Dust rejects from lime production – are they suitable for the sanitation of organic wastes from animal production and dogs' excrements?

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Summary

The effect of dust rejects from lime production caught on the electrostatic precipitator on the survival of parasitic germs in manure and dogs´ excrements mixed with hay in the ratio of 1:5 was studied under laboratory conditions. An application of dust rejects at a concentration of 20 $g.kg^{-1}$ of organic wastes, resulted in a devitalisation of 82.41 ± 8.49 % of model unembryonated *Ascaris suum* in the manure and 77.05 ± 4.74 % of eggs in mixed dogs' excrements within 24 hours. *A. suum* eggs were totally devitalised as early as within 36 days after application of dust rejects to manure and within 8 days in dogs' excrements. For the sanitation of organic wastes from animal production and dogs' excrements, the use of dust rejects from lime production, at more affordable price than quality lime dust, is very suitable.

Key words: rejects from lime production, sanitation, manure, dogs´excrements, Ascaris suum eggs

Introduction

Pig excrements frequently contain bacteria of the family Enterobacteriaceae, most of which are of zoonotic character. Protozoa (*Isospora* spp., *Balantidium coli*) and eggs or larvae of enteronematodes are also found in pig faeces. *Ascaris suum* eggs and coccidial oocysts are hygienically the most hazardous, primarily for their high resistance in the environment.

Regarding the spread of helminthoses, domestic animals (dogs, cats) are also of great importance because they live in a close contact with man. Through faeces of infected dogs and cats the germs of parasitozoonoses spread into the environment. Infection and way of transmission of the disease depends on the way of breeding and on the breeding environment where the animal occurs.

On the other hand, animal excrements can supply other essential plant nutrients and serve as a soil amendment by adding organic matter. The most serious problem is the sanitation of this organic wastes. The eim of our study was to study the effect of dust rejects from lime production on the survival of parasitic germs in manure and in dogs´ excrements under laboratory conditions.

Materials and methods

Pig manure (M) and dogs´ excrements mixed with hay in the ratio of 1:5 (D) were used in the experiment. Organic wastes were mixed with dust rejects from lime production caught on the electrostatic precipitator in a concentration of 20 $g.kg^{-1}$ of wastes and periodically shovelled. Experimental design: UM - untreated manure, M20 - manure mixed with dust rejects in a concentration of 20 $g.kg^{-1}$, UD - untreated dogs´ excrements, D20 - dogs´ excrements mixed with dust rejects in a concentration of 20 $g.kg^{-1}$.

The ”artificial contamination of organic wastes” with unembryonated *A. suum* eggs was used approach to make sure that there was a sufficient number of positive samples in our observations. Eggs were inoculated into polyurethane carriers, prepared according to Plachý and Juriš (1995), at a dose of 1000 eggs per carrier. The carriers were placed to perforated PET bottles (50 ml) and introduced into the organic wastes. The controls with eggs were incubated in distilled water.

The methods used for monitoring physical and chemical properties of organic wastes corresponded to the STN 465 735. The C content was calculated according to the content of OM by the method of Navarro et al. (1993), and the C:N ratio was calculated. Samples for parasitological and physical and chemical examination were collected after 0, 1, 3, 8, 14, 36 (only UM and M20) and 73 (UD, D20) days of sanitation. Three samples were taken and analysed at the given sampling intervals.

Results and discusion

Utilisation and disposal of wastes generated from animal farms has been the subject of many investigations with regard to contamination of the environment with emissions, toxicity of treated wastes to plants but also potential survival and spreading of pathogenic agents (Papajová et al., 2002; Liang et al., 2006; Côté, et al., 2006).

The following changes in physical and chemical properties of the organic wastes during the stabilisation were monitored: the pH, dry matter (DM), ammonium ions (NH_4^+), total nitrogen (N_t) and C:N ratio. The physical and chemical properties of the treated material are given in Figures 1-5.

A. suum eggs are amongst the helminth eggs most resistant to environmental factors. Their cell wall is enveloped with an outer layer formed by acid polysaccharides and proteins, central layer consisting of proteins (25%) and lipids (75%, particularly alpha glycosides). Thus this resistant cell wall protects *A. suum* eggs against effects of chemicals and drying (Eckert, 1992). This is the reason why they have been chosen as model eggs.

