

Preparation and Characterization of Natural Fertilizer from Farm's Waste

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Abstract

Study on the some physicochemical properties of natural fertilizer by using farm's waste (vegetables waste). All the farm's waste were collected from Namphar Quarter, Banmaw Township, Kachin State, in the month of December, 2017. The collected samples were mixed December 2017 to April 2018 under aerobic condition S(I) and anaerobic condition S(II). Some physicochemical properties of prepared natural fertilizers such as moisture, pH, bulk density, organic matter, carbon nitrogen ratio and nutrients content (total N, P and K) were determined by instrumental, analytical, and titrimetric methods. Generally, all the physicochemical properties of prepared natural fertilizer were found to be in the range of moisture 5.797% to 19.555%, pH 7.02 to 7.09, bulk density 0.54 gcm⁻³ to 0.63 gcm⁻³, organic matter 42.56% to 68.69%, carbon nitrogen ratio 12.01 to 21.07 and total nutrients, nitrogen 1.89% to 2.87%, phosphorous 0.04% to 0.878% and potassium 6.00% to 7.56% respectively. The elemental composition of all samples were analyzed by ED XRF. They have no detectable toxic metals such as Cd, Zn, Hg, etc. And then, the fertilization activities of prepared samples were also determined by cultivation of Lettuce within two months.

Keywords: mixture, fertilization activities, nutrients, aerobic, anaerobic

Introduction

Myanmar is an agricultural country. Myanmar agriculture has become a chemical agriculture in which numerous chemicals like insecticides, herbicides and commercial fertilizers are being used in producing crops (Bhawalker, 1989). This has resulted into a major shift in microbial population and whole rhizosphere is getting polluted. Nutrient dis balance, fast depletion in soil fertility and continuous deterioration in physical properties of soil are some of the added disadvantages of chemical agriculture. Natural fertilizer play an important role in improving soil fertility and thereby boosting crop yields. Natural fertilizers are capable in nitrogen fixation, phosphate solubilizing and decomposing organic matter at a faster rate (Johns, 1998). Besides, the microbes are help improving the soil fertility and boosting crop productivity. Natural fertilizer have to play a definite supplementary and complementary role to chemical fertilizers in supplying plants nutrients in the country. Generally, the research aimed to promote proper waste management by the farm via natural fertilizer production and demonstrate the feasibility of growing vegetables using natural fertilizer as the major source of plant nutrients. Specifically, it aimed to determine the efficiency of natural fertilizer (under aerobic and anaerobic conditions) generates major nutrients for vegetable production and its effect on some physical properties (PANIDA, 2013). Vegetables wastes generated pose an environmental threat and call for the development of a pollution-free model. Generation of renewable energy by bioconversion of vegetables waste is gaining importance as it has proved to be a proficient means of utilizing the perishable vegetable residues (Biswas, 1994). Researchers and industries are now fully engaged in a number of projects involving the technology of "waste to fuel" with a view to overcome the disposal problems. The present article deals with the studies conducted on vegetables waste for production of various types of biofuel (John, 1998). The vegetable waste obtained the different nutrients for growing plant. The purpose of aerobic and anaerobic treatment is to prepare different nutrients which are objectionable either from protection of environmental pollution or from plants health point of view (Roy, *et al.*, 2006). Following are the purposes of samples treatment:

- To be chosen farm 's waste materials (vegetables waste)
- To prepare the natural fertilizer under two conditions(aerobic and anaerobic)
- To determine the some physicochemical properties of samples
- To determine the elemental composition of samples by EDXRF analysis
- To investigate the properties of samples due to the cultivation of Lettuce plants within two months

Experimental

Materials and Methods

All chemicals and reagents used in this research were analytical grade and purchased from Banmaw University, Dagon University and West Yangon University.

General

All the farm's waste were collected from Namphar Quarter, Banmaw Township, Kachin State. The collected samples were mixed under aerobic condition S(I) and anaerobic condition S(II) within four months .

Sample Preparation

All vegetables waste were mixed under aerobic condition S(I) and S(III) and anaerobic condition S(II) and S(IV). For aerobic condition, all the farm's waste were placed under ground by opening method and a close atmosphere using plastic housing method was used for anaerobic condition. The pile size was (14', 10', 8').

Determination of Physicochemical Properties of Prepared Natural Fertilizers

Physicochemical properties of natural fertilizer such as moisture, pH, bulk density , organic matter, carbon nitrogen ratio and nutrients content (total N, P and K) were determined by instrumental, analytical and titrimetric methods.

Elemental Composition of Prepared Natural Fertilizers

The elemental composition of prepared natural fertilizers under aerobic and anaerobic conditions were determined by EDXRF.

Fertilization Activity of Prepared Natural Fertilizers

The fertilization activity of prepared natural fertilizers were also investigated by cultivation of Lettuce plants.

Results and Discussion

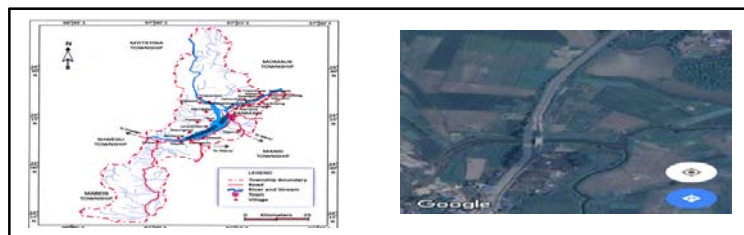


Figure (1). Farm's wastes sampling sites.



Figure (2). Sample preparation
(a) natural fertilizer (aerobic)
(b) natural fertilizer (anaerobic).

