

Contamination of organic waste materials by antibiotics and its implications for use in agriculture

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Organic wastes are used increasingly in biogas plants to produce energy and digestates are used as fertilizers. Input and output materials were collected from 30 biogas plants comprising manures originating from different animal species, and sewage sludge in varying ratios. Eight representative antibiotics were determined: sulfadiazine (SFD) and sulfamethazine (SMZ), enrofloxacin (EN), ciprofloxacin (CF), difloxacin (DF), chlortetracycline (CTC), oxytetracycline (OTC) and tetracycline (TC). Input and output materials of biogas plants were sampled at the same day. All sewage sludge samples proved to be contaminated by antibiotics. In cattle manure OTC, TC and EF were prevailing in higher concentrations, in pig slurry SFD was found often, too. In poultry dung the dominating antibiotics were EF, CF and TC. The highest antibiotic concentrations with values > 8600 µg EF/kg DM were detected in chicken manure. The highest concentration of 8626 µg EF/kg DM and 8180 µg TC/kg DM was found in in poultry dung, followed by 7781 µg OTC/kg DM in pig slurry.

The composition of antibiotics in sewage sludge differed from that in animal manures: CF and TC were detected in all sewage sludge samples. EF and SFD were detected frequently. In all sewage sludge samples TC was found while in manures and slurries OTC was the dominating tetracycline. Comparable to the input materials digestates contained significant amounts of antibiotics. All digestates derived from sewages sludge were contaminated with a maximum value of 2440 µg TC/kg DM. 79% of all substrates (animal manures + sewage sludge) and 86 % of the digestates contained antibiotics. The data showed that antibiotics were hardly degraded during the fermentation process in the biogas plant. The results revealed that the direct use of farmyard manure and sewage sludge will yield a contamination with antibiotics comparable to that of digestates.

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