Producing Organic Fertiliser from Urine-Diverting Dry Toilets in Dongsheng, China

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Although batch composting of manure is very common throughout China at both large and small scales, there is little experience with composting of human waste in urban centres. This project, the first on thermal composting of human faeces under indoor controlled conditions, took place in a high-density urban setting in Dongsheng, Erdos Municipality in Inner Mongolia, China.

Composting of human faeces in an urban setting
Photo: Jan Mertens

The project aimed to close the nutrient loop, reduce environmental pollution, provide local farmers with organic fertiliser and improve the soil quality. It was part of a housing project carried out by the local Dongsheng government in collaboration with Stockholm Environment Institute. The first phase of implementation, which included 832 households, or about 3000 inhabitants, was used to train local workers to run the composting plant by themselves.

Urine-diverting dry toilets were installed and the faeces collected in basement bins. These were transferred periodically to an onsite composting facility built for this project. The composting was carried out using a batch technique in a building with six individual, 6 m^3 compartments, each with forced air supplied through small openings in the floor beneath the mass and supplemental floor heating. Temperature, moisture and pH were controlled, so optimal conditions were achieved, thus ensuring sanitisation and composting. The temperature was monitored twice daily and the moisture was controlled daily using a standard compaction method. Effective microorganisms including lactic acid bacteria, purple sulphur bacteria and yeast were inoculated at the start in order to optimise and reduce the compost cycle to 35 days. To sanitise the compost, the natural heat of the composting process itself was used. WHO Guidelines stipulate that 1-2 days at 65°C under controlled conditions is sufficient to kill all pathogens. Therefore, the main task was to reach this needed high temperature. Sawdust was added as an additional carbon source in order to help fuel the composting process. Although the temperature only reached around 61°C, this was sufficient for elimination of E.coli (which was used as an indicator) during a typical 35-day compost cycle.

The households added sawdust as a carrier and desiccant, prior to the composting step in order to regulate moisture levels and reduce odour. The result was a, more or less, pure faeces compost, which determines the fertiliser value. In comparison to animal manure, which contains urine, the nitrogen levels for the faeces-only compost were lower (2.43 per cent of dry mass), but the content of stable organic carbon was high (organic matter was 49 per cent of dry mass). Thus the faeces-only compost is a good source of organic carbon to act as a soil conditioner for water and nutrient retention. This is of particular importance in this part of China where soils are carbon deficient. The increased humus content enhances soil fertility by increasing organic carbon and better water retention. Large-scale agriculture trials, using the compost and urine from the households on potato and maize crops, showed good results.

The work showed that composting of human faeces can be carried out in an urban setting and the compost along with urine provides a competitive alternative to chemical fertiliser.

Content of the finished compost	
Moisture	32
	Percentage of dry mass
Organic matter	49
pH Value	7.3
Total nitrogen	2.4
Available N	0.8
Available P	0.2
Available K	0.2

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