Table (1). Physicochemical Properties of Natural Fertilizers

Sample	Moisture (%)	pH	Bulk Density (g/cm ³)	Organic matter (%)	Total N (%)	Total P (%)	Total K (%)	C:N
S(I)	18.531	7.06	0.62	52.79	2.17	0.641	6.24	14.11
S(II)	19.555	7.09	0.63	68.69	1.89	0.878	6.00	21.07

S (I) = natural fertilizer aerobic condition after two months

S(II) = natural fertilizer anaerobic condition after two months

Major Nutrients Constituent in Prepared Natural Fertilizers

Among major nutrients (N,P and K) constituents in prepared natural fertilizers were the major constituents forming about 2 % of nitrogen, 0.641 and 0.878 % of phosphorus and 6.00-6.24 % of potassium whereas organic matter % was 52.79 to 68.69 % were investigated .The pH value of prepared samples were suitable for plants growth .

Table (2). Relative Abundance (%) of Some Typical Elements in Prepared Natural Fertilizers

Element (%)	Natural Fertilizer	
	S(I)	S(II)
Ca	57.913	51.704
K	22.192	22.563
Fe	5.508	9.995
Si	5.339	9.342
S	5.098	3.985
Ti	0.637	1.097
Mn	0.397	0.549
Zn	0.114	0.123
Cu	0.047	0.046

S (I) = natural fertilizer aerobic condition after two months

S(II) = natural fertilizer anaerobic condition after two months

Table 2 shows various elemental distribution of all sample of prepared natural fertilizers. According to the relative percentage data tabulated, Silicon, Calcium and Potassium were found to be pronounced.

Relative Elemental Abundance of Prepared Natural Fertilizers

Figure 3 show the EDXRF data of prepared natural fertilizers. In the EDXRF method excitation of characteristic X-rays is accomplished by

- primary seen of electromagnetic radiation (X-rays)
- charged particles (alpha, beta or photon rays)

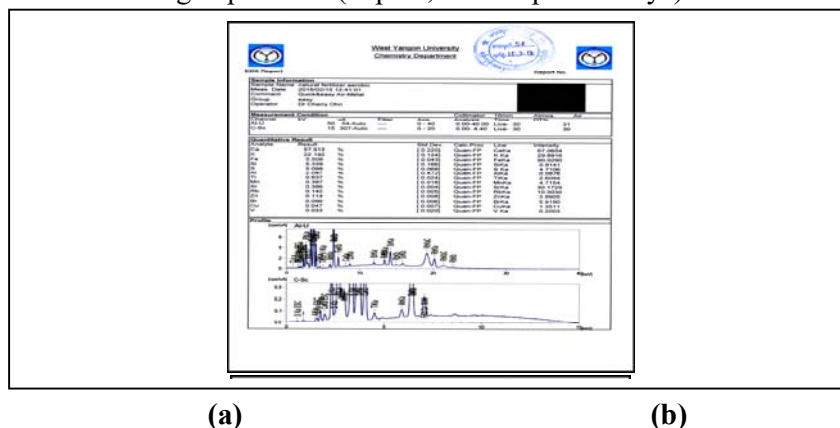


Figure (3). EDXRF spectrum of prepared natural fertilizes

The Fertilization Activities of Natural Fertilizer

The fertilization activities of natural fertilizer (aerobic and anaerobic conditions) were also determined by growing plants (Lettuce) within two months.



Figure (4). The growth of Lettuce plants within two months

Table (3). Natural Fertilizer Application Rate for Vegetables Production

Treatment	Plant Height (cm) After Sowing					
	7 days	14 days	21days	28days	35days	42days
Soil	1.1	1.9	3.5	6.1	8.8	10.2
Soil +S (I)	1.1	1.9	3.8	6.8	9.7	15.1
Soil +S (II)	1.1	1.9	3.9	6.7	9.6	14.8

Conclusion

The collected vegetables waste from Namphar Quarter, Banmaw Township, Kachin State were mixed under aerobic and anaerobic conditions in December 2017 to April 2018. The natural fertilizer (under aerobic and anaerobic conditions) have been prepared after two months S(I) and S(II). The pH value of S(I) S(II) were 7.06 and 7.09. It was found that the pH value of all samples were nearly the same. These values are suitable for growing plants. Among the different samples, the bulk density and moisture contents of natural fertilizer under anaerobic condition obtained the highest after two months. Low bulk density indicates increased pore space and improved soil properties. And also it was found that the organic matter and carbon nitrogen ratio were increased in natural fertilizer S(II) due to the slow microbial decomposition. Nitrogen content, potassium and phosphorous contents in prepared natural fertilizer were the following order:

Nitrogen content S(I) > S(II)

Potassium content S(I) > S(II)

Phosphorous content S(II) > S(I)

The content of calcium in all samples were the highest relative to that of other elements and potassium (essential nutrient) content was the second highest for samples (I) and (II). The other elements such as Fe, Ti, Mn, Cu, Zn and etc were also investigated. All the prepared natural fertilizers from vegetables waste do not obtain the toxic heavy metals (such as Hg, Pb, Cd and As). It was observed that the growth factors of Lettuces were increased in different duration of time (within two months). The Lettuces grew in prepared natural fertilizers were higher than the original soil. Due to the experimental results, plant height were significantly increased in the application of prepared natural fertilizers under different conditions (aerobic and anaerobic). With using natural fertilizer, a low input system can be carried out and it can be supported achieving outcomes for farms. Natural fertilizers are chemical-free and can save your money. These fertilizers are suitable for growing plants. Use of the natural fertilizer for vegetable production of a large scale can solve the problem for disposal of wastes. Wastes are being recycled, and also reduced the environment pollutions.

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