

Evaluation of the Efficiency of Biogas Treatment for the Removal of Siloxanes

The considerable energy potential in organic wastes motivates communities and industries to adopt waste-to-energy processes for efficient waste management and energy extraction from renewable resources. Biogas originates from the anaerobic digestion (AD) of organic wastes, including residuals from wastewater, and contains mainly methane and carbon dioxide. It also contains a number of pollutants e.g. nitrogen, hydrogen sulfide, siloxanes, mercaptanes, halogenated hydrocarbons. The contaminants present in biogas vary with the waste source and treatment strategies employed to clean biogas for energy recovery. This study focused on siloxanes removal from biogas primarily due to the problems caused by siloxanes when biogas is used to recover energy. Siloxanes, a class of organosilicon compounds, form silicon dioxide (SiO₂) which damages gas processing equipment during biogas combustion, reduces equipment life, and increases operational and maintenance costs for energy extraction from biogas. Energy recovery from biogas includes application of internal combustion engines, gas turbines, waste heat boilers, fuel cells and biogas upgrading for the production of natural gas-quality biomethane. Each of these end-use technologies has specifications regarding biogas quality (including siloxanes content) that must be complied with to ensure optimum efficiency and lifetime equipment guarantees. This study accomplished following objectives:

- Assess the existing analytical methods for siloxanes quantification. Develop practical guidelines for sampling and analysis of siloxanes in biogas.
- Assess siloxane compound distribution and concentrations in a range of biogas sources.
- Compare effectiveness and economics of adsorbents for siloxanes removal from biogas.
- Evaluate the siloxanes removal requirement for various biogas valorisation routes.

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