

MASTER'S THESIS

Effects of residual veterinary antibiotics on soil enzyme activity and plant growth

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**Effects of Residual Veterinary Antibiotics on Soil Enzyme
Activity and Plant Growth**

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Principal Supervisor: Ming Hung WONG

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Abstract

Antibiotics are commonly used to control diseases caused by microorganisms in order to sustain high yields in aquaculture. These chemicals may be taken up by fish, washed off into surface water, or leached to groundwater where they can adversely affect the soil environment in coastal area. They may also enter soils with manure or sediment from treated animal farms or fishponds used as organic fertilizers. Pathogenic bacteria may develop resistance when exposed to these antibiotics, which may threaten human health. Therefore, it is important to properly manage the usage of antibiotics in coastal areas with intensive fish and shrimp farming activities.

Simple HPLC methods for analyzing two commonly used veterinary antibiotics, namely tetracycline (TC) and ciprofloxacin (Cipro), were established in present study. Recoveries of analytical methods for manure sample and soil sample were up to 95% and 90%, respectively, with the inter-day RSD values lower than 5% in the continuous 5-day experiments, which indicated a satisfactory accuracy and repeatability of present method. Laboratory study indicated the adverse effects ($p < 0.01$) caused by TC and Cipro on *Bacillus megaterium*, a soil bacterium species, and microbial activities in soil. Pot experiments showed that the healthy growth of two higher plants, *Lolium perenne* and *Astragalus sinicus*, was affected negatively by the presence of TC and Cipro from 1 mg kg⁻¹ to 100 mg kg⁻¹ in soil, by decreasing their total biomass ($p < 0.05$) and up take of nutrients such as nitrogen (N), phosphorus (P), potassium (K) ($p < 0.05$). The results of present study also indicated the significant inhibition effects ($p < 0.01$) of TC and

Cipro on the microbial communities such as *Bacillus megaterium* and *Penicillium chrysogenum* in soil. In addition, these two antibiotics exert an inhibition effect on the growth of these two plants. The present results showed that both TC and Cipro have inhibition effects on soil enzymatic activities such as urease and phosphatase. On the other hand, the relatively higher degradation of antibiotics in the present study ($p < 0.01$) indicated that biodegradation caused by the existence of *L. perenne* and *A. sinicus* really contributed to the total degradation of antibiotics in the soil environment. It is concluded that the existence of *L. perenne* and *A. sinicus* could offer a possibility of phytoremediation to clean up the antibiotic-contaminated soil. Results of the present study also revealed that pig manure and feed samples collected from the Pearl River Delta contained high level of TC and Cipro residues in all pig manure samples and one feed samples from Shunde, Guangdong province. To reduce the increasing risk of environmental contamination of antibiotics, a more responsible control in animal farming husbandry and reduction of the consumption of antibiotics is needed.

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