Nutrient Recycling from an Engineering and Electrochemistry Perspective

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As concern increases over climate change, exponential world population growth and resource depletion, the agricultural sector is under tremendous strain. The last century has seen a steep increase in agricultural productivity, mainly caused by huge demands; it has thus become evident that this growth cannot be longer sustainable[1].

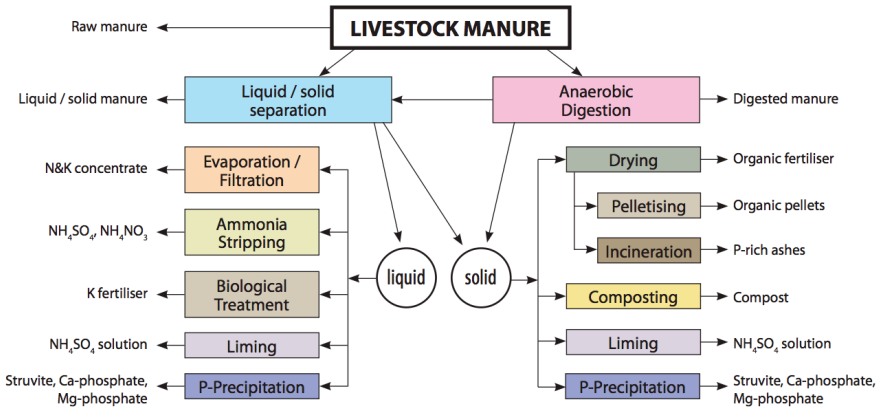

Figure 1 *– Overview of the main routes for nutrient recovery and reuse and the products obtained[1]*

The environmental impacts in the agricultural sector have been serious, e.g., causing water, soil and air pollution disasters, loss of biodiversity and soil erosion. In Europe, agricultural pollution (mainly from excess fertilizers and nutrients, pesticides, bacteria, viruses etc) is a major problem due to poor manure management causing pollutants to enter soil and waterways (e.g., wetlands, lakes, rivers, coastal waters and groundwaters)[1,2]. Consequently, the sector has set some urgent priorities, such as reducing significantly air, soil and water pollution, minimizing storage and handling of slurry by minimizing the water content (>80%), reducing energy consumption, and creating on-site renewable energy systems[1]. Most of the agricultural manures contain useful nutrients (nitrogen (N), phosphorus (P) and potassium (K)), and efficiently extracting them could reduce significantly environmental impacts and save on commercial fertilizers' costs. With the clear intensification of the agricultural sector, slurry management has now become a major problem. Thus, it is important to implement novel environmental (and energy) technologies with the view of recycling important nutrients from agricultural sludges and wastes. There are various methods to extract these important nutrients, such as chemical, biological and physical[3]. This presentation will focus on (i) nutrient recycling using electrochemical engineering processes[4] (mainly electrocoagulation) and (ii) the recovery of nutrients by electrochemical precipitation of struvite[5]. The presentation will also highlight new technologies for the eradication of contaminated wastewaters and sludges containing bacteria and viruses using acoustics, in particular, sonochemical engineering[6].

References

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