ARTIFICIAL WETLANDS AND IRRIGATED VEGETATION FOR EXTRACTION OF NUTRIENTS FROM RESIDUAL SOLID WASTES TREATED IN LANDFILL BIOREACTOR CELLS.

– AN IMPORTANT PART OF A CIRCULAR ECONOMY

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Abstract
A sustainable biological waste management strategy for residual wastes, after material recycling, includes a combination of biogas extraction and recirculation of nutrients.
During treatment in landfill bioreactor cells, about 90-95 % of the produced biogas can be collected. Due to long-term accumulation of organic fractions, the landfill acts as a carbon sink, like a peat-land, balancing increased CO2 concentrations in the atmosphere. A 100 000 tons/yr bioreactor landfill can compensate for the annual CO2 emissions from approximately 20 000 cars. At the same time, fossil materials, like e.g. plastics, do not take part in the biogas production and is brought back to long-term storage. Therefore the landfill can be regarded as a "Resource bank" for future raw material, when the availability has decreased and prizes increased.
Another important carbon sink is caused by increased biomass production and thus improved soil organic matter accumulation after irrigation of leachates to vegetation systems within the controlled landfill area. During full scale experiments in a major Swedish landfill leachates were irrigated to vegetation. The system comprised of an open aeration pond followed by nitrogen reduction in a small constructed wetland, and finally irrigation to a mixed deciduous forest plantation for final capture of the nutrients. The wetland consisted of two sections with hydraulic communication via pipes. The leachate was distributed to the units consisting of a sand and peat matrix. The water was stored in the wetland for about six days, and was then transported to the forest plantation with birch (*Betula verrucosa*) and willow (*Salix caprea*), The irrigation system was operated from May to October.
Fertilization with leachates improved tree vitality and increased biomass production, which also resulted in increased water evaporation (evapo-transpiration). Nutrient levels in the upper soil were increased, while the effects in deeper soil horizons, down to 50 cm, were limited indicating a high plant uptake and immobilization in the humus layer. The increased standing biomass, as well as higher soil humus contents, improved total accumulation of organic carbon.

Keywords: Leachates, nutrient recovery, bioreactor landfill, constructed wet-land, forest irrigation, CO2 concentrations.

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