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PREPARATION OF BIO-ORGANIC MATERIALS FOR THEIR UTILIZATION AS SOIL AMENDMENT AND GROWTH MEDIA

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ABSTRACT

Processing of different plant residues (peanut shell and saw dust) and natural minerals and rocks (bentonite, manganese ore dust and rock phosphate) were done via partial acidifying, steam pressure, then composting. Afterwards, the product was bore with some beneficial microorganisms to prepare non-traditional bio-organic fertilizer. The different processing stages were chemically monitored and the end product was submitted to different physical, chemical and biological examination. Results obtained clearly revealed that values of pH, EC, C/N, organic-C, total-N and available forms of plant nutrients were greatly fluctuated among the different stages of the processing. At the last stage, all parameters investigated were fitted to the reasonable values. The end product has acceptable values for pH. EC and C/N ratio. Also, end product contained appreciable quantities from macro and micronutrients in total and available forms. Moreover, it has high degree of water holding capacity and bulk density. In addition, it has high biological vigor which reflected by the valuable values of dehydrogenase and nitrogenase activity as well as the main groups of microorganisms.

Key words: Bio-organic materials, Soil amendments, Plant residues, Natural minerals and rocks and growth media

INTRODUCTION

Intensive agriculture led to increase using of agrochemicals (chemical fertilizers and pesticides), but using such agrochemicals reached to squandering extent. These chemicals accumulated in agricultural soils and reached to water and food causing gross environment injuries. In respect of fertilization, organic materials and biofertilizers became the alternative solution for reducing consumption of chemical fertilizers as well as environment protection. However, the arid and semi arid regions such as Egypt are suffer from shortage in organic matter content as well as insufficient organic sources which can compensate by chemical fertilizers. Unfortunately, the available sources in huge quantities such as sewage sludge and municipal wastes are considered environmentally unsafe in most

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cases due to their contents of injurious pollutants such as heavy metals and potentially toxic organic compounds (e.g. PCBs, Poly Chlorinated Biphenyle), hence their addition into agricultural lands are still not amputated in most countries (**Chaney, 1992; Gardiner *et al* 1995; Otabbong *et al* 1997; Mench, 1998 and Abdel-Wahab *et al* 2002**). Moreover, most of traditional organic manures, particularly farmyard manure may causing some problems for newly reclaimed soils resulted in transporting their undesirable contents such as nematode, plant pathogenic microorganisms and weed seeds.

Hence the attention is greatly attracted to exploit the huge quantities of organic resides such as crop residues and food processing wastes, by recycling them via composting process either by traditional or developed methods. Developed methods of composting including the enrichment of composted materials with bioactivators, natural minerals, rocks and plant extracts (Gaur, 1986 & 1987; **Rynk *et al* 1992; Conacher & Conacher, 1998 and Abdel-Wahab, 1999**). In addition, using of chemicals (acids or alkalins) and/or physical (e.g. steam pressure) treatments displayed significant changes in chemical composition as well as utilization of cellulose and hemicellulose of some agricultural residues for producing silage and feed materials (**Schukking, 1976; Rai & Mudgal, 1987 and 1988**).

The aim of this work, therefore was to accelerate the production of bio–organic amendments using physical and chemical pretreatments of some agricultural residues with some minerals and rocks as well as enrichment the decomposed materials with some biofertilizers. The different processing stages were chemically monitored. In addition, evaluation of the end product chemically and biologically was considered.

MATERIAL AND METHODS

Some crop residues, natural minerals and biofertilizers were collected from different sources (Table, 1). The main chemical characteristics of raw materials used are presented in (Table, 2). The processing of these raw materials are carried out in successive steps as following:

1. Mixture of grounded peanut shell and saw dust at a ratio of 1 : 1 w/w treated with sulfuric acid solution (5 %) and maintained at 50 % moisture at room temperature for 7 days.
2. This mixture was treated with steam pressure in autoclave at 1.5 atmospheric pressure for 2 hr.
3. The mixture received rock phosphate and manganese ore dust in fine form at rate of 10 and 5 %, respectively from the original mixture weight. They thoroughly incorporated and well tamped then left for 15 days with maintaining the moisture content at 50 %.
4. Afterward, the mixture is incorporated with 20 % bentonite and 5 % urea and inoculated with *Trichoderma* sp., then they composted for 30 days.
5. After elapsing of composting period, some microbial activators namely *Azotobacter*, *Azospirillum*, *Bacillus*, *Psuedomonas* and *Serratia* are added and left 10 days as a final step for production the bio-organic compound.

