

## **NEW HYGIENE RULES FOR BIOGAS PLANTS- REVISING GERMAN BIOWASTE ORDINANCE -**

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Revising the German Biowaste Ordinance**

### **Introduction**

Biowaste Ordinance was primarily implemented in 1998 for composting plants. Before that moment hygiene-requirements for biogas-plants were not scientifically confirmed. The Regulation (EC) nr. 1774/2002 demands since 2003 additional investigations processing standard.

In this context the hygienisation-effect of different biogas-treatments (anaerobic mesophilic and thermophilic fermentation) has to be supervised. The research program investigated the survival of defined indicator-organisms (*Salmonella*, *Enterococcus faecalis*, coliphages, *Ascaris suum*, *Campylobacter jejuni*, *Mycobacterium avium* ssp Noroviruses, Parvoviruses, *Plasmodiophora brassicae*, tomato seeds, Tobacco mosaic Virus (TMV)), monitoring process temperature, product quality and minimal residence time.

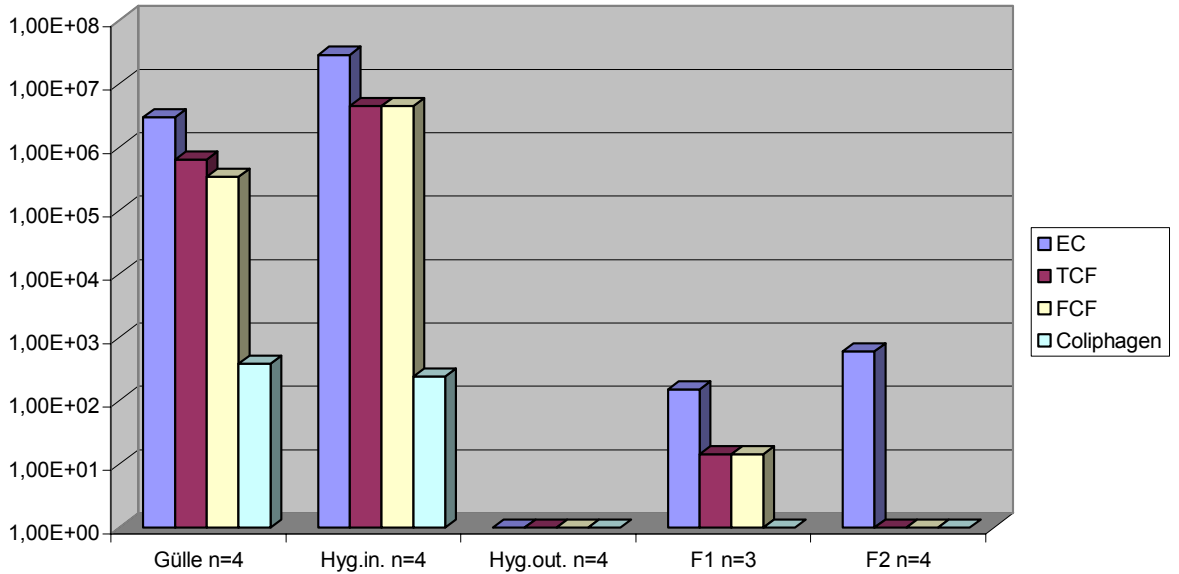
### **Material and methods**

The investigations were done with generally recognized methods of diagnosis in both anaerobic plants and in the laboratory experiments. Detailed representations of the methods are represented in the final report from Böhm et al. (2004), Ade-Kapelmann (2005) and Lorenz (2005).

### **Results**

The results of selected microorganisms in liquid manure as well as after a pasteurisation (70°C) are represented in the figure1. The figure 1 shows additionally the selected microorganisms after mixing with nonpasteurized liquid manure in anaerobic treatment plant (codigestion).

Fig. 1: Amount of enterococci, fecal coliforms, total coliforms and bacteriophages before and after hygienisation (70°/1 h) and after mesophilic anaerobic treatment



It is evident that after heating the coferments (biowaste) above 70°C for 1 h the examined microorganisms are reduced under their detection limit. After heating from the cosubstrates and mixing with nonpasteurized liquid manure the values of the examined microorganisms again 2-3 powers of ten rise up in an anaerobic mesophilic digestion plants.

