

13th Global Conference on Sustainable Manufacturing - Decoupling Growth from Resource Use

## Sustainable Technology for Using Bio-Waste in Rural and Urban Regions in South- and South-East-Asia

Michael H. Böhme<sup>a\*</sup> Le Hung Anh<sup>b</sup>

<sup>a</sup>German University Bangladesh, Telepara T & T Road, Gazipur 1702, Bangladesh

<sup>b</sup>Ho Chi Minh University of Industry, Institute for Environmental Sciences Engineering and Management, Ho-Chi-Minh City, Vietnam

\* Corresponding author. Tel.: +880 1796631425; fax: +880 2 929 4701. E-mail address: [michael.boehme@gub.edu.bd](mailto:michael.boehme@gub.edu.bd)

### Abstract

In many South-East-Asian countries is big lack of organic fertilizers for sustainable crop production, although there are many sources of biodegradable waste material. The best and sustainable way to convert the bio-waste from different sources in organic fertilizer is composting. Following our investigations, the supply of NPK is realized in Germany with about 40% by use of compost and in Vietnam with 1% only. Therefore, new organic sources are required and new technologies have to be developed in order to increase the amount of organic fertilizers. The available bio-wastes, have often high content of cellulose and lignin with slow decomposition rate. In order to enhance decomposition of such materials, specific microorganisms were added. For composting different types of container were used. Very good decomposition rate in short time were determined by use of a mix of different microorganisms and use of rotating containers.

© 2016 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the International Scientific Committee of the 13th Global Conference on Sustainable Manufacturing

Keywords: bio-waste, organic fertilizer, controlled composting, decomposition of cellulose material, wood decomposing fungi and bacteria

### 1. Introduction

In many South- and South-East-Asian countries is a gap between demands of organic material for improving the soil fertility and the sources or technologies to provide such material.

Often stables with large amount of dung, as in Germany, are not available, respectively technologies for collecting and processing of bio-waste from rural households ore the municipalities. The best and sustainable way to convert the bio-waste from different sources in organic fertilizer is composting. With this method comparably low cost organic fertilizer can be produced. Following our investigations, the supply of NPK for agricultural crops is realized in Germany with about 40% by use of compost and e.g. in Vietnam with 1% only. The lack of organic matters in the soil is also responsible for low biological activity, instable chemical and physical properties and erosion. The supply of organic matter should be increased for the integrated cropping and of course for organic farming [1]. Investigations in many villages in Vietnam indicate a lack of organic fertilizers although there are many sources of biodegradable waste material [2], [3], [4].

Composting is one possibility for sustainable use of organic wastes from farms, households in the communes and food industry [5]. For some countries, in the tropics e.g. Vietnam and Bangladesh this is the only way to bring the organic material from rural and urban markets and households as well as from the industry back to the fields. It is very important to close again the cycle between the resources produced on the field and going to the markets in rural and in urban regions and to bring back a part of it to the fields [6]. The aim of this paper was to analyze the sources, flow and use of solid waste, as well their composition in urban regions in Bangladesh and Vietnam. Furthermore investigations to sustainable technologies for reuse of bio-waste in particular by composting.

The sources of bio-wastes in South-East-Asia, e.g. sugar cane bagasse, sugar cane and banana leaves, wheat straw, coconut residual and wood shavings, however, have high content of cellulose and lignin, because their slowly decomposition. In order to decompose such organic materials use of appropriate microorganisms are necessary [7], [8], [9].

Experiments were carried out using waste materials with high content of cellulose and lignin in order to enhance the decomposition rate different cellulose decomposing microorganisms were added before composting [10]. Furthermore were investigated composting in rotatable containers filled with bio-waste mix and coconut residuals different *Trichoderma* strains [11].

