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The 16th Meeting of the International Humic Substances Society

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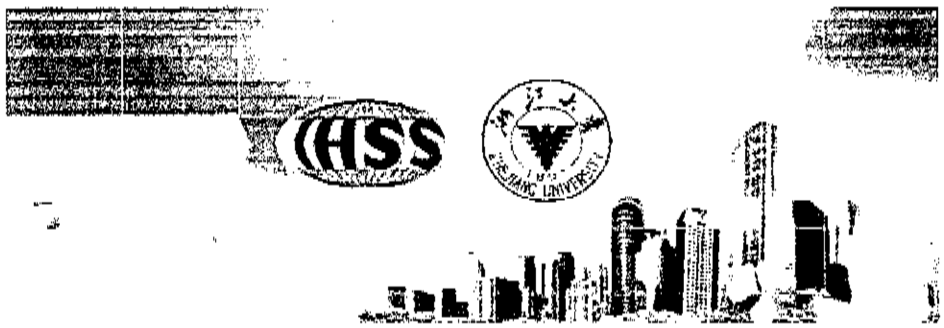

Theme:Functions of Natural Organic Matter in Changing Environment
Dates: September 9-14, 2012
Location: Zijingang Campus of Zhejiang University, Hangzhou, China

Brief introduction of Hangzhou city

Hangzhou city, the capital of Zhejiang Province,was settled as early as 4,700 years ago, giving birth to the Liangzhu Civilization Hangzhou is one of the seven ancient capitals and a key scenic and historic city in China Marco Polo, the 13th century Italian traveler, applauded it as "the most splendid and luxurious city in the world". The beautiful city of Hangzhou is known as a paradise on the earth with numerous touristic sites within and nearby the city, and the city attracts millions of foreign and domestic tourists. Participants will surely enjoy and benefit from the beautiful natural scenery and historical cultural sites.

It only takes 60 min to travel from Shanghai to Hangzhou by high-speed train The Hangzhou International Airport serves a network of 160 domestic and international routes connected to 58 cities and regions.

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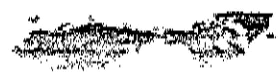

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Functions of Natural Organic Matter in Changing Environment

With 356 figures

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Study of Humification Dynamics of Organic Residues on Vermicomposting Process

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Abstract: The work aims the study of humification of three organic residues (cattle manure, orange pomace and filter cake) submitted to vermicomposting during six months. Some parameters were studied such as pH, temperature, total carbon, total nitrogen and C/N ratio.The data showed typical behavior of the composting process including mesophilic, thermophilic, cooling and maturation phases, the important preliminary results on the dynamics of the process of vermicomposting.

Keywords: Vermicomposting, Humification, Organic residues

Introduction

For the successful agricultural use of organic wastes it is mandatory to evaluate each type of organic waste, soil and culture in order to support future public discussions about the standardization of the use of the evaluated organic compost. In this sense, there is an evident need to establish a regulatory standard for the climate and soils from Brazil in order to ensure that the use of an organic waste is actually beneficial and environmentally safe and offer no damage to soil-plant-atmosphere system. The carbon applied through organic wastes can lead to inadequate soil-atmosphere dynamics and favor mechanisms that negatively influence climate change. The organic material applied to the soil may find conditions that favorits decomposition, emitting alarge amount of CO_2 into the atmosphere and, along with other gases, increasing the green house effect. In the literature there are many chemical and biological tests to characterize the quality of organic composts, however, the concept of stability and maturity of the composts is still not clear distinct (Wang *et al.*, 2004). Spectroscopic analysis of ^{13}C nuclear magnetic resonance (NMR), electron paramagnetic resonance (EPR), fluorescence, light absorption in the UV-Vis and Fourier transform infrared (FTIR), also come been widely studied, in order to monitor the composting process (Provenzano *et al.*, 2001).The general objective of this work is to study the dynamics of humification of organic wastes in the process of vermicomposting and evaluate the influence of vermicomposts in cultivated plant (*Ocimumbasilicum* L.) on the growth, level of macro and micronutrients in plant tissue and essential oil production, i.e., to study the soil-plant system after addition of stabilized wastes. The results obtained during the development of this project shall provide support for legislation of organic fertilizers, on the standardization of agricultural use of agro-industrial residues in soil conditions and climate of Brazil.

Materials and Methods

The experiment was conducted on an outdoor concrete platform on a farm located in the city of São Carlos, São Paulo state. The experiment was initiated in September 2011 and lasted 6 months. Approximately 300 kg of each residue (orange pomace, filter cake and fresh cattle manure) were obtained. The orange peel was obtained from an orange juice industry. The fresh cattle manure was obtained at a farm in the region of

São Carlos-SP, Brazil. The filter cake obtained from the sugar and ethanol industries is composed of impurity minerals and pulp sugar cane particles retained in sieves during the juice filtration. The wet residues were dried at room temperature and after were ground in a knife mill. First of all, the dry residues were characterized based on total N, total C, C/N ratio. The proportion of residues was calculated to C/N ratio values to begin between 25 and 40 for all mixtures.The experiment was conducted in triplicate. Nine mixtures (piles) were prepared using different organic residues with the following dry proportions:

Pile 1, 2 and 3 (P1, P2 and P3): fresh cattle manure + orange pomace;

Pile 4, 5 and 6 (P4, P5 and P6): fresh cattle manure + filter cake;

Pile 7, 8 and 9 (P7, P8 and P9): fresh cattle manure - 100% (reference material).

