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HYGIENIC ASPECTS OF RECYCLING OF ORGANIC WASTE IN BIOGAS PLANTS

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INTRODUCTION

Anaerobic digestion in biogas plants is an attractive alternative to treat biowaste. This process produce biogas, and the digested residues may be used in agriculture. As is practice in Sweden, a biogas plant may also have a separate pasteurisation step where the substrate is processed at 70°C for one h. Most of the substrate is manure from pig- and dairy farms together with biowaste from food industries, households, slaughterhouses and restaurants. It is well known that biowaste contains pathogens; therefore the aim of this study was to find out if pathogens are sufficiently reduced when biowaste is processed in biogas plants.

MATERIALS AND METHODS

Four Swedish commercial biogas plants were sampled at 6 occasions during one year. All plants processed animal low risk waste from slaughterhouses, which requires a separate, batch wise pasteurisation at 70°C for 60 min. before digestion. One plant used thermophilic (50-55°C) digestion while the other three used mesophilic (30-38°C) digestion. Digesters, as well as pasteurisation tanks, were continuously stirred. Sampling was performed from substrate before and after pasteurisation, after digestion, in storage for digested residues and from intermediate storage wells at farm sites. The samples were analysed for indicator bacteria (coliforms 37°C, thermotolerant coliforms 44°C, *E. coli* and *Enterococcus* spp.) spore forming bacteria (*Bacillus* spp. and *Clostridium* spp.) and selected pathogens (*Salmonella* spp., *E. coli* O157, *Listeria monocytogenes* and *Campylobacter* spp.). The methods for indicator bacteria and spore forming bacteria were quantitative while pathogens were qualitative analysed.

RESULTS AND SUMMARY

No growth of indicator bacteria or pathogens was observed after pasteurisation, after digestion or in storage for digested residues. Occurrence of *Clostridium* spp. and *Bacillus* spp. was not reduced in the pasteurisation process. In all samples, viable counts of *Clostridium spec.* and *Bacillus spec.* were unchanged from raw to treated substrate. Most isolations of pathogens were done before pasteurisation, and *Salmonella* spp. were the most frequently isolated pathogens. At two occasions *Salmonella agona* was isolated before pasteurisation and also in the storage wells at farm sites. By DNA-fingerprinting methods these two isolates were exactly identical. It is therefore assumed that a contamination has occurred of the digested residues in the storage wells at the farm sites or in the transportation cars.

The pasteurisation process is an effective way to ensure pathogen reduction. The number of spore forming bacteria is not reduced in the pasteurisation process.

In general the anaerobic digestion with a pre-treatment step in 70°C for 60 min. results in a total reduction of *Salmonella* spp. present in biowaste. In this study, however, it was noted that cleaning of the tanks of the transportation cars was not efficient, therefore, the a risk of contamination of digested residues during transportation to the farms is obvious.