

Sustainable Biogas Upgrading: Characterization of Adsorption Properties of Tuff

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Abstract : This paper presents experimental results from the analysis of Tuff for CO₂ and H₂S removal from biogas. Synthetic zeolites, commonly used for biogas upgrading, are characterized by excellent performance in terms of carbon dioxide adsorption, however, cost and environmental footprint represent a negative contribute to their sustainability. Natural zeolites contained in Tuff, a totally inexpensive byproduct of the construction industry, show very interesting selective adsorption properties, associated with its availability in regions, as central Italy, where biogas production from small scale plants is rapidly increasing. An in-house experimental device was assembled to measure the adsorption capacity of Tuff as a function of partial CO₂ pressure for different temperatures (i.e. adsorption isotherms). Results show performances as high as 66% with respect to commercial zeolites (13X). A sensitivity analysis of different regeneration processes is also presented. A comparative analysis of natural and synthetic zeolites was finally performed using biogas samples obtained from different types of feedstock and characterized by varying CO₂ and H₂S content.

Keywords : biogas upgrading, CO₂ adsorption, sustainable energy, tuff

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