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Green Insights on Biogas Processing Technologies

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Introduction

Biogas is a source of clean energy for the future that met the global energy requirements. However, biogas requires specific processing in terms of its up-gradation to remove the presence of acid gas (CO_2 and H_2S) containments. The impurities are removed to increase the calorific value of the Biogas to make it a useable fuel. This is attained through the upgrading process to produce a high methane concentration [1]. An increasing trend of biogas upgrading plants is observed worldwide, mainly in Europe.

Various upgrading techniques are available commercially, and many are under development Figure 1.

However, these conventional processing technology impacts the process with higher energy content for solvent regeneration, solvent loss causes a threat to the environment with its toxicity, damaging the operations due to corrosion. Therefore, there exists a distinction between the various upgrading techniques because the best technology to choose is based on various variables, i.e., low methane loss, high methane purity, lower energy consumption, small carbon footprints, lower capital, and operational cost. In this view, Ionic Liquids (ILs) and Deep Eutectic Solvents (DESs) emerged as a potential candidate that provides a favorable facet in both processing and ecological aspects.

Assessment of Problem

Assessing the feasibility of any process in terms of technical, economic, and environmental aspects before the commercial utilization, the Process System Engineering (PSE) perspective helps study the process design and performs process optimization. In recent times, process system design has become an essential factor in visualizing ILs and DES's performance as a solvent to initiate its commercialization [2-4] provided a comprehensive insight on the various classes of ILs and their potential performance characteristics for CO_2 and H_2S removal Xie et al. [5] also studied the prospects of IL and observed that selected IL seems to provide 24% less energy consumption compared to MEA. Ma et al. [6,7] also studied Deep Eutectic Solvent (DES) characteristics against DEPG and Propylene Carbonate (PC) and found DES solvent to be both processes efficient as well as environmentally friendly.

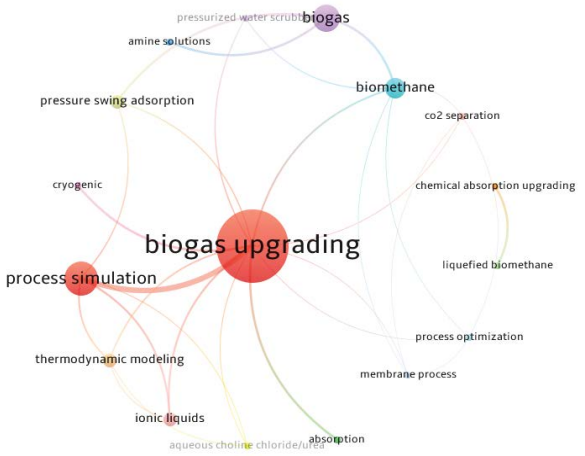

Figure 1. Biogas upgrading technology linkage and current perspective.

IL and DES Capabilities

Ionic liquid and deep eutectic-based solvent for biogas physical absorption is a relatively new technology that ensures high purity and recovery of biomethane with almost negligible CH_4 loss in the environment. ILs and DES are considered green solvents as they are chemically more stable, resulting in less thermal energy requirement for regeneration, less toxic. ILs has almost negligible vapor pressure, providing a process-wise advantage of solvent recycling without any loss. However, the only issue pertaining is their initial cost, which is high due to the less production and high viscosity, hindering the mass transfer during the processing. Having said this, it can arguably be one of the most sustainable choices for upgrading Biogas due to their environment benign nature and superior selectivity towards impurities. ILs and DES are promising and emerging solvents that require scaling up [8].

Conclusion

ILs and DESs are promising solvents for biogas upgrading with their advantageous properties as a green solvent, suggesting that ILs are the potential for commercial-scale operations. ILs, as a potential solvent for the future, can be functionalized with amines providing a sustainable hybrid solvent providing enhanced selectivity for acid gas containments removal with extensive economic feasibility. IL and DES can also be utilized in combination with the membrane. Analysis through process simulation-based studies is an essential platform for its future development based on a technical, economic, and environmental basis as a medium to explore its large-scale operation suitability.

References

1. Qyyum, Muhammad Abdul, Junaid Haider, Kinza Qadeer and ValentinaValentina, et al. “Biogas To Liquefied Biomethane: Assessment Of 3p’s–Production, Processing, and Prospects.” *Renew Sustain Energy Rev* 119 (2020).
2. Haider, Junaid, Muhammad Abdul Qyyum, Bilal Kazmi and Imran Ali, et al. “Simulation Study of Deep Eutectic Solvent-Based Biogas Upgrading Process Integrated with Single Mixed Refrigerant Biomethane Liquefaction.” *Biofuel Res J* 7 (2020): 1245-1255.
3. Kazmi, Bilal, Zahoor Awan, Saud Hashmi and Zafar Khan Ghouri.“Desulfurization of the Dibenzothiophene (DBT) by using

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Imidazolium-Based Ionic Liquids(Ils)." *Mater Phys Chem* 1 (2018): 1.

4. Haider, Junaid, Saad Saeed, Muhammad Abdul Qyyum and Bilal Kazmi, et al. "Simultaneous Capture of Acid Gases from Natural Gas Adopting Ionic Liquids: Challenges Recent Developments and Prospects." *Renew Sustain Energy Rev* 123 (2020): 109771.
5. Xie, Yujiao, Johanna Björkmalm, Chunyan Ma and Karin Willquist, et al. "Techno-Economic Evaluation of Biogas Upgrading using Ionic Liquids in Comparison with Industrially used Technology in Scandinavian Anaerobic Digestion Plants." *Appl Energy* 227 (2017): 742-750.
6. Ma, Chunyan, Yujiao Xie, Xiaoyan Ji and Chang Liu, et al. "Modeling, Simulation and Evaluation of Biogas Upgrading using Aqueous Choline Chloride/Urea." *Appl Energy* 229 (2018):1269-1283.
7. Ma, Chunyan, Chang Liu, Xiaohua Lu and Xiaoyan Ji. "Techno-Economic Analysis and Performance Comparison of Aqueous Deep Eutectic Solvent and Other Physical Absorbents for Biogas Upgrading." *Appl Energy* 225 (2018): 437-447.
8. Junaid, Haider, Bilal Kazmi, Muhammad Abdul Qyyum and Ahmad Naquash, et al. "Biogas Upgrading through Blends of Deep Eutectic Solvents and Monoethanol Amine : Energy, Exergy, Environmental, and Economic." *Green Chem* 23 (2021): 6076-6089.

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