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HYDROGEN SULFIDE REMOVAL FROM BIOGAS USING POLYURETHANE FOAM AND CELLULAR CONCRETE WASTE BIOFILTERS: EXPERIMENTAL EVALUATION AND COMSOL SIMULATION

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Abstract – This study evaluates the hydrogen sulfide (H_2S) removal efficiency of a laboratory-scale biofilter packed with a combination of polyurethane foam (PUF) and cellular lightweight concrete (CLC) waste under varying operational conditions. The biofilter, consisting of five stages, was operated for six days to assess the effects of inlet loading rates, H_2S concentrations, temperature, and humidity on removal efficiency. Experimental results revealed that the PUF-CLC waste configuration achieved removal efficiencies of up to 85 % in the initial stages and 65–70 % in the later stages. These findings were compared to a biofilter packed solely with CLC waste, which demonstrated a slightly higher efficiency of 90 % in the initial stages and 70 % in the later stages under similar conditions. COMSOL 6.1 simulations were conducted for both configurations to model biogas flow, H_2S concentration, and removal trends. The simulation results aligned closely with the experimental data, showing comparable performance across the two setups. The study highlights the advantages and limitations of PUF-CLC waste biofilters and provides insights into the optimal design and operation of biofiltration systems for biogas purification.

Keywords – Hydrogen sulfide (H_2S) removal; biofilter; polyurethane foam (PUF); cellular lightweight concrete (CLC) waste; biofiltration system; removal efficiency; COMSOL 6.1 simulations

Biofilter packed with PUF and CLC waste to remove H2S from biogas

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