



národní
úložiště
šedé
literatury

Single-Step Purification of Raw Biogas to Biomethane Quality by Hollow Fiber Membranes without any Pre-Treatment – Innovation in Biogas Upgrading.

Žák, Michal
2018

Dostupný z <http://www.nusl.cz/ntk/nusl-387538>

Dílo je chráněno podle autorského zákona č. 121/2000 Sb.

Tento dokument byl stažen z Národního úložiště šedé literatury (NUŠL).

Datum stažení: 10.04.2024

Další dokumenty můžete najít prostřednictvím vyhledávacího rozhraní nusl.cz.

Single-Step Purification of Raw Biogas to Biomethane Quality by Hollow Fiber Membranes without any Pre-Treatment – Innovation in Biogas Upgrading

*Student: Ing. Michal Žák
Supervisor: Ing. Pavel Izák, Ph. D., DSc.*

Herein, a radical innovation in biogas production is presented using a single-step membrane purification technology without any necessary pre-treatment steps for contaminant removal. Asymmetric hollow fiber membranes with a thin, selective, non-porous layer made from polyester carbonate on the bore side were successfully used in a single-step raw biogas upgrading process at biogas plant Choťovice in Czech Republic.

A double-stage arrangement operated at 17 °C exhibited the best CO₂/CH₄ separation factor (~23) with 96 vol.% CH₄ purity. This single-step biogas upgrading technology with highly H₂S and water-resistant membrane modules allows reductions in capital expenditures of ~20% and in operational expenditures of ~50% compared to high pressure water scrubbing (HPWS) and ~70% compared to pressure swing absorption (PSA). Due to small energy consumption required merely for biogas compression, our units consumed around only ~2 MJ/Nm³ CH₄. Thus, our approach with significantly improved performance and robustness of the membrane separation process can be seen as a major breakthrough of membrane gas separation for inexpensive biogas production.

References

1. Abatzoglou, N; Boivin, S; A review of biogas purification processes, *Biofuels, Bioprod. Biorefin.* 2009, 3, 42–71.
2. Zhou, K; Chaemchuen, S.; Verpoort, F. Alternative materials in technologies for Biogas upgrading via CO₂ capture, *Renew. Sust. Ener. Rev.* 2017, 79, 1414–1441.
3. Scholz, M.; Melin, T.; Wessling M. Transforming biogas into biomethane using membrane technology, *Renew. Sust. Ener. Rev.* 2013, 17, 199–212.

- +
-
- | +
-
4. Chen, X.Y.; Vinh-Thang, H.; Ramirez, A.A.; Rodrigue, S. Kaliaguine, D. Membrane gas separation technologies for biogas upgrading, *RSC Adv.* **2015**, *5*, 24399–24448.
 5. Shin, M.S.; Jeon, Y.W.; Yoon, Y.M.; Lee, D.H. Module Configurations of Membrane Gas Separation System for Effective Utilization of Biogas, *Environ. Eng. Sci.* **2017**, *34*, 110–121.
 6. Havas, D.; Lin, H.; Optimal membranes for biogas upgrade by removing CO₂: High permeance or high selectivity? *Sep. Sci. Technol.* **2017**, *52*, 186–196.
 7. Molino, A.; Migliori, M.; Ding, Y.; Bikson, B.; Giordano, G.; Braccio, G. Biogas upgrading via membrane process: Modelling of pilot plant scale and the end uses for the grid injection, *Fuel* **2013**, *107*, 585–592.