The Potential of Biological Agenst for Domestic Wastewater Treatment in Ghana

Ahiable, Peter Koblah

2010

ABSTRACT

The focus of the study was to find an efficient, less expensive and environmentally sustainable method for treating domestic waste water. For this purpose, continuous flow system of duckweed, algae and combined duckweed-algal (hybrid) ponds were constructed to access their performance in terms of faecal bacteria reduction under reduced light input condition in ponds.

Samples were picked from all the treatment ponds and faecal coliform analyses were undertaken using chromocult agar plates. Environmental conditions such as pH, DO and temperature were monitored. Similar investigations were carried out in a batch scale system. This is a non-continuous flow system where the waste water was kept in small containers and subjected to monitoring. Results of the studies show that the algal pond line (that is the set of ponds with algae as treatment agent) was relatively more efficient in faecal bacteria reduction than the duckweed and the hybrid ponds under the same condition of reduced light input. Reduced light input means only 20% of the surface area of the pond was exposed to sunlight. This gave sunlight input equivalent to 6.79×10^5J sunlight radiations. Under this condition, the algal pond showed one log unit reduction of faecal coliform from a mean of 6.31 to 4.99. The batch scale experiment also confirmed that the algal pond is relatively more efficient in terms of faecal coliform reduction. There were two units log removal in the algal in the algal ponds under reduced light input (20% light input equivalent to 2.22×10^4 J sunlight radiations). A similar sized algal pond exposed to full light showed almost 100% faecal bacteria removal.

Another batch scale experiment was conducted to determine the concentration of algae for effective faecal bacteria reduction in wastewater. At 20% light (equivalent to 2.22×10^4 J sunlight radiations) input , algae concentration within the range 200 to 1000µg/l was found to be effective to cause a reduction of two log units (from 10^6 to 10^4cfu/ 100ml) of faecal bacteria.

Samples were picked at various sections of the pond to find the relationship between faecal coliform and macroinvertebrates present in waste water. The treatment ponds showed high

diversity of macroinvertebrates. Results obtained from the Univariant Diversity Index analysis showed that the sediments of the algae ponds have high macroinvertebrate species diversity. Shannon-Wiener Diversity Index (H^1) analysis showed that the algal treatment pond systems have high diversity of macroinvertebrates with values ranging from 0.0457 (for influent pond) to 1.075 (for effluent pond). The algal pond system was relatively the most efficient in faecal coliform reduction. This agrees with the fact that invertebrate diversity is a function of quality of pond water. In general about thirteen different macroinvertebrates were identified in all treatment ponds of which most of them were crustaceans. *Ostracoda* and *Cladocera* were the dominant species, which were found to be concentrated in sediments, the surfaces of duckweed and algal ponds where faecal bacteria concentration were also high. The suggested feeding and habitat relationship between bacteria and macroinvertebrate. There was high density of bacteria on the duckweed plant reaching about 1.76 $x10^6$cfu/g of duckweed plant. The high faeacal bacterial in the sediment of the waste water were attributed to possible faecal bacteria attachment to suspended matter such as algae and particles.

SUPERVISORS

Professor Danson, P. K. Ofori (Principal)

Dr. Ampofo, J. A

Mr. Ansa, E.D.O