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Microbiological Evaluation of Antibiotic Resistance and Pathogenicity in Autothermal Thermophilic Aerobic Digestion Treated Swine Manure

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Abstract

In both untreated and conventionally stabilized swine manures antibiotic resistant (AR) microorganisms, *Staphylococcus*-like and *Salmonella*-like microorganisms were detected. Also pathogens with MAR phenotype were detected. Presence of such microorganisms suggest high level of pathogen-related health risk to farmers who may be in direct contact with the manure and its conventionally stabilized product. In contrast, the autothermal thermophilic aerobic digestion (ATAD) treatment have efficiently reduced AR and pathogenicity from the swine manure. When soil was fertilized using swine manure and its stabilized products, despite no detection of MAR-exhibiting pathogen-like microorganisms in fertilized soil, potential pathogen-related health risk could not be ruled out from the fertilized soil since the organic fertilization led to increase in AR and pathogenicity in the soil microbial communities. As conclusion, this microbiological study demonstrated that an ATAD process is applicable in control of pathogen-related health risk in livestock manure.

Key word : antibiotic resistance, autothermal thermophilic aerobic digestion (ATAD), multiple antibiotic resistance (MAR), livestock manure, pathogens, organic fertilizer.

1. Introduction

In agricultural industry livestock manures are anaerobically stabilized and used as alternatives to chemical fertilizers [Division of Sustainable Development, 2000]. These stabilized manures contain high concentrations of antibiotics due to large quantities of antibiotics added to livestock feeds (~0.2% w/w) [Christian *et al.*, 2003; Walsh, 2003]. The high antibiotic concentrations can result in selection of AR microorganisms in the livestock manure and its stabilized products [Walsh, 2003]. AR microorganisms could raise significant health risk by generating AR or even MAR pathogens in livestock manure through mechanisms known as horizontal gene transfer (HGT) [Medigan *et al.*, 2003].

Lagoon fermentation have been conventional manure stabilization methods and it require several months of stabilization period. To reduce this period autothermal thermophilic aerobic digestion (ATAD) was applied. According to our preliminary study ATAD process only required 3 days for livestock manure stabilization, and due to thermophilic condition (60~65°C) developed ATAD is also applicable in control of pathogenicity risk in livestock manure. Therefore the ATAD stabilized swine manure was evaluated to meet the requirements for an organic fertilizer [Samjung Construction Co. LTD, 2005].