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Evaluation of mechanical comminution as substrate pretreatment in biogas production

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The improved utilization of the energy potential of agricultural biomass is of tremendous importance. But anaerobic microbiological processes can only, very slowly and incompletely, break up the lignocelluloses matrix of a typical agricultural biomass. There is, therefore, an urgent need for economically viable technologies for the pretreatment of biomass which improves subsequent microbiological utilization. A mechanical comminution of the biomass reduces it to smaller particle sizes. It should lead to an exposure of the surface of the solid substrates and facilitate their accessibility for anaerobic microorganisms. The main focus of the experiment is the determination of the possible influence of selected mechanical comminution of typical agricultural substrates on the biogas process. To represent the market offer, five different mechanical crushing technologies were compared. The comparison is made by applying the comminution technologies to a selection of agricultural substrates for biogas production: maize silage, grass silage, cow dung and Hungarian energy grass silage. The comminuted substrates and different comminution technologies were investigated in batch tests. Here, two substrates (maize silage and cow dung) were selected in combination with two technologies (hammer mill and cross flow chopper) to show the highest biogas production increase in order to investigate the effect further under semi-continuous flow conditions. With the statistical evaluation in the batch experiment, it was found that the substrate selection is the variable which has the greatest influence on the measured methane yield, regardless of the technology or the treatment. In addition, the relevance of the treatment could be demonstrated if the rate of substrate degradation was also considered. Under semi-continuous flow conditions, an increase in biogas productivity (maize silage up to 17% and cow dung up to 22%) could be measured by the mechanical substrate preparation. Furthermore, a positive effect on the degradation kinetics of the substrates was demonstrated.

Biography

Diana Andrade graduated in 2002 as Civil Engineer at Barranquilla Colombia. She moved to Germany in 2003 after collecting some experiences as a Researcher in the topic aerobic degradation for waste water treatment. She obtained her Master of Science degree in Ecology Engineering and Environmental Planning from Technical University of Munich in 2007 with a focus on renewable energy. Since then, she works as a Senior Researcher for the Institute of Agricultural Engineering and Animal Husbandry in the Bavarian State Research Centre for Agriculture in the research group biogas technology and waste management. Her research concentrated in the optimization of the anaerobic degradation process of lignocellulose materials for the biogas production and the effect of nutrients supplementation on the biogas process.

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