BIOHYDROGEN PRODUCTION IN A CONTINUOUS STIRRED TANK BIOREACTOR FROM SYNTHESIS GAS BY ANAEROBIC PHOTOSYNTHETIC BACTERIUM: RHODOPIRILLUM RUBRUM

Abstract

Hydrogen may be considered a potential fuel for the future since it is carbon-free and oxidized to water as a combustion product. Bioconversion of synthesis gas (syngas) to hydrogen was demonstrated in continuous stirred tank bioreactor (CSTBR) utilizing acetate as a carbon source. An anaerobic photosynthetic bacterium, Rhodospirillum rubrum catalyzed water-gas shift reaction which was applied for the bioconversion of syngas to hydrogen. The continuous fermentation of syngas in the bioreactor was continuously operated at various gas flow rates and agitation speeds, for the period of two months. The gas flow rates were varied from 5 to 14 ml/min. The agitation speeds were increasingly altered in the range of 150-500 rpm. The pH and temperature of the bioreactor was set at 6.5 and 30 °C. The liquid flow rate was kept constant at 0.65 ml/min for the duration of 60 days. The inlet acetate concentration was fed at 4 g/l into the bioreactor. The hydrogen production rate and yield were 16 ± 1.1 mmol g^{-1} cell h^{-1} and 87 ± 2.4% at fixed agitation speed of 500 rpm and syngas flow rate of 14 ml/min, respectively. The mass transfer coefficient (K_La) at this condition was approximately 72.8 h^{-1}. This new approach, using a biocatalyst was considered as an alternative method of conventional Fischer-Tropsch synthetic reactions, which were able to convert syngas into hydrogen.

Author Keywords

Agitation rate and dilution rate; Hydrogen; Mass transfer; Rhodospirillum rubrum; Syngas