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Biogas desulfurization by autotrophic de-nitrification–temperature dependence

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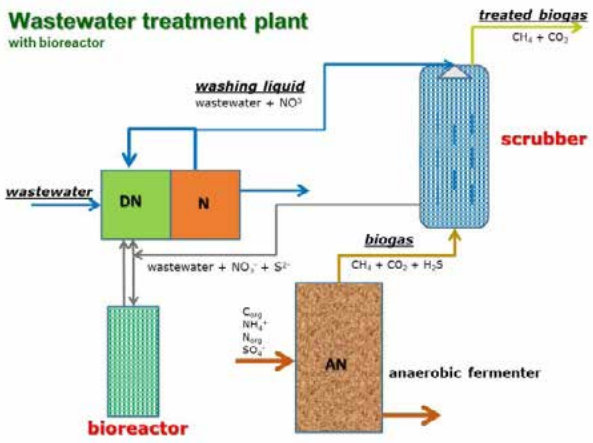
Biogas utilization is complicated when it contains hydrogen sulfide coming from reduction of sulfur compounds during anaerobic digestion. There are many methods for desulfurization of biogas, but biological one based on activity of sulfur bacteria is advantageous from ecological and economical points of view. Our research was focused on the removal of hydrogen sulfide from biogas by water scrubbing and on the treatment of washing liquid in a separate bioreactor with sulfur bacteria. The bioreactor was packed with a plastic carrier for immobilization of bacteria and operated in up-flow mode so that sulfates were the final forms of sulfur. These bacteria can use oxygen or nitrates as electron acceptors during oxidation of sulfides and both oxidizing agents were studied. Process efficiency depends mainly on sulfide loading rate, dosed amount of oxygen, molar ratio S/N when nitrates were used, pH and temperature. In the case of nitrates addition bacteria of genus *Paracoccus, Thiobacillus denitrificans* and *Thiobacillus thioparus* were detected in biomass by FISH analysis. According to literature, the bacteria of genus Paracoccus have optimum for growth at high pH 6.5–10.5 and this fact was confirmed by our study, where bioreactor operation was stable and effective at pH over 10. Molar ratio S/N, which influences end products of autotrophic de-nitrification, has been set on value 0.55. The dependence of the process efficiency on temperature was studied for three temperatures: 20°C, 25°C and 30°C and the highest loading rate of sulfides (350.9 mg•L-1•d-1) and N-NO-3 (258.6 mg•L-1•d-1) with sufficient efficiency was reached at temperature 30°C. Our research has demonstrated the suitability of biological desulphurization of biogas in the external packed bed reactor with immobilized sulfur bacteria with oxygen and nitrate as oxidizing agents. Especially, desulfurization with nitrates can be advantageously included as autotrophic de-nitrification in the wastewater treatment line.



Biography

Dana Pokorna is an Assistant Professor in the Department of Water Technology and Environmental Engineering, Faculty of Technology of Environment Protection, University of Chemistry and Technology Prague. Main areas of her research interest are "Anaerobic biodegradation of organic substrates, determination of anaerobic biomass activity, analytical determination of byproducts and end products of anaerobic degradation, biogas cleaning (H_2S removal), upgrading biogas to bio-methane and transformation of CO_2 to bio-methane. She is the member of International Water Association (IWA) and European Federation of Biotechnology (EFB); the member of Czech Biogas Association and Czech Water Association and; the member of the Czech Biotechnology Society Committee.

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