Composting of dry toilets solid residues: evolution of the characteristics over time

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Introduction

Dry toilets with bio-controlled litter (DTBL) are based on the separation of urine and the addition on the surface of the feces, of a layer of absorbent litter (sawdust for example). The solid residues thus obtained are a mixture of litter, excrement, toilet paper and a small amount of urine. They can be the subject of agricultural valorization after a sanitizing phase.

These toilets are a sanitation device that can meet certain specific needs: absence of wastewater network, limited access to water, willingness to use ecological sanitation, water resources sensitive to the risks of contamination. In developing countries, where open air defecation is still widespread, it is also a means of access to sanitation that can be inexpensive, dignified and healthy.

To date, few studies have been conducted on DTLB residues to determine their characteristics, their composting conditions, their agricultural interest as organic amendment and their safety. It is in the need to provide scientific knowledge on the use of DTLB in a context of developing countries that we conducted a research program addressing the sociological, economic, technical, environmental and health aspects. To this end, we have set up a field experiment to develop the complete channel, from the construction of the DTLB to the valorization of residues, with the involvement of the population concerned, at the various stages of development of the implemented system.

Pilot trials of composting residues and laboratory analyzes have provided insights into the characteristics of the litter used, fresh residues and residues at different stages of evolution. This paper presents the results obtained on the evolution of the characteristics of the residues during the pilot tests carried out in the field.

Material and methods

Two series of pilot composting trials were followed for several months:

- The P1 series consisting of six 100-liters pilots (P1.1 to P1.6), to simulate composting on an individual scale;
- The P2 series consisting of 5 300-liters pilots (P2.1 to P2.5), to simulate collective composting.

The pilots, circular in shape, were built from locally available natural materials (bamboo).

These trials have allowed to test several composting parameters (litter type, aeration, moisture, heap size, etc.) that can influence excreta sanitation and the production of quality amendments. Three types of bedding were tested: 100% fine sugarcane bagasse, 100% wood sawdust and 70% bagasse / 30% wood sawdust. The composting trials were conducted at Grande Plaine, a community in Gros-Morne (Artibonite) where the DTLBs and a composting platform were installed. In situ monitoring focused on temperature, ambient humidity, oxygen and carbon dioxide content. The analyzes on fresh residues and during the tests were carried out at LAQUE laboratory at Quisqueya University and at DEEP laboratory at INSA Lyon. These relate to dry matter, total organic matter, water retention capacity, self-heating capacity, soluble fraction, pH, conductivity, COD, BOD and microbiological analysis. residues.

Results and discussion

The first series of tests (100-liters pilots) showed that the volume was not large enough to obtain a rise in temperature allowing a quick sanitation of the residues, which was one of the main objectives sought. In larger

pilots (300 liters), with insulated walls using local materials, it was possible to note a rise in temperature for several days beyond 60°C.

Detailed analyzes are conducted on the residue samples taken from this second series of pilots. At writing date of this summary, the tests are still in progress. The latest analyzes are scheduled for the first quarter of 2018.

Conclusion

This research program is the first to provides solid scientific data on the implementation of a sanitation system by DTLB. On the basis of the tests carried out, this method of sanitation would be very well adapted to rural areas of developing countries, provided that strict hygiene conditions are followed because of the close contact during the handling of solid residues. It is indeed easier to control this health risk by good hygiene measures than the risk of contamination of water or via animals (insects in particular) through the use of leaky latrines or open air defecation.

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