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Simultaneous biogas upgrading and centrate treatment in an outdoors pilot scale high rate algal pond

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ABSTRACT

The bioconversion of biogas to biomethane coupled to centrate treatment was evaluated in an outdoors pilot scale high rate algal pond interconnected to an external CO₂-H₂S absorption column (AC) via settled broth recirculation. CO₂-removal efficiencies ranged from 50 to 95% depending on the alkalinity of the cultivation broth and environmental conditions, while a complete H₂S removal was achieved regardless of the operational conditions. A maximum CH₄ concentration of 94% with a limited O₂ and N₂ stripping was recorded in the upgraded biogas at recycling liquid/biogas ratios in the AC of 1 and 2. Process operation at a constant biomass productivity of 15 g m⁻² d⁻¹ and the minimization of effluent generation supported high carbon and nutrient recoveries in the harvested biomass (C = 66±8%, N= 54±18%, P•100% and S =16±3%). Finally, a low diversity in the structure of the microalgae population was promoted by the environmental and operational conditions imposed.

Keywords: algal-bacterial symbiosis, biogas upgrading, biomethane, microalgae, outdoors conditions, wastewater treatment.

1. Introduction

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