problems in up and down stream processes. To remove \( \text{H}_2\text{S} \) from oil and gas streams a non-regenerative solution is often chosen, where a scavenger is introduced and let to react with the \( \text{H}_2\text{S} \). One of the most commonly used scavengers are triazines where especially 1,3,5-tri-(2-hydroxyethyl)-hexahydro-s-triazine has found great use when a water soluble triazine is needed. However, the use of triazine based scavengers is often reported to lead to fouling during transportation and processing of the oil and gas.

In this study we have studied the reaction of two triazines: 1,3,5-tri-(2-hydroxyethyl)-hexahydro-s-triazine and 1,3,5-tri-(2-hydroxypropyl)-hexahydro-s-triazine, with \( \text{H}_2\text{S} \). To investigate the reaction system electrospray ionization mass spectrometry (ESI-MS) has been employed to analyse the composition of the generated mixture as \( \text{H}_2\text{S} \) is bubbled through the scavenger. The fouling obtained from the experiments has been collected and analysed with FTIR spectroscopy, X-ray diffraction and elemental analysis, and related to the compositional changes as found in the ESI-MS analysis. The results of the study have found the existing model for the reaction between triazines and \( \text{H}_2\text{S} \) to be incomplete, since significant peaks were observed that could not be explained within the model. By using tandem mass spectrometry to isolate and investigate these new peaks, a new updated model for the reaction system has been constructed. This new model is capable of explaining from where the fouling originates, how it is formed, and may be used to design a scavenging process in which fouling can be avoided.