

Thesis for Masters Degree by Research

**Phosphorus Behaviour and
Availability within a
Chemically Loaded Soil**

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Summary

The aim of this thesis was to investigate the behaviour of Phosphorus (P) in a constructed Reed Bed Treatment Systems (RBTS).

P availability to plants is a complex area, and one that as yet is not fully understood. Plant available P has been supplemented by man since the 19th century, however, the recommended rates of fertilisation even now are often vague and uncertain, and consideration as to how fertiliser application rates are related to plant available P is often not given. Long-term studies of P requirements are expensive and time consuming and the information gained from these experiments is usually not transportable to other soils or crops.

Environmental considerations are increasingly important as awareness is growing of the impact of relatively low levels of P can have on receiving waterways, and the consequences of over fertilisation can be critical to certain ecosystems. The majority of studies carried out on wetland soils have been to investigate their ability to remove or reduce P from receiving waters. This work studied the behaviour of P in these soils, the pools that are favoured under saturated conditions and how these pools can be related to predicting the P fertiliser requirements of such systems. A review of the available literature was also performed which gave the necessary background to the importance of P in this kind of system.

The current analytical techniques available were reviewed to assess how useful these are in predicting P requirements, and the limitations involved with the different methods, and why these particular techniques are used.

An experiment was carried out to investigate the distribution of P in a sandy loam soil under saturated conditions using a modified fractionation procedure for a control and a trial treating high

ammoniacal solution from the coke making process from the Whyalla Steelworks. Due to the unusual nature of this man-made system the Hedley fractionation procedure was chosen to gain a greater understanding of how P behaves in this unique system. Both systems were planted with *Phragmites Australis*. Monitoring of the P levels leached from this system was performed to account for the total P. Time and resource limitations determined the final form of the experiment and due to the location access to university resources and support was limited.

Monitoring of the treatment of ammoniacal solution by the trial RBTS was performed focusing on three main constituents of the solution. The results of this monitoring were reported and potential treatment mechanisms discussed.

Modelling techniques have been used for predicting P behaviour and requirements, some more accessible than others depending on the requirements involved however, more work needs to be done in this area to develop a simple and easy to use system. Using a modelling software package LEACHN designed by Dr J Hutson originally to model Nitrogen in soils modified for P in non wetland soils, it was possible to compare the predicted behaviour of P with the experimental results obtained by the fractionation experiment.

Declaration

'I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.'

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