

Phosphorus removal from wastewaters using andesitic tephra soil filters and its reuse for plant growth

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Many inland towns in New Zealand continue to discharge municipal sewage wastewaters rich in dissolved reactive phosphorus (DRP) into rivers. As regional councils set stricter standards for DRP levels in surface waters, the onus is put on district councils to improve the treatment of their municipal discharges. Conventional treatment methods for DRP removal, which typically involve chemical dosing, can be cost-prohibitive particularly for smaller communities. In the central North Island there is an abundance of soils formed from moderately weathered andesitic tephra with high P adsorption capacities, which have promise for use in constructed DRP sorbing filters. This also provides the possibility of recycling of the captured P when the wastewater treated (WT) soil is eventually applied to agricultural land.

The ability of andesitic tephra soil filters to remove DRP from wastewater at the Dannevirke Sewage Treatment Plant (STP) was assessed in a pilot study (two identical soil filters, each containing approximately 0.25 m³ of soil). At the completion of this study, the plant availability of phosphorus in the WT soil was evaluated in a glasshouse pot experiment. In this experiment, ryegrass was grown in an Allophanic soil with a very low Olsen P of 2 mg P/kg. The response of ryegrass growth to the addition of various rates of WT soil was compared to various rates of soluble P fertiliser addition.

The pilot study showed that the soil filters had a high P sorption capacity (6 g P/kg soil) and also a high average removal efficiency (67 %). The glasshouse experiment demonstrated that WT soils were effective when used as a phosphorus source for plant growth. On average the ryegrass growth response over the first two harvests was equivalent to approximately 4 mg soluble fertiliser P/g WT soil.