

Evaluation of sulfate reduction and sulfide production in an upflow anaerobic sludge blanket reactor (UASB) treating domestic sewage

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In the treatment of domestic sewage in Upflow Anaerobic Sludge Blanket (UASB) anaerobic biological reactors, the production of hydrogen sulfide (H₂S) occurs due to the presence of sulfate and the action of sulfate-reducing bacteria (SRB). This is an extremely toxic gas at high concentrations, and its production is associated with foul odors, even at low concentrations. Its solubility, combined with low agitation inside the reactor, makes it difficult to separate in the gas phase (biogas), and the presence of dissolved sulfide can compromise the quality of the treated effluent due to an increase in Chemical Oxygen Demand (COD) concentrations. In this context, the present study aimed to evaluate the production of sulfide in the sulfate reduction process in anaerobic reactors, specifically an innovative configuration UASB reactor treating domestic sewage. The experiment was conducted by comparing two reactors operated under the same conditions: a conventional reactor (CR) and a modified reactor (MR). Essentially, the MR reactor has a larger gas collector and biomass retention compartment (anaerobic sludge). Samples were collected from the raw sewage (RS) and treated in the reactors over a 24 hour period for sulfate and COD analysis. Spot samples of effluents and biogas were also collected for analysis of dissolved sulfide and sulfide in the gas phase. The results for sulfate in the effluents were 31.8 mg/L in the RS, 12.2 mg/L in the CR, and 11.8 mg/L in the MR. Dissolved sulfide results were 5.16 mg/L in the CR and 6.17 mg/L in the MR, while sulfide in the biogas had values of 512 ppm in the CR and 641 ppm in the MR. Therefore, the conversion fees were 61.7% of sulfate to sulfide in the conventional reactor, while in the modified reactor, this value was 63.0%. COD concentrations of 902 mg/L of total COD were obtained in the RS, and 113 mg/L and 109 mg/L for filtered COD, respectively, in the CR and MR reactors. Thus, the biological efficiencies in the biogas suggest that sulfate reduction in the RM reactor is superior to that in the RC reactor. This may have occurred due to the larger amount of biomass present in the RM, but it could also be owing to the geometric characteristics of the gas collector, which has a larger available area for gas release compared to the CR reactor.

Key words: Sulfate; Sulfide; UASB; Domestic sewage.

Avaliação de redução de sulfato e da produção de sulfeto em reator anaeróbico de manta de lodo (UASB) tratando esgoto doméstico

No tratamento de esgotos produz-se sulfeto de hidrogênio (H₂S), em consequência do sulfato e da ação de bactérias redutoras de sulfato (BRS). Objetivou-se avaliar a produção de sulfeto pela redução de sulfatos, por comparação entre dois reatores UASB. A conversão encontrada foi de 61,7% no reator convencional (RC), e 63,0% no reator modificado (RM). As eficiências biológicas foram da ordem de 87% em ambos reatores. As concentrações de sulfeto sugerem maior redução de sulfato no RM que no RC. Tal fato pode ter ocorrido em razão da maior quantidade de biomassa e das dimensões do coletor de gases.

Palavras-chave: Sulfato; Sulfeto; UASB; Esgoto doméstico.

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