The microorganisms were provided from Biofertilizers Production Unit, Soils, Water and Environ. Res. Instit., ARC, Giza, Egypt.

Table 1. Sources and addition portion of raw materials and microbial inoculants used

Raw material and Microbial inoculant	Source	Addition portion
Peanut shell	EL Sharkia Governorate	500 kg
Saw dust	Wood processing waste	500 kg
Manganese ore dust	South Sinai Governorate	50 kg
Rock phosphate	Abou Zabal, El-Qalubia Governorate	100 kg
Bentonite	El-Fayom Governorate	200 kg
Trichoderma sp.	Agriculture Research Center	750 ml
Azotobacter chroococcum	Agriculture Research Center	[a]800 g
Azospirillum brasilense	Agriculture Research Center	[a]800 g
Bacillus polymyxa	Agriculture Research Center	[a]800 g
Pseudomonas sp.	Agriculture Research Center	[a]800 g
Serratia sp.	Agriculture Research Center	2 Liter

a: Carrier based inoculant.

Table 2. Some chemical properties of raw materials

Property	Peanut shell	Saw dust	Mn-ore dust	Bentonite	Rock phosphate
pH	6.50	4.99	7.50	8.00	7.80
EC (dS/m)	2.34	0.76	9.60	7.15	3.07
Organic-C (%)	56.29	83.89	0.46	0.12	0.41
Total-N (%)	1.52	0.58	0.015	0.029	0.031
C/N ratio	37.03	144.64	30.67	4.14	13.23
Total-P (%)	0.45	0.072	0.065	0.38	10.9
$N-NH^{+}_{4}$ (ppm)	225.2	74.7	nd	nd	nd
$N-NO^{-}_{3}$ (ppm)	132.4	70.3	nd	nd	Nd
Total-Fe (ppm)	434.3	101.4	(39.6 %)	(5.7 %)	(0.59 %)
Total-Mn (ppm)	65.3	40.7	(17.8 %)	(0.015)	(0.036 %)
Total-Zn (ppm)	98.7	47.3	285.9	73.2	82.3
Total-Cu (ppm)	36.7	20.5	359.0	47.0	11.5

* ND: Not detected
* Values in parenthesis are percentage

After each step, three representative samples are collected, air dried and grounded, then stored for the chemical analysis. In addition, the end product of this processing was evaluated for different physical, chemical and biological properties.

Analysis

- Chemical and microbiological analysis of raw materials at different stages of processing and end product were conducted according to **Page *et al* (1982)**.
- Physical properties of the end product were carried out according to **Black *et al* (1965)**.
- Dehydrogenase enzyme activity (DHA) was determined in five represented samples using 2,3,5 Triphenyltetrazollium chloride according to **Page *et al* (1982)**.
- Nitrogenase enzyme activity (N_2-ase activity) was determined by using Acetylene Reduction Assay method using Gas Liquid Chromotography (GLC) Model DANI 1000 according to **Page *et al* (1982)**.
- Extinction coefficient (E_4/E_6 ratio) was measured at 465 and 665 nm in aqueous extract Spectrophotometrically according to **Page *et al* (1982)**.
- Seed germination test was conducted using cress seeds (*Lepidium sativum*, c.v. local) which sown on four layers of whatman No.1 filter paper placed in Petri dishes and humidified with 5 ml from end product extract (1:10). Distilled water was used as control without photoperiod. The percentage of germination was recorded at 24, 72 and 120 hr. If the germination index is above 50%, the organic material has a degree of acceptable maturity (**Zucconi *et al* 1981 and Pare *et al* 1997**).

RESULTS AND DISCUSSION

Processing of raw materials

Data presented in Table (3) show the chemical changes causing in raw materials during different stages of their processing. pH values tended to sharp decrease after treatment with sulfuric acid (pH, 3.21) and exhibited more decline by treating with steam pressure (pH, 2.51). However, pH values raised again at composting stage and they became nearly similar to the original values of organic residue mixture before chemical and physical treatments. Addition of bentonite (clay minerals) and urea have been implicated for this rising of pH levels at composting stage. Presence of pH enclosed by acidic conditions at earlier stages of processing may established suitable conditions for increasing the solubility of rock phosphate and Mn-ore. In addition, such acidic conditions is favourable for fungal activity (*Trichoderma*). Similar findings were obtained by **Bangar *et al* (1989); Sharma & Prasad (1996) and Abdel-Wahab (1999)**, used acidified materials such as sulfur and pyrite for preparing compost enriched with phosphate and natural phosphate fertilizers.

