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# Influence of Disintegration of Sida hermaphrodita Silage on Methane Fermentation Efficiency

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**Abstract :** As a result of sonification, the destruction of complex biomass structures results in an increase in the biogas yield from the conditioned material. First, the amount of organic matter released into the solution due to disintegration was determined. This parameter was determined by changes in the carbon content in liquid phase of the conditioned substrate. The amount of carbon in the liquid phase increased with the prolongation of the sonication time to 16 min. Further increase in the duration of sonication did not cause a statistically significant increase in the amount of organic carbon in the liquid phase. The disintegrated material was then used for respirometric measurements for determination of the impact of the conditioning process used on methane fermentation effectiveness. The relationship between the amount of energy introduced into the lignocellulosic substrate and the amount of biogas produced has been demonstrated. Statistically significant increase in the amount of biogas was observed until sonication of 16 min. Further increase in energy in the conditioning process did not significantly increase the production of biogas from the treated substrate. The biogas production from the conditioned substrate was 17% higher than from the reference biomass at that time. The ultrasonic disintegration method did not significantly affect the observed biogas composition. In all series, the methane content in the produced biogas from the conditioned substrate was similar to that obtained with the raw substrate sample (51.1%). Another method of substrate conditioning was hydrothermal depolymerization. This method consists in application of increased temperature and pressure to substrate. These phenomena destroy the structure of the processed material, the release of organic compounds to the solution, which should lead to increase the amount of produced biogas from such treated biomass. The hydrothermal depolymerization was conducted using an innovative microwave heating method. Control measurements were performed using conventional heating. The obtained results indicate the relationship between depolymerization temperature and the amount of biogas. Statistically significant value of the biogas production coefficients increased as the depolymerization temperature increased to 150°C. Further raising the depolymerization temperature to 180°C did not significantly increase the amount of produced biogas in the respirometric tests. As a result of the hydrothermal depolymerization obtained using microwave at 150°C for 20 min, the rate of biogas production from the Sida silage was 780 L/kg VS, which accounted for nearly 50% increase compared to 370 L/kg VS obtained from the same silage but not depolymerised. The study showed that by microwave heating it is possible to effectively depolymerized substrate. Significant differences occurred especially in the temperature range of 130-150ºC. The pre-treatment of Sida hermaphrodita silage (biogas substrate) did not significantly affect the quality of the biogas produced. The methane concentration was about 51.5% on average. The study was carried out in the framework of the project under program BIOSTRATEG funded by the National Centre for Research and Development No. 1/270745/2/NCBR/2015 'Dietary, power, and economic potential of Sida hermaphrodita cultivation on fallow land'.

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