

STORAGE AND TREATMENT OF FARM ANIMAL EXCREMENT FROM THE HYGIENIC AND ECOLOGICAL POINT OF VIEW.

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ABSTRACT

The wastes from animal production can contain except organic and inorganic nutrients also a great number of pathogenic microorganisms and parasitic germs. The objective of presented work was to study the influence of various systems of the solid manure treatment (direct spreading on the field, stocking in dung-hill, composting and anaerobic fermentation) and the liquid manure treatment (direct application to agricultural land, long term storage under anaerobic and aerobic condition, thermophilic aerobic stabilisation, composting, anaerobic fermentation and biological process using waste-water treatment technology) assessed from the point of view of hygiene, ecology and economy. The dynamics of processing (thermophilic, mesophilic and psychrophilic microorganisms) and hygienic-epizootologic (coliforms, coli-faecalis, enterococci and moulds) microbial indicators and parasites was measured during the animal waste treatment mentioned above. We proved various level of hygienic safety treatment of solid and liquid manure during these stabilisation processes. The number of mesophilic and psychrophilic microorganisms as well as coliforms and coli-faecalis mostly decreased by 2-3 log units. Total devitalisation of coliforms and coli-faecalis was reached in storage tanks after thermophilic aerobic stabilisation and anaerobic fermentation of liquid manure.

INTRODUCTION

Modern animal husbandry faces many tasks given by increasing number of animals raised per unit area; decreasing labour costs by automated animal feeding, watering and housing. Microorganisms play an important role in the natural environment and in engineered systems. In addition, they are important in the transmission of many diseases (COLE et al.,1999). Production and utilisation of solid and liquid manure represent one of the most serious problems. The causative agents of many infectious diseases are excreted by the faecal route and also with other excretions or secretions of the body. Under these conditions livestock owners are sometimes not aware that manure may contain pathogens, and therefore they do not take precautions against possible spread of disease by utilisation of manure as fertiliser.

MATERIAL AND METHODS

The objective of presented work was to study the influence of various systems of solid manure treatment (direct spreading on the field, stocking in dung-hill, composting and anaerobic fermentation) and liquid manure treatment (direct application to agricultural land, long term storage under anaerobic and aerobic condition, thermophilic aerobic stabilisation, composting, anaerobic fermentation and biological process using waste-water treatment technology) assessed from the point of view hygiene, ecology and economy. Samples of solid and liquid manure were tested by current quantitative microbiological methods. The dynamics of processing (thermophilic, mesophilic and psychrophilic microorganisms) and hygienic-epizootologic (coliforms, coli-faecalis, enterococci and moulds) microbial indicators and parasites was observed during the animal waste treatment mentioned above. E.coli and enterococci could be used as indicators to monitor the reduction of vegetative bacterial pathogens. In any case the enterococci give the broadest "safety margin"(LARSEN et al.,1994). Oocysts of genus Eimerida, Isospora, Cryptosporidium and cysts of Giardia and Balantidium were identified together with eggs of A.suum, Trichuris spp. And Hymenolepis spp.in samples by direct method.

RESULTS AND DISCUSSION

Solid manure

Direct spreading of solid manure on the field require relatively low investment and service costs but in the case of infected animals we cannot suppose the sufficient effect on microorganisms and parasitological eggs devitalisation. Self-heating up to 50-60°C during the storage **of manure in dunghill** reduces the numbers of pathogens and is intensified by prolongation of the storage time (NOVÁK, 1990). **Composting** seems to be the perspective way of manure treatment. The success of microbiological and parasitological devitalisation is caused by the increase of temperature up to 65°C for 21 days. The appropriate composition of the substrates increases the effectiveness (NOVÁK, 1994). On the contrary MOTE et al. (1988) does not share this optimism, because according to their studies the decrease of coliform bacteria in final substrate was not substantially lowered. **Anaerobic fermentation** is the progressive method of solid manure treatment carried in baskets covered with gas-tight and thermo-insulated bells. In field condition the number of thermophilic microorganisms increase by 1 log unit, the number of mesophilic and psychrophilic microorganisms decrease by 3 log unit. Coliforms dropped by 2 and coli-faecalis by 1 log unit. The success of this process is based on the increase of temperature and may be influenced by a large number of factors for instance by the quality and the quantity of straw, the fodder dose and its sudden changes and the pH of the dung (NOVÁK, 1990). The pathogens do not survive very long in solid manure because of the increase of temperature and biochemical activities (STRAUCH, 1991).

Liquid manure

The conditions in liquid manure are different because the temperature does not rise and own biochemical activity in this substrate is low. Therefore the pathogens survive for rather long periods in slurry. (STRAUCH, 1991). **Direct application to agricultural land** represents one of the cheapest ways of slurry application, however the hygienic point of view is sometimes not carefully watched. This method is limited by the quantity the land is able usefully consume, the number of animals in the stock and the distance of applicants fields. **Long term storage under anaerobic and aerobic condition** is limited by the capacity of stock tanks, because the storage should last at least for minimum 120 days. After six weeks of storage of liquid manure was proved the great decrease of mesophilic and psychrophilic microorganisms by the 6 resp. 7 log units. From the point of view of the hygienic-epizootologic indicators: any significant changes of coliform microorganisms were observed, but the only slight decrease was found during the end of the experiment after twelve's weeks. Faecal coliforms microorganisms were not detected in winter conditions since the eleventh week of the storage (NOVÁK, 1996). Storage and aeration of pig slurry before disposal reduces the risk of dissemination of antibiotic-resistant bacteria of animal origin in the environment, as compared to the frequent direct spreading of untreated wastes (AVIGNON-LAFONT, 1985). **Thermophilic aerobic stabilisation** The success of this technology needs the increase of temperature up to 50-60°C and the adequate amount of injected oxygen. This way of liquid manure thermophilic stabilisation has shown high degree of the final product hygienic. High investment and economical costs make this way not easy for practical application. The use of **composted liquid manure** is bound on the appropriate amount of sorbent (cut straw or bark, event. sawdust etc.). The composition of composted components is of great significance for the success of this technology (NOVÁK, 1994). During **anaerobic fermentation** of liquid manure the number of mesophilic and psychrophilic microorganisms, as well as coliforms and faecal coliforms decreased by 2-3 log units. Total devitalisation of coliforms and faecal coliforms in most samples was reached during storage in storage tanks. In the liquid manure

stuff for spreading to the fields the total devitalisation eggs of parasites was found (JURIŠ et al.,1992, 1996). LARSEN et all. (1994) proved, that thermophilic as well as mesophilic digestion with thermophilic pre-treatment will result in a sufficient reduction of both vegetative pathogenic bacteria and intestinal parasites occurring in concentrations usually found in animal waste. At present the use of biological **process based on the waste-water treatment technology** (VENGLOVSKÝ et all, 1994). This technology so far the agricultural practice is concerned represents economically to expensive method and from this reasons declines.

CONCLUSIONS

All technologies used for treatment of solid and liquid manure have to be compatible with the ecology and must hold with the legislation on the environment protection. That means the technologies used must substantially limit the possibility that by inappropriate methodology the land, water and the air may be contaminated.

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