Bio-conversion of Food Wastes into Vermicompost and Vermiwash

M. M. Manyuchi., A. Phiri., P. Muredzi, N. Chirinda

Abstract: ***Vermicomposting technology is the bio-conversion of organic waste into bio-fertilizers using earthworms. Vermicomposting is widely being used for solid waste management. Various food wastes were vermicomposted over 30 days using Eisenia fetida earthworms. Vermicompost and vermiwash were obtained as vermi-products. The vermicompost nitrogen, phosphorous and potassium composition was 2.1%, 0.29% and 0.19% respectively. Whereas, the vermiwash only contained 0.58% nitrogen and 0.47% potassium. Vermicomposting technology is necessary as a food wastes management strategy.***

Keywords: Eisenia fetida, food wastes, vermicomposting, vermiwash, vermi-products

I. INTRODUCTION

Vermicomposting technology is increasingly becoming popular as an organic solid waste management strategy [1]-[11]. During the process, earthworms ingest organic waste into their gut whereby the waste is digested and expelled as vermicompost which is also known as vermicasts [1]. Furthermore, a leachate, called vermiwash is produced as the liquid excreta of the earthworms [1]. Vermicomposting is optimally carried out at feedstock temperature range of 25-45◦C, pH 5-9 and moisture content 45-75% [1]. The vermicomposted and vermiwash produced from vermicomposting are reported to be rich in nitrogen, phosphorous and potassium as well as trace elements [12]. In addition, the vermicomposting process produces earthworms; as they grow in number, weight and size during the process [12-15]. In Zimbabwe 150 tons of wastes are generated per annum [13]. 70% of the total waste generated constitutes of food wastes hence there is need to applying this vermicomposting technology as a food waste management technology [13]. If left lying around, food wastes pose a threat of polluting the environment and can also cause diseases to human beings and animals.

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Musaida Mercy Manyuchi, Department of Chemical and Process Systems Engineering, Harare Institute of Technology, P O Box BE 277, Belvedere, Harare, Zimbabwe.

Anthony Phiri, Department of Chemical and Process Systems Engineering, Harare Institute of Technology, P O Box BE 277, Belvedere, Harare, Zimbabwe.

Perkins Muredzi, Dean, School of Engineering and Technology, Harare Institute of Technology, P O Box BE 277, Belvedere, Harare, Zimbabwe.

Ngoni Chirinda, Director, Technology Center, Harare Institute of Technology, P O Box BE 277, Belvedere, Harare, Zimbabwe.

II. MATERIALS AND METHODS

A. Materials

Various food wastes obtained from different sources as indicated in Figs 1a and 1b were vermicomposted. The various food wastes included cabbage, rice, bread, potato peels and carrots (Figs 1a and 1b). The vermicomposting methodology is described in detail by Manyuchi *et al.*, [11].

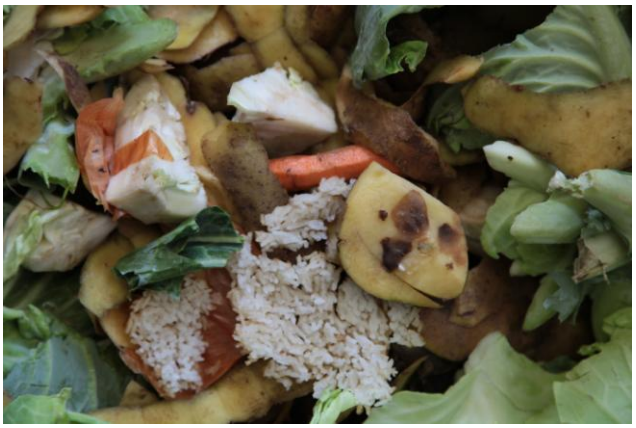

Fig 1a: Food wastes used for vermicomposting

Fig 1b: Food wastes used for vermicomposting

B. Methods

The various food wastes were vermicomposted over 30 days using *Eisenia Fetida* earthworms. The vermicompost and vermiwash produced from different food wastes were analyzed for the nitrogen, phosphorous and potassium (NPK) composition. The nitrogen content was measured by the Kjeldahl method (AOAC-920.87), whereas the phosphorus content was measured by the Gravimetric Quimociac method (AOAC-962.02) and

the potassium content was measured using a Shimadzu 6800 atomic absorption spectrophotometer.

III. RESULTS AND DISCUSSION

A. *The vermicomposting cycle*

The vermicomposting cycle which the food wastes underwent using the *Eisenia Fetida* earthworms is represented in Fig 2. Vermicompost and vermiwash was produced as vermi-products.

The vermi-products were fed into a bed of spinach as bio-fertilizers (Fig 2). The spinach generated some wastes upon harvesting and consumption which were fed into the vermireactor as part of the food wastes for vermicomposting (Fig 2). Thus the vermicomposting cycle continued.

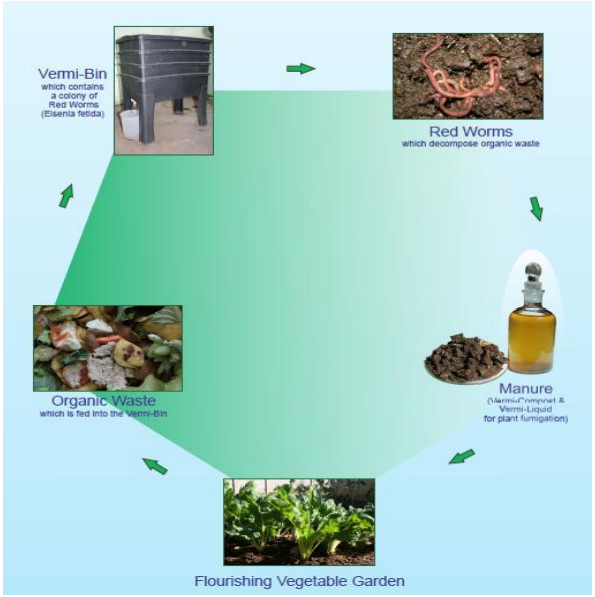

Fig 2: The vermicomposting chain

B. Vermicompost and vermiwash from food waste nutrient composition

The vermi-products' ammonical, nitrate, nitrogen, P_2O_5 and K_2O composition was quantified (see Table 1). The vermicompost had a total nitrogen content of 2.1%, phosphorous content of 0.29% and potassium content of 0.19%.

Table 1: Vermi-products nutrient compositions

Nutrient composition (%)	Vermicompost	Vermiwash
Ammonical-N	1.05	0.20
Nitrate-N	0.0	0.09
Nitrogen	1.05	0.29
P_2O_5	0.29	0.0
K_2O	0.19	0.47

IV. CONCLUSION

Food wastes which pose a threat of polluting the environment can be vermicomposted into vermicompost and vermiwash. The vermicompost and vermiwash can be utilised as bio-fertilizers.

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