Linnaeus ECO-TECH 2016
Kalmar, Sweden, November 21-23, 2016

THE EFFECTS OF WASTE TREATMENT TECHNIQUES ON CLIMATE CHANGE

Torleif Bramryd
Michael Johansson
University of Lund
Sweden

Abstract

The relevance of different solid waste management techniques, in relation to global warming, has recently been discussed. Due to increasing waste volumes, waste management has a growing impact on the flux of carbon dioxide and other greenhouse gasses from the urban system to the atmosphere. This includes plastics, synthetic textiles and rubber, a.s.o. On average, about 30 % of the CO_2 emissions from waste incinerators has fossil origin, In RDF (Refuse Derived Fuels), where e.g. food has been separated, the percentage of fossil carbon is even higher, and can be over 50 %. This is e.g. the situation for much of the waste imported from abroad to Swedish incinerators.

Recycling of plastics and other fossil material is of great importance. If this cannot be done, landfilling of these fossil fractions is strongly preferred instead of incineration. During landfilling, fossil carbon is brought back to long-term storage, and will not contribute to methane gas emissions. With new landfill mining techniques, the stored plastics can be important future resources to produce new products. If incinerated, waste with fossil origin is a major source of emissions of fossil CO_2. Also, during reduction of NOx from the stack-gases from waste incineration, N_2O is often a by-product emitted to the atmosphere. N_2O is approximately 35 times as potent as an agent for climate change compared to CO_2.

The use of compost or fermentation residues as soil improvement adds long-lived organic carbon to the soil, and thus increases the long-term storage. Environmentally controlled landfills, and different types of landfill bioreactor cells, also provide one of the few available carbon accumulating processes in the human society, and can be compared to the natural peat and sediment accumulating processes in natural ecosystems. Thus, provided that a reliable and efficient biogas collection system is installed, strictly controlled landfilling of municipal sold waste could be a technique to counteract global warming. New techniques from e.g. the US, UK Australia and Sweden show promising results for such improved efficiency in landfill gas collection. In modern, strictly controlled reactor landfills around 80-95 % of the produced biogas can be collected. According to recent estimates a landfill or a landfill bioreactor cell is positive from a climatic point of view if more than 60-65 % the produced biogas can be collected, and be prevented from reaching the atmosphere.

In a landfill reactor-cell, treating approximately 100 000 tons of waste per year, and where the fermentation residues are left in the landfill, a long-lived organic fraction corresponding to about 45 000 metric tons of carbon dioxide is long-term accumulated each year. This compensates for the annual carbon dioxide emissions from about 15 000 cars, provided that each one runs 15 000 km per year with fossil fuel. Long-lived organic matter in a landfill further helps to immobilize e.g. heavy metals and decrease leaching.

To this should be added the benefits of replacing fossil fuels with the collected biogas.

Landfill gas, extracted from about 50 landfills in Sweden, today generates over 310 GWh in energy, of which about 25 GWh as electricity. The use of this biogas substitutes fossil fuels. However due to the restrictions on landfilling of residual waste in Sweden, the magnitude of this resource will decrease significantly over the next decade.