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Effects of electrodialytic process on soil phosphorus

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Abstract

Phosphorus (P) is an essential element for all life forms, assuming a key role in crop growth and food production. Phosphorus has no substitute in fertilizer crops and the main source of P applied in agriculture comes from non-renewable phosphate rocks. Therefore, there is a global concern that P resources could be depleted in the next 50–100 years, related to the increasing P demand to satisfy consumption rates of an increasing global population. Eventually long-term phosphorus reserves will become scarce, thus the challenge is to introduce alternatives to manage the P cycle before it becomes seriously scarce. In this sense recovering, recycling and reuse phosphorus will have to be adopted as integral parts of P management responses. Phosphorus is not widely circulated on the globe, there is a flux from land to water but the reverse flux is extremely limited. As a result, excessive amount of P can accumulate in water bodies and can contribute to eutrophication. Eutrophication is caused by the overenrichment of aquatic ecosystems with nutrients, principally phosphorus, leading to algal blooms and anoxic environments. This event is a persistent condition of surface waters and a widespread environmental problem, which can lead to decreases on ecosystems services, such as losses on fish, wildlife production, and recreational amenities, and increases in costs of water purification for human uses. To mitigate such algal blooms much effort has been made to implement measures to reduce external loading of phosphorus decreasing phosphorus concentrations in lake waters. However, such approaches do not consider the roll of internal phosphorus release from sediments. In lakes where phosphorus internal loading constitutes a considerable part of total loading, the success of management actions requires an integrated approach of both external and internal phosphorus loads. Reduction in internal phosphorus loading for control of algal biomass can be achieved by various restoration approaches, either physical or chemical, such as the removal of phosphorus-rich surface layers or by the addition of iron or alum to increase the sediment's sorption capacity, or by a combination of different approaches.

This study was developed in order to evaluate the feasibility of electrodialytic remediation (EDR) to remove and recover phosphorus from soils. Phosphorus removal and recovery results were not as higher as expected from unpublished results, not

exceeding 2% for both removal and recovery for all experiments. Although more research is needed, as many different mechanisms may be involved in soil phosphorus release, this approach when combined with other remediation techniques may be useful in controlling nutrient loading to surface waters.

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