Optimizing the Agricultural and Food Industrial Biogas Production

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Abstract

Key-words: biogas, poultry feather, Hydraulic retention time, trend-analysis

My research focused on developing special biogas input material variants that results a higher methane-yield during utilization. The optimal pre-treatment parameters were determined of the slaughterhouse poultry feather. 70°C temperature, 1:2 and 1:3 ratios of feather and water, 1% concentration of bacteria culture, mechanical stirring are recommended at laboratory scale. 70°C temperature, 1:3 ratio of feather-water, bacteria culture of 1% concentration, compressed oxygen supply are recommended for industrial environment. Solution for the co-fermentation of pre-treated feather and pig slurry was defined. Due to the amount of produced hydrogen sulphide (ppm) the critical mixing ratio of feather proved to be 5-10% in laboratory environment and 2% in the Regional Biogas Plant of Nyírbátor. The relationship between the used raw-material combinations in the agriculture biogas plant and the end-product were revealed concerning the quality and quantity parameters (C-, N-, organic matter and dry matter content, C/N rate). The relationship between the produced biogas amount and the retention time was also analysed. Average hydrological retention time (HRT) has been determined for mesophilic- (19 days) and thermophilic (23 days) fermentors and for the whole system (43 days). The relationships were significant. Specific (1 ton input material) optimal effectiveness indicators and interval optimum values have been elaborated in order to reach higher biogas production. A strong relationship could be revealed between the quality parameters of the raw material and the biogas production (Nm^3) (the sum of the data of 43 days). Based upon the analysis of the time series derived trend and periodic effects were defined on the process of biogas production. The time series trend-analyses is applicable to measure the fluctuation of the periodic biogas production (Pi=±400 Nm^3) and also to evaluate the volume of a technological reserve (Max.=20%).