

Influence of the Nature of Plants on Drainage, Purification Performance and Quality of Biosolids on Faecal Sludge Planted Drying Beds in Sub-Saharan Climate Conditions

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Abstract : In new approaches that are being developed for the treatment of sludge, the valorization of by-product is increasingly encouraged. In this perspective, *Echinochloa pyramidalis* has been successfully tested in Cameroon. *Echinochloa pyramidalis* is an efficient forage plant in the treatment of faecal sludge. It provides high removal rates and biosolids of high agronomic value. Thus in order to advise the use of this plant in planted drying beds in Senegal its comparison with the plants long been used in the field deserves to be carried out. That is the aim of this study showing the influence of the nature of the plants on the drainage, the purifying performances and the quality of the biosolids. *Echinochloa pyramidalis*, *Typha australis*, and *Phragmites australis* are the three macrophytes used in this study. The drainage properties of the beds were monitored through the frequency of clogging, the percentage of recovered leachate and the dryness of the accumulated sludge. The development of plants was followed through the measurement of the density. The purification performances were evaluated from the incoming raw sludge flows and the outflows of leachate for parameters such as Total Solids (TS), Total Suspended Solids (TSS), Total Volatile Solids (TVS), Chemical Oxygen Demand (COD), Total Kjeldahl Nitrogen (TKN), Ammonia (NH_4^+), Nitrate (NO_3^-), Total Phosphorus (TP), Orthophosphorus (PO_4^{3-}) and *Ascaris* eggs. The quality of the biosolids accumulated on the beds was measured after 3 months of maturation for parameters such as dryness, C/N ratio $\text{NH}_4^+/\text{NO}_3^-$ ratio, ammonia, *Ascaris* eggs. The results have shown that the recovered leachate volume is about 40.4%; 45.6% and 47.3%; the dryness about 41.7%; 38.7% and 28.7%, and clogging frequencies about 6.7%; 8.2% and 14.2% on average for the beds planted with *Echinochloa pyramidalis*, *Typha australis* and *Phragmites australis* respectively. The plants of *Echinochloa pyramidalis* (198.6 plants/m²) and *Phragmites australis* (138 plants/m²) have higher densities than *Typha australis* (90.3 plants/m²). The nature of the plants has no influence on the purification performance with reduction percentages around 80% or more for all the parameters followed whatever the nature of the plants. However, the concentrations of these various leachate pollutants are above the limit values of the Senegalese standard NS 05-061 for the release into the environment. The biosolids harvested after 3 months of maturation are all mature with C/N ratios around 10 for all the macrophytes. The $\text{NH}_4^+/\text{NO}_3^-$ ratio is lower than 1 except for the biosolids originating from the *Echinochloa pyramidalis* beds. The ammonia is also less than 0.4 g/kg except for biosolids from *Typha australis* beds. Biosolids are also rich in mineral elements. Their concentrations of *Ascaris* eggs are higher than the WHO recommendations despite a percentage of inactivation around 80%. These biosolids must be stored for an additional time or composted. From these results, the use of *Echinochloa pyramidalis* as the main macrophyte can be recommended in the various drying beds planted in sub-Saharan climate conditions.

Keywords : faecal sludge, nature of plants, quality of biosolids, treatment performances

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