UTILIZATION OF FOOD WASTES TO THE INCREASE OF THE BIOGAS PRODUCTION ON THE MUNICIPAL WASTEWATER TREATMENT PLANTS (WWTPs)

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INTRODUCTION

Capacity of sludge and biogas reactors in Slovak municipal waste water treatment plants is not fully utilized. From technological point of view fermentation tanks have enough volume for increase biogas production. Through the appropriate choice and dosage of external substrates, we can increase production of biogas, which would also contribute to increased energy production. The presented contribution describes several months laboratory scale research using kitchen waste as an organic source for biogas production. The results confirmed the high potential of food waste as co-substrate for anaerobic fermentation. The obtained specific biogas production was around 1 m³ of biogas from 1 kg VSS of waste.

WORLD EXAMPLE

An example of wastewater treatment plant using the household organic substrates is the municipal WWTP Gorenje Velenje, Slovenia. The anaerobic system at Gorenje WWTP consists of 2 digesters operated at mesophilic temperature with a total volume of 2 000 m³. Organic loading rate of 1 kg VSS/m³.d and hydraulic retention time 20 d. As co-substrate with sewage sludge (organic loading rate of 0.8 kg VSS/m³.d) was household organic waste. The results of co-substrate addition and organic loading rate of 1 kg VSS/m³.d biogas yield of 80 %, specific biogas production from 0.63 to 0.89 m³/kg VSS, production of electric power of 150 % and heat of 35 %.

EXPERIMENTAL PART

The laboratory modelling of the biogas production from food and restaurant wastes was realised in the anaerobic reactor (producer ASIO Bytča, Slovakia) with the total volume 13 L (figure 1.) with duration of six months. The reactor was heated up to 37 – 38 °C by thermostat TS – 050 SRCI (producer MERLIN GERIN) and stirred by IKA RW 14 basic. The evolvement speed was 100 in minute, the stirring started every thirty minutes and the duration of stirring was 15 minutes. The biogas was carried to biogas flow meter where the production of biogas was measured.

Fig. 1. Laboratory anaerobic reactor ASIO. a) front view b) lateral view.

RESULTS AND DISCUSSION

The laboratory model was filled with the anaerobic sludge from WWTP Devínska Nová Ves (Slovakia). The initial values of the sludge were: total suspended solids 13.7 g/L, volatile suspended solids (VSS) 54 % and pH 7.18. The dosing of the substrate was starting on November 5, 2008 and stopped May 18, 2009. The restaurant (food) wastes from the canteen of FCHPT STU Bratislava were used as the substrate. Every new substrate was mixed, hygienised at 70°C by thermostat TS – 050 SRCI (producer MERLIN GERIN) and stirred by IKA RW14 basic. The evolve speed was 100 in minute, stirring of every 15 minutes. The biogas was carried to biogas flow meter where the production of biogas was measured.

Tab. 1. Sludge and substrate composition

COD (g/l) 145 – 310 230
TSS (g/l) 102 – 249 196
VSS (g/l) 96 – 237 186
VSS (%) 85 – 96 93

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CONCLUSION

Result from the up-to-now experiments held during several months in FCHPT STU Bratislava it can be confirmed that utilisation of food wastes as the substrate for biogas production increase is possible. However it is necessary to dose the substrate to WWTPs with sensitivity, to define the composition of the wastes, to define optimal load of fermentation reactors. The next important condition for the utilisation of food wastes is the definition of their influence to the quality of input parameters of waste water namely from the point of view of nitrogen and its removal from waters.