Manuka (*Leptospermum scoparium*) as a Remediation Species for Biosolids Amended Land

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Abstract

The application of biowastes such as biosolids to land is a viable means of re-cycling valuable nutrients in an otherwise useless waste product. With this practice comes the risk of introducing contaminants such as heavy metals and pathogenic microorganisms into the soil system, posing a risk to humans and animals. A land-management system is needed to mitigate any potential risk. One such system finding application at many locations around the world is phytoremediation, the use of plants to remove, degrade or render harmless environmental contaminants. The plant species *Leptospermum scoparium* (Manuka) is a hardy native New Zealand plant resistant to heavy metals, with the ability to grow on degraded and erosion prone sites, and encourage re-vegetation in zones of impaired soil quality. In addition, manuka products have been shown to have antiseptic and antimicrobial properties. The aim of this research was to investigate the potential use of manuka in the remediation of contaminated land, through the use of manuka's antiseptic properties to aid in pathogen control, and on the extraction or stabilisation of heavy metals in soil.

Experiments were carried out using water extracts of manuka, as well as soil from underneath manuka stands, to test for antimicrobial activity of manuka against a number of pathogenic bacteria potentially found in biosolids. Results found that the presence of prepared manuka-water extracts significantly reduced the growth of the five bacterial strains tested, in some cases exhibiting complete die off. However, in-situ effects of antimicrobial ability in soil from underneath manuka were not observed. Further research using whole plants, and different plant components would be useful.

Research was also conducted to investigate the effect of manuka growth on Zn and Cu bioavailability in soil. Three plant species, (manuka, *Coprosma robusta* and rye grass), were grown for six months and one year in Zn - and Cu - spiked soil to assess their effect on metal availability. Results clearly showed that the three plant species investigated differ in their ability to uptake and accumulate both metals, but have no apparent effect on HM bioavailbility over a one year time period.

The experiments in this research were able to closely evaluate the potential of manuka as a remediation species for biosolids-amended land. Results indicate that further research into the potential use of manuka in this way is warranted, particularly with respect to manuka's ability to manage levels of pathogenic soil microorganisms. In addition, manuka components are economically valuable, and in future, biosolids disposal systems may be able to combine with that of manuka production to produce a sustainable disposal system with potential for economic return. The solution may be to develop manuka plantations on otherwise unuseable land, where biosolids application can help recondition soil and enhance manuka growth, whilst manuka acts as a means of 'treating' both the bacterial and inorganic contaminants in the biosolids. Continual leaf fall or rotational cropping and mulching of manuka biomass would aid in the attenuation of introduced bacteria, and manuka roots may help stabilise metals. In an age where waste reduction and contaminant control are top priority, remediation systems such as this may represent an economically, socially and environmentally acceptable solution.

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TABLE OF CONTENTS

List of Figures

List of tables