Integral (VOCs, CO_2, mercaptans and H_2S) photosynthetic biogas upgrading using innovative biogas and digestate supply strategies

Mariana Franco-Morgado, Alma Toledo-Cervantes, Armando González-Sánchez, Raquel Lebrero, Raúl Muñoz

PII: S1385-8947(18)31493-1
DOI: https://doi.org/10.1016/j.cej.2018.08.026
Reference: CEJ 19640

To appear in: *Chemical Engineering Journal*

Received Date: 9 June 2018
Revised Date: 2 August 2018
Accepted Date: 4 August 2018

Please cite this article as: M. Franco-Morgado, A. Toledo-Cervantes, A. González-Sánchez, R. Lebrero, R. Muñoz, Integral (VOCs, CO_2, mercaptans and H_2S) photosynthetic biogas upgrading using innovative biogas and digestate supply strategies, *Chemical Engineering Journal* (2018), doi: https://doi.org/10.1016/j.cej.2018.08.026

Integral (VOCs, CO_2, mercaptans and H_2S) photosynthetic biogas upgrading using innovative biogas and digestate supply strategies

Mariana Franco-Morgado[1, 2], Alma Toledo-Cervantes[3], Armando González-Sánchez[2], Raquel Lebrero[1], Raúl Muñoz[1]*

1. Department of Chemical Engineering and Environmental Technology, University of Valladolid, C/Dr. Mergelina s/n., Valladolid 47011, Spain.

2. Instituto de Ingeniería, Universidad Nacional Autónoma de México, Circuito Escolar, Ciudad Universitaria, C.P. 04510. México City, México.

3. Departamento de Ingeniería Química, CUCEI-Universidad de Guadalajara, Blvd. M. García Barragán 1451, C.P. 44430, Guadalajara, Jalisco, México.

*Author for correspondence: mutora@iq.uva.es

Abstract

The performance of a pilot high rate algal pond (HRAP) interconnected with a biogas absorption column during the simultaneous upgrading of biogas and treatment of digestate was evaluated under two innovative biogas and nutrient supply strategies. Process operation with biogas supply during the night at a liquid recirculation/biogas ratio of 0.5 to prevent N_2 and O_2 stripping resulted in a biomethane complying with most international regulations for injection into natural gas grids (99.1 ± 1% CH_4, 0.5 ± 0.2% CO_2, 0.6 ± 0.5% N_2 and 0.07 ± 0.08% O_2). The potential of this technology to remove methyl mercaptan (MeSH), toluene and hexane from biogas (typically present at trace levels) was assessed, for the first time, with removal efficiencies under steady-state correlating with pollutant hydrophobicity (7 ± 7% for hexane, 66 ± 4% for MeSH and 98 ± 1% for toluene). Finally, the supply of