Artificial soil for earthworm growth: initial stage for chemical modification of charcoal by earthworm.

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Introduction

Chemical modification of soil organic matter by earthworm activity is well known. In Brazil, charcoal fines are useless residues in many industrial processes, and their use as soil conditioner is a current topic of interest.[1]

Terra preta do índio (TPI) studies showed the presence of charcoal-like material in soils providing suitable conditions for high fertility in these soils and that knowledge was grasped by researches to promote a way for sustainable tropic agriculture. In fact, charcoal-like material detected in TPI is substantially functionalized when compared to an ordinary charcoal. These differences are thought to be caused by natural degradation of charcoal through the years.[2]

In order to produce functionalized carbon material from charcoal many chemical transformation studies have been conducted around the world. Biological transformation, such as that caused by earthworms in soils, is expected to yield a chemically modified charcoal, but no study has been conducted yet. In order to verify the potential transformation of charcoal by earthworm, some analytical questions must be considered, for example, the analytical technique to detected the chemical transformations from the original charcoal into a new biofunctionalized material.

In such context, a very simple soil matrix is desirable to the earthworm growth, since a complex soil matrix, with *e.g.* presence of natural organic matter, could difficult the comprehension about the origin of chemical transformations.

The present study evaluated the earthworm growth in an artificial soil with and without charcoal. The artificial soil matrix was manufactured as a mixture of sand (70%) , kaolin (20%) and coconut fibre (10%) with extra amount of charcoal (0%, control, 1.0%, 2.5% or 5.0%), sugars (glucose, and fructose), nutrients and vitamins.

Results and Discussions

After 30 days the corporeal ratio of initial mass and final mass (im:fm), mortality and coprolite yields were assessed. The earthworm mortality (20%) occurred only in the soil with 2.5% of charcoal. Neither statistical differences between mass ratio ($p<0.05$), nor variation of the earthworm masses during the experiment were observed. The coprolite yield was seen in all artificial soil, but slight difference was detected between treatments (variation less than 25%). The average yield for all treatments was 0,47 ± 0.10 g (Table 1).

Table 1. Assessed parameters during the experiment.

Charcoal (%)	corporeal ratio	mortality (%)	Coprolite (g)
0	0.95±0.18	0	0.53
1	0.93±0.33	0	0.33
2.5	1.03±0.20	20	0.54
5	0.98±0.11	0	0.46
Total	0.98±0.03	5±6	0.47±0.10

Conclusions

The artificial soils showed to be an excellent bed for earthworm growth, since any significant mortality was detected and the mass ratio was kept constant during the experiment. Chemical characterization of coprolite using Py-GC-MS is currently being performed.

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