The proportion of the residues mixtures in P1, P2 and P3 were approximately 2:1 by dry weight, in P4, P5 and P6 were approximately 3:1 by dry weight. Sawdust was used as structuring agent and to assist in the aeration of these piles. Each pile presents the dimensions: 1.5 m (base) and 1.0 m (height). The piles were assembled layer by layer (approximately 20 cm each layer) in the following order: sawdust - fresh cattle manure-orange pomace or filter cake and so on and so forth. Water was added to each layer, so that the end piles were already humid. At the end the residues were mixed and the piles were molded into a conical shape. The mixtures were composted and their moisture adjusted near to 60% once a week during the composting process. The piles were manually turned each week until the 6th week. At the 6th week the composting process returned to mesophilic phase, as observed by temperature measurements and so the organic composts were moved to boxes. Five hundred earthworms were added in each box. The mixtures were vermicomposted and their moisture adjusted near to 60% once a week during the vermicomposting process. The boxes were manually turned each 15 days until the end of the process. Samples were collected at five different points of each pile. These samples were mixed and homogenized obtaining approximately 1.0 kg of composite sample of each pile. The compost piles were sampled at 0, 7, 15, 30, 45, 60, 75, 90, 105, 120 and 135 days. The samples were dried at 60 °C, then ground and sieved. It was used for analyses particles of vermicomposts smaller than 0.5 mm in diameter. The physicochemical analyses made are temperature, pH and C/N atomic ratio. Temperature was measured daily, by inserting a thermocouple into the pile, between 6 and 7 a.m., at three different positions inside the pile (base, middle and top). It was monitored until the 6th week of the composting process. At this time temperatures of the piles are constant at room temperature. For pH measurement, a 0.5 g sample was stirred with 5 mL of 0.1 mol L^{-1} $CaCl_2$. The pH was measured using a Tec-2 Tecnal pH meter after the solutions stirring for 30 min. Total C and N content of collected samples was measured using Elemental Analyzer EA 1110 CHNS-O CE Instruments The elemental ratios were calculated as the quotient of elemental concentration and atomic weight.

Results and Discussion

Table 1 shows the preliminary residues characterization in terms of N and C contents and pH. With this values could be allowed estimating the rates of C/N appropriated for the beginning of the process of vermicomposting.

Table 1 Physicochemical parameters of the organic residues used for composting

Parameters	Fresh cattle manure	Orange pomace	Filter cake
C_{total}	32.11±4.32	41.95±5.28	37.97±0.38
N_{total}	1.73±0.00	1.34+0.00	1.73±0.00
C/N	26.11	36.62	25.66
pH[a]	8.0	2.4	7.3

[a] Measured in $CaCl_2$ 0.01 mol L^{-1} (1:10, *v:v*).
[b] Results expressed in %of dry matter

During the experiment conduction, in general, a slight variation of pH was observed in the piles. For P1, P2 and P3 there was a slight increase of pH (7.09 to 8.07). For P4, P5 and P6 there was a slight decrease of pH (8.40 to 7.41) and for P7, P8 and P9 the pH was practically the same at the beginning and end of the process (~7.8). Piles presented pH values near neutrality or slightly alkaline in the end of the process, conditions expected for astabilized compost (Fialho *et al.*, 2010). During the vermicomposting the temperature variation in all piles presented silimar behavior as a typical composting processes (Fialho *et al.*, 2010). Three temperature phases were observed – 1th: mesophilic phase (there was an increase in temperature from 25 °C to more than 30 °C); 2th:

thermophilic phase (temperature reached maximum values, more than 60 °C for piles P1, P2 and P3); 3th: cooling and maturation phase (after 15 days, the temperature decreased at room temperature again, around 25 °C). The regional climate is tropical, with average temperatures between 16 °C and 27 °C. According to Fialho *et al.* (2010) these behaviors are a consequence of microorganisms activity upon the residues and also of the microbial population dynamics and for maximum decomposition of residues, the temperature must be between 50 and 60 °C. This range is the temperature range for thermophilic phase of P1, P2, P3, P4, P5 and P6 composts. The temperatures of the piles P7, P8 and P9 did not reach 50 °C, what according to Fialho *et al.* (2010) suggests slow microbial growth in comparison to other piles and efficiency of composting process depends on the type of the substrate. In general the C/N ratio of the residue determines the microbial capacity to degrade that material but some organic residues like plants residues could have optimal C/N ratio but they can contain a high proportion of lignin, a component that is difficult to degrade. Box P4, P5 and P6 needed moretimethan other treatments for vermicomposting. Spectroscopic analysis of ^{13}C NMR, EPR, light absorption in the UV-Vis and Pyrolysison-linecoupled to gas chromatography and mass spectrometry and are the next techniques to evaluate the residues, in order to monitor the composting process.

Conclusions

The preliminary results showed expected and significantly informations about the dynamic of the vermicomposting process. These evidences may bemore deeply studied from chemical and spectroscopic analysis of humic acids extracted from vermicompost samples collected during the humification process.

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