Our experiment showed that stabilisation of organic wastes with dust rejects result in complete devitalisation of *A. suum* eggs (Figure 6). The most important physico-chemical factors affecting viability of helminth eggs include pH and ammonia. We observed the highest pH and ammonia content especially in the organic wastes treated with dust rejects from lime production (Figure 1, 3). One of our previous studies (Ondrašovič et al., 2002) on the effect of ammonium hydroxide on *A. suum* eggs showed that at 10 % concentration of NH_4OH, pH 12.16 and exposure time 180 min. approx. 94 % *A. suum* eggs were devitalised. Pescon and Nelson (2005) also reported that environmentally relevant concentrations of ammonia may significantly increase the rate of *Ascaris* eggs inactivation during alkaline stabilization.

The present experiment showed that during stabilisation of organic wastes with dust rejects model parasitic germs were devitalised. The issues of safe sanitation and waste management are highly topical as it has been universally acknowledged that the majority of endoparasitic germs is able to cause infection in animals and humans even a year or two later.

Conclusion

For the sanitation of organic wastes from animal production and dogs' excrements, the use of dust rejects from lime production, at more affordable price than quality lime dust, is very suitable. This way of treatment is thus not associated with a risk of dissemination, survival and potential spread of developmental stages of endoparasites to the environment via stabilised organic wastes.

Figure 1 Changes in pH of organic material

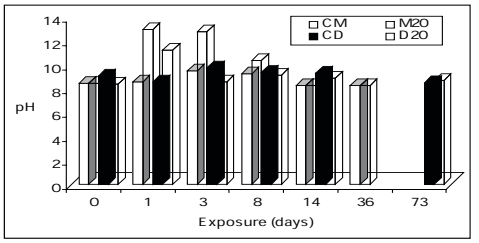


Figure 2 Changes in dry mater of organic material

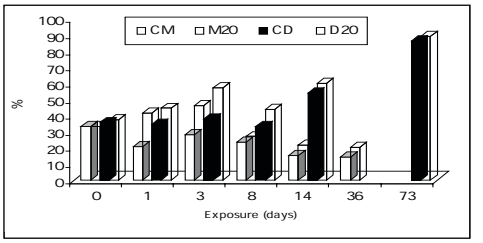


Figure 3 Changes in NH_4^+ content of organic material

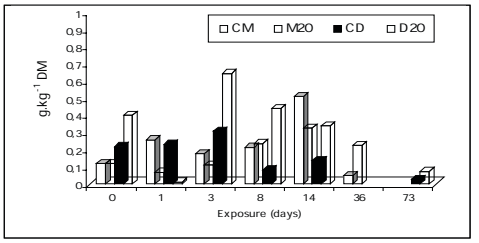


Figure 4 Changes in Nt content of organic material

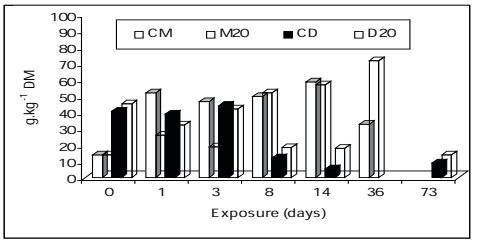


Figure 5 Changes in the C:N ratio

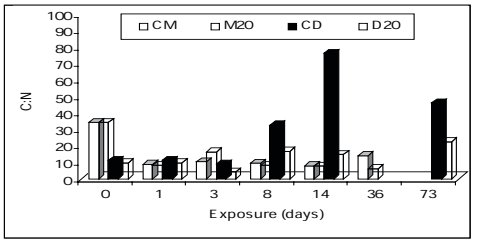
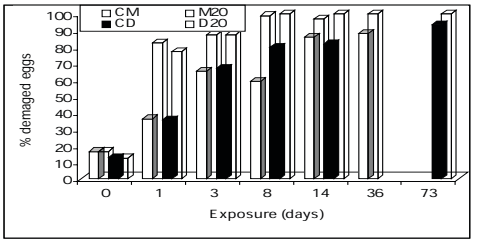


Figure 6 Damage of A. suum eggs during the stabilisation



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