Figure 2 shows the inactivation of TMV in a special pasteurisation unit with 70, 75 and 80°C in laboratory experiments. With different test carriers the TMV as well as liquid manure was brought into the pasteurization unit (70°C/1h) and 80°C/1 h. This treatment was not enough to inactivate all TMV.

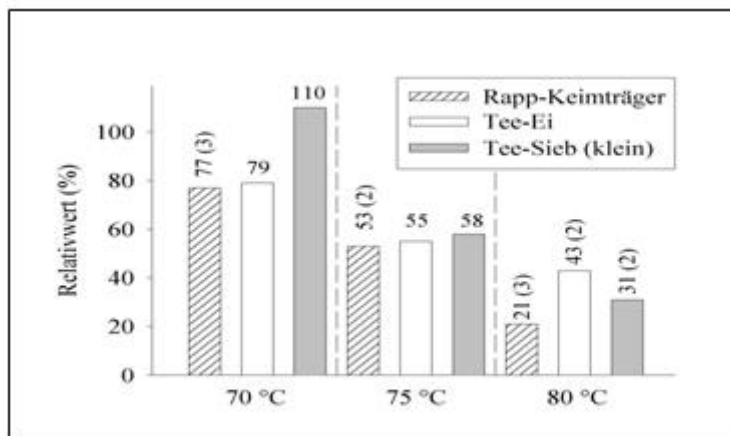


Fig 2: Tenacity of Tobacco Mosaic Virus (TMV) in laboratory experiments for the hygienisation of slurry and coferments at different temperatures

In order to revising the Biowaste Ordinance and develop a protocol for direct process monitoring (process-validation) we evaluated different “test organisms”. In mesophilic laboratory fermenters the test organisms could not be inactivated within 24 h. In thermophilic laboratory fermenters all organisms were totally inactivated after 24 h of treatment. These results could mostly be confirmed for full-sized fermentation plants. In trials where the material was preheated (70-90°C for 1 – 2 hours) even the thermostable coliphage T1 was totally inactivated within 1 h at 70°C. To receive an environmentally safe fermentation product, it is recommended to require an actual retention time for particles of 22 – 24 h at a temperature of 55°C (Ade-Kappelmann, 2005).

In mesophilic anaerobic fermentation plants *Plasmodiophora brassicae* and tomato seeds were only marginally reduced within 24 h. In thermophilic anaerobic fermentation these parameters are completely reduced within 24 h. To maintain the conditions to the phyto hygienic safety of biowastes in mesophilic anaerobic fermentation plants required in the BioAbfV (1998), heating to 70°C for 1 h is enough for the inactivation of the „test” organisms named above. However, to inactivate tobacco mosaic virus safely, prior or post fermentation a heating step of either 80°C for 2 hours or 85°C for 1 – 2 hours must be added. Other investigated test organisms like tobacco rattle virus showed a comparable survival rate to tobacco mosaic virus. Sorrel seeds and other weed seeds were comparable to the survival of tomato seeds (Lorenz, 2005).

#### Consequences for Revising the Biowaste Ordinance

The consequences for revising the German Biowaste Ordinance is that composting like since before and thermophilic anaerobic codigestion are accepted only until the end of December 2005. Mesophilic digestion is accepted only together with a hygienisation (pasteurization) unit for biowaste (pre- and after heating at 70°C / 1h).

For thermophilic operated biogas-plants a process-validation with indicator organisms (*Salmonella*, *Plasmodiophora brassicae*, tomato seeds) is necessary in order to control the minimal retention time. The use of *Bacillus globigii* spore suspension as a ‘biological tracer’ has proven to be useful. This way during the direct process monitoring the exposure time of test organisms can be adjusted to the now determined retention time for each individual plant.

For hygienisation-units, a process-validation with indicator-organisms (*Salmonella*, *Plasmodiophora brassicae*, tomato seeds) is not necessary, only for thermophilic anaerobic digestion biogas-plants and composting-plants. TMV is not adequate test-organism for this process-test.

In co-fermenting biogas-plants, the product quality is checked directly after the hygienisation unit (without *Salmonella* spp. in 50 g; germable seeds and drive outable parts about 2 per litre).

## References

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