**2. Generation of Solid Waste Material in Bangladesh and Vietnam**

The amount of waste generated in urban regions in Bangladesh is about 13,300 t per day, about 67.6% consists from food and vegetable waste and 9.7% from paper, so about 77% consists from organic matter [12] (Fig. 1). Whether, still the collecting of the waste from households, markets and the industry, in particular the garment factories, is still problematic, this figure shows the high amount compostable organic material. The problem is often separating the organic waste from the plastic brick/stone, wood, metal, glass/ceramic and other inorganic components. Because missing of appropriate technique it is mainly done by hand.

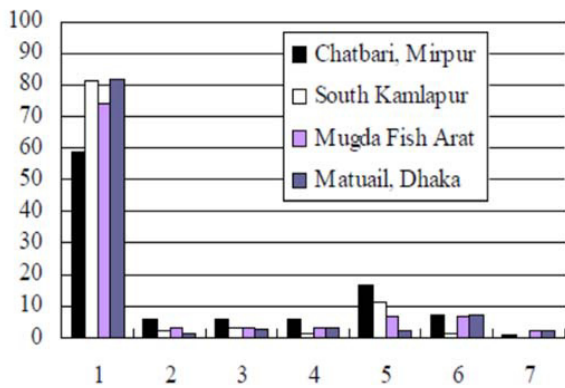


Fig. 1. Composition of mixed waste from Dhaka City Corporation at dumping (in %) [12]  
 1 = Food waste, 2 = Paper, 3 = Polythene, plastic, 4 = Cloth, 5 = Garden trimmings, leaves & branches, 6 = Brick/ stone, wood, metal, glass/ ceramic, 7 = others

In Vietnam exists a good estimation of the waste generated in different regions, respectively different areas or origin [13] (Table 1).

Table 1. Solid waste generation in Vietnam [13]

Waste categories	Unit	2003	2008
Municipal waste	tons p. a.	6,400,000	12,802,000
Agriculture waste	tons p. a.	6,400,000	9,078,000
Industrial waste	tons p. a.	2,638,400	4,786,000
Medical waste	tons p. a.	21,500	179,000
Waste from villages	tons p. a.	774,000	1,023,000
Total waste generated	tons p. a.	15,459,900	27,868,000

Related to increasing of the urbanization the amount of municipal waste is also increased, but also in agriculture the waste generation is very high. It can be assumed the composition of the waste in Vietnam is also mostly from organic origin, probably 60 to 85%, that means it exists also a high potential to reuse those bio-waste by composting

In Ho Chi Minh City were analysed the sources of the solid waste from households, marketplaces, streets and others as factories and public places (Fig. 2). Interestingly the amount of solid waste on the streets is quite low, e.g. in comparison to Bangladesh.



Fig. 2. Sources and Utilization of solid Waste in Ho-Chi-Minh City (Basic data [15] and own investigations)

Remarkable is the increasing of the recycled solid waste in Ho Chi Minh City from near to zero 1998 to about 15% 2014. The amount of collected solid waste increased from about 50% in 1998 to 70% in 2014. The consumption of the solid waste is comparable to Bangladesh, as already mentioned about 60 to 85% are bio-waste that means this fractions can be composted. Unfortunately the amount of composted bio-waste is still not very high.

**3. Sustainable reuse of bio-waste by composting**

Normally most of the materials can be easily composted, in particular waste originated from food. Investigations showed often the collected bio-waste consisted also from organic materials with high cellulose and lignin content, as sawdust, wood shavings, Sugar cane bagasse, banana leaves and coconut residuals.

*3.1 Preparation of the composting with slow decomposing bio-waste*

Sugar cane bagasse with high C:N ration and a relatively high water capacity (Table 2) was composted in containers with 10 L volume. Also sugar cane bagasse, sugar cane and banana leaves, wheat straw and wood shavings were used because their high relevance as bio-waste in particular in tropical countries as Vietnam. These materials have a high pore volume with more the 79 Vol. % and are therefore suitable to enhance the structure of the compost (structure improving materials, SIM) (Table 2).

Download English Version:

<https://daneshyari.com/en/article/1699102>

Download Persian Version:

<https://daneshyari.com/article/1699102>

[Daneshyari.com](https://daneshyari.com)