

## **Effect of leachate recirculation on *Municipal Solid Waste* (MSW) stabilisation : column Study**

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### **Introduction**

Recent waste management intend to control landfill emissions and their effects (including greenhouse effect) and shorten the long term environmental impact (aftercare phase). Leachate recirculation seems to be the best solution as a landfill management system. Indeed, leachate treatment costs are reduced and waste degradation is optimised by the increasing of moisture content in waste (Christensen and al., 1992; Reinhart and Townsend, 1998). The main objective of the present study is to quantify the effects of leachate recirculation on MSW stabilisation using columns filled with wastes at different stages of degradation.

### **Results and discussion**

The columns were designed to simulate landfill conditions (anaerobic media, darkness, temperature of 37°C, drainage layer). Two types of wastes were selected: young waste of defined model composition and old waste extracted from a MSW landfill with the same composition. The watering of waste, simulating the rainfall over the landfill, is carried out with desionised water in two columns (called control columns) whereas leachate is recirculated in the two others (test columns). The young waste test and control columns are respectively named column 1 and 2; the old waste control and test column are respectively called column 3 and 4.

pH, temperature, redox potential, biogas composition and production are tested continuously. Leachate is sampled every two weeks to measure COD, TKN, DOC, BOD, Alkalinity, VFA (volatile fatty acids), anion, cation, and heavy metal content.

#### *Leachate analysis*

Leachate parameters analysis (COD, pH, AGV and TAC) show the various stages of waste degradation (Figure 1). Methanogenesis began after 90 days for old waste while only after 150 days in columns filled with young waste. The COD contents of leachate generated by old waste are lower than those of young waste (more advanced state of degradation). Moreover, results point out the low difference between column 3 and 4: it seems that leachate recirculation has no real impact on leachate quality produced by old waste.

## Biogas production and composition

After 250 days, biogas production of column 1 was 32 L/kg of waste, twice as much as gas production of column 2 (15 L/kg of waste). For columns 4 and 3, methane production was respectively 25 L/kg and 14 L/kg (Figure 2). A slowing down of the production occurred after day 100 in column 3 whereas the same phenomenon appeared only after day 150 in column 4. These results show the enhancement of methane production by leachate recirculation for each kind of waste.

CH<sub>4</sub> and CO<sub>2</sub> contents of young waste columns change with the phases of degradation. The acidogenic phase is pointed out by low contents of CH<sub>4</sub>. Then these contents increase up to 50 % during the methanogenesis. For old waste, methanogenic phase is quickly reached (as early as 70 days) and the CH<sub>4</sub> content remains stable the following days until it decreases after day 150 in both column. On the other hand, methane content increased slowly in younger columns until reaching 50% after 120 days. Since day 170, methane content tends to decrease in column 1 and 2. It is presumed that it doesn't remain easily biodegradable organic material. An analysis of the quality of the COD released by the column should give us additional information.

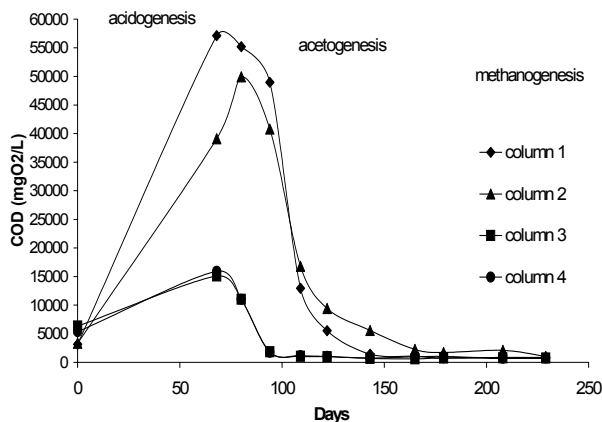


Figure 1 : COD content released in leachate

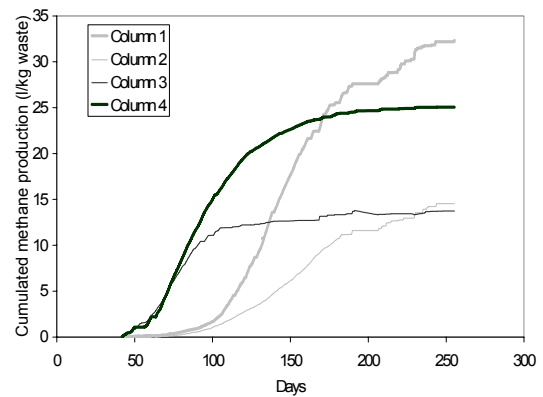


Figure 2 : Cumulated methane production

## Conclusions

The results indicate a more advanced degradation of waste in columns where leachate recirculation occurs: there is a significant impact of moisture and organic compounds addition through leachate recirculation in test columns. Leachate recirculation increases biogas production, so enhances waste stabilisation. Young waste seems to be more sensitive on leachate recirculation. However, the tests are realised at a pilot-scale and results cannot be generalised to a landfill site. Others experiments must be carried out on landfill.

## Reference list

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