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Integral (VOCs, CO₂, mercaptans and H₂S) photosynthetic biogas upgrading using innovative biogas and digestate supply strategies

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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 N₂ and O₂ stripping resulted in a biomethane complying with most international regulations for injection into natural gas grids ($99.1 \pm 1\%$ CH₄, $0.5 \pm 0.2\%$ CO₂, $0.6 \pm 0.5\%$ N₂ and $0.07 \pm 0.08\%$ O₂). 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 ($7 \pm 7\%$ for hexane, $66 \pm 4\%$ for MeSH and $98 \pm 1\%$ for toluene). Finally, the supply of

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