

Survivability of plant pathogens during anaerobic digestion of agricultural crops in biogas plants

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The survivability of selected plant pathogens during anaerobic digestion of diverse substrates in biogas plants has been studied. The goal is to estimate the risk of spreading plant pathogens by use of derived digestates as organic fertilizer. The investigation focus on biogas plants with mesophilic operating temperatures and continuous feeding. Exclusively infected plant material and no pure cultures used. Initially a screening of the inactivation of selected pathogens was carried out in lab-scale anaerobic digestion experiments. The results obtained were validated in a full-scale biogas plants.

Eight host-pathogen-systems were considered: sorghum - *Fusarium proliferatum* or *F. verticillioides*, rye - *Alternaria alternata*, wheat grain – *A. alternata*, sugar beet – *Sclerotinia sclerotiorum* and potato - *Rhizoctonia solani*, *Potato Virus Y* (PVY) or *Synchytrium endobioticum*. The infected plant material was introduced into the process using cylindrical carriers made of polypropylene. The influence of exposure time, storage of the digestate and prior ensiling of the plant material were analysed in regard to the efficiency of pathogen inactivation.

Results obtained show that in lab-scale fermentation experiments the time required for a complete inactivation of the pathogens varied dependant on the pathogen species. Most of the pathogens tested were inactivated within 6 hours. However, in fresh sorghum no viable *F. proliferatum* or *F. verticillioides* was detected initial after 138 hours. The ensiling of fresh sorghum considerably accelerated the inactivation. *F. proliferatum* was already inactivated within 24 hours while *F. verticillioides* required only 6 hours. The inactivation of *A. alternata* in rye already took place during the ensiling process. In general the storage of the digestate can shorten the required time for inactivation. *S. endobioticum*, causing potato ward disease, could not be inactivated at all. These results were validated in full-scale biogas plant exemplarily for the pathogens *F. proliferatum*, *F. verticillioides* and *S. Sclerotiorum*.

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