

## A B S T R A C T

Anaerobic digestion of poultry litter (30% manure + 70% bedding) was investigated in the laboratory using two-litre and ten-litre capacity digesters. Two types of litter were investigated, the difference being in the nature of the bedding material used, viz. sawdust and bagasse. A synthetic medium seeded with a small quantity of litter was also utilized thus presenting a substrate subject to greater control over its basic composition. Use of this medium was an attempt to obtain additional useful evaluation of microbial behaviour. The efficiency of digestion was measured primarily in terms of gas production, since the program of investigation was instituted chiefly as a study of an alternative energy possibility for the Caribbean region.

Gas production was found to have a direct relationship with substrate utilization. The degree of substrate utilization in turn was considered a reasonable indicator of pollution reduction.

The biodegradability of the substrate material was found to be an important factor in anaerobic digestion, with materials of a ligno-cellulosic nature being especially difficult to digest. Sawdust and bagasse being ligno-cellulosic in nature, the gas yields as obtained proved relatively small. Acid treatment proved successful as a pre-treatment technique, for increasing gas yield.

Acidity and pH were found to be good indicators of the progress of digestion.

Carbon to nitrogen ( $C/N$ ) ratio, temperature and initial total

solids concentration were all found to affect digestion, and optimum values of these parameters for digestion were found to be, 16, 35°C and 10% respectively. In addition, an optimum seed volume of 20% was determined for digestion. Scale-up, within the limits to which it was investigated (5:1 weight and volume basis) did not seem to have had a pronounced effect on digestion efficiency although there were deviations in behaviour especially in respect of pH. The percentage composition of nitrogen, potassium and phosphorous which were originally present in the raw litter were largely retained on digestion. A nitrogen balance however revealed only a 71% absolute recovery on digestion, the majority of the nitrogen loss seemingly having been due to ammonia volatilization when the sludge was dried prior to analysis.

An economic analysis done citing a hypothetical small poultry farm situation showed that anaerobic digestion would not prove economically viable as an energy production process. Economic viability to the farmer was possible however, if the process was considered as one of waste treatment made mandatory by pollution laws. This viability can only be possible if the capital cost is subsidised by government. The analysis highlighted the need for substantially increased gas yields over those obtained, and revealed the importance of the sludge fertiliser value.

A mathematical model was proposed which contributed to a better overall understanding of the process but which was limited by its inability to predict digester failure caused by unfavourable environmental conditions.