Considering the electrical conductivity (EC), addition of diluted sulfuric acid solution led to more increase their values that reached the highest value (9.76). However, EC values decreased gradually with progressing the processing stages. This great rising in EC value may be due

Table 3. Chemical changes during processing stages of bio-organic compound

Treatments	pH	EC dS/m	O.C %	Total-N %	C/N ratio	Available form (ppm)			DTPA-extractable (ppm)			
						NH^+_4	NO^-_3	P	Fe	Mn	Zn	Cu
Peanut shell + saw dust at ratio 1:1 by weight (mixture)	5.87	2.51	66.17	0.97	68.22	133.7	104.5	43.8	298.3	25.8	28.4	3.7
Mixture after acid treatment and tamping for 7 days	3.21	7.42	59.72	1.03	57.98	435.3	95.9	92.6	387.0	36.2	33.3	5.9
After steam pressure treat. At 1.5 atm .p for 2 hr.	2.51	9.76	47.68	1.12	42.57	560.6	80.3	148.6	472.7	41.8	39.5	7.8
After addition of rock-p and Mn-ore and tamping for 15 days.	3.89	8.82	41.71	1.20	34.76	568.2	69.7	253.9	546.1	68.4	45.8	11.8
After addition of bentonite, urea and *Trichoderma* and composted for 30 days.	5.76	6.87	33.24	1.30	25.57	621.9	153.4	291.8	535.3	66.4	42.4	9.7
After addition of *MA (10 days from treatment)	6.45	7.12	28.72	1.40	20.51	663.8	160.0	302.0	531.7	64.1	41.6	8.9

* MA : Microbia activators.
DTPA : Di-ethylene tri-amine penta acetic acid

to sulfuric and its effects on decomposition of raw materials. Moreover, EC values at end of processing reached to 7.12 mmohs/cm, but this value seem it still in acceptable values for such materials which may employed as amendments, organic fertilizers or growth media (**Verdonck, 1988; Abou-Bakr, 1994; El-Nadi *et al* 1995; Vuorinen & Saharinen, 1997 and Abdel- Wahab, 1999**).

The organic-C revealed that their values gradually decreased with successive stages of processing. The values of organic-C during different stages was fluctuated from 66.17 to 28.72 which represented a loss of carbon reached 56.6 % during the processing duration (62 days). Among given treatments, data clearly displayed that the loss of organic carbon was greater in case of steaming the acidic mixture than other treatments followed by composting stage. This gradually decreases in organic-C was due to acidic action which greatly accelerated by steam pressure and due to biological oxidation during composting stage. These findings are nearly similar to those obtained by **Tiwari *et al* (1989); Kaloosh (1994); Vuorinen & Saharinen (1997) and Abdel-Wahab (1999)**.

With respect to changes occurred in total nitrogen, data show that its values were gradually increased during the processing duration from 0.97 to 1.40 %. This gradually increase in total-N presumably due to the reduction in the weight of decomposed materials during acidic hydrolysis and to application of urea and nitrogen fixers at later stages (**Gaur, 1987; Nuntagij *et al* 1989; Kaloosh, 1994 and Abdel- Wahab, 1999**).

C/N ratio indicted that its values exhibited a great decrease at beginning from 68.22 to 20.51 for end product. As a result of sharp decreasing of organic-C and increasing of total-N, hence the C/N ratio decreased. This C/N ratio (20.51) considered as an acceptable limit as organic manure particularly for Egyptian conditions where the oxidation rate of organic matter is high, the end product under investigation may be relatively suitable for arid conditions in desert soils of Egypt (**Abdel-Malek *et al* 1961 and Abdel-Malek, 1971**).

The soluble forms of nitrogen (ammonium and nitrate) reveled that ammonium values was gradually increased with progressing in processing stages, while the nitrate values decreased at early stages then they increased at composting and microbial activators addition stages. Increases in soluble-N presumably acted to decomposition of organic materials, urea addition and biological nitrogen fixation. The relatively high values of soluble- N obtained may be considered as indication of the occurrence of the reduction in nitrogen losing during the processing stages. In fact, the main important problem facing the practicing of compost production that their lower in mineral nutrients, particularly nitrogen. Nitrogen exposed to vigorous losing during composting process which caused by volatilization of ammonia and leaching of ammonium and nitrate. The factors which led to nitrogen losses are high temperature, alkaline pH and forced aeration (**Witter & Lopez-Real, 1988; Brink, 1993 and Dewes, 1995**). Therefore, composting such organic materials under mild acidic conditions may be decreased nitrogen losses. In addition, incorporation of clay minerals such as bentonite with composted materials could increasing and maintenance the plant nutrients against different losing factors.

The values of available phosphorus gave a gradual increasing during the processing stages. Results clearly exhibited the great effect of diluted sulfuric acid and steam pressure on dissolution of organic material (peanut shell and saw dust) and mineral phosphate (rock phosphate). It worth to mention that, sulfuric acid which considered the basic step in manufacturing of super phosphate as well as it is the target from addition of elemental sulfur to composted materials. In addition, the prominent role of microorganisms in dissolution of rock phosphate during composting stage may considered with acidic action a comprehensive effect. Using of acidifying materials and phosphate dissolving organisms in composting process are reported by many investigators (**Mishra & Bangar, 1986; Bangar *et al* 1989; Mahimairaja *et al* 1994; Sharma & Prasad, 1996 and Abdel-Wahab, 1999 & 2003**).

The changes in DTPA-extractable micronutrients, obtained results showed that their values were behaved similarly as those obtained with available phosphorus. The incubation of manganese ore dust with organic materials under acidic conditions for 15 days and during composting stage led to enrich the product with appreciable extents of available micronutrients in presence of decomposed organic materials which may maintain these elements in available forms. The available Zn and Cu were recorded the same trend. Similar findings were obtained by **Chen and Stevenson (1986); Bar-Ness & Chen (1991) and Abdel-Wahab (1999)**.

Characteristics of end product

Table (4) shows the physical, chemical and biological analysis of the bio-organic compound as end product. Value of pH was nearly neutral and in acceptable range (**Verdonck, 1988**). Value of EC is relatively high, but it still in acceptable range as a soil amendment or as a growth media. This is reflected by the high percentage of cress seeds germination obtained from germination test for the aqueous extract of end product (91.6 %). These findings is in accordance with those obtained by **Zucconi *et al* (1981)** and **Pare *et al* (1997)**. The end product has C/N ratio of 20.44 and this value considered moderate and suitable for arid and semi arid conditions which prevailed in Egypt . Such ratio make the decomposition rate of organic materials behave slowly during the growth season without appearance of phytotoxicity effects. These results are in agreement with **Abdel-Malek *et al* (1961) ; Abdel-Malek (1971); Abou Bakr (1994) and Abdel-Wahab *et al* (2002)**. The end product has appreciable quantities of total and available macro and micronutrients indicating that the product possess high fertilizer value, particularly in presence of decomposed organic materials which act to prevent nutrients losing or precipitation.

Concerning the physical properties of the end product, data revealed that this

Table 4. Characteristics of the end product

Parameter	Value
Moisture content (%)	32
Bulk density (kg/ m^3)	590
Water holding capacity (%)	170
pH in 1 : 5 extract	6.47
EC in 1 : 5 extract (dS/m)	7.19
E_4/E_6	3.46
Organic-C (%)	26.77
Total-N (%)	1.31
C/N ratio	20.44
Total-P (%)	1.16
Total-K (%)	0.64
N- NH^+_4 (ppm)	697.0
N-NO^-_3 (ppm)	165.1
Available-P (ppm)	296.0
Available-K (ppm)	913.0
Total - Fe (%)	0.78
Total - Mn (ppm)	284.3
Total - Zn (ppm)	167.0
Total - Cu (ppm)	38.5
DTPA-extractable- Fe (ppm)	624.8
DTPA- extractable- Mn (ppm)	63.9
DTPA- extractable- Zn (ppm)	39.5
DTPA- extractable- Cu (ppm)	8.2
Dehydrogenase activity (□g TPF/g)	142.5
Nitrogenase activity (nmol C_2H_4 / hr)	98.8
Total count of bacteria	14×10^7
Total count of fungi	13×10^6
Total count of actinomycetes	2.7×10^6
Seed germination test %	91.6

product has suitable water holding capacity and bulk density for their employing as growth medium.

With respect to the biological properties, data showed that the end product has high biological activity which reflected by high activities of dehydrogenase and nitrogenase enzymes as well as the total count of microorganisms. This means that this product may behave likewise as biofertilizers and plant growth promoting rhizobacteria.

From the obtained results, it could be concluded that the bio-organic compound suitable alternative of peat moss which represented the major material in production of vegetables and fruit seedlings as well as production of biofertilizers. In addition, this end product may be utilized as biofertilizer for newly reclaimed soils. without any environmental troubles and rationalization chemical fertilizer and encouragement of organic farms.

REFERENCES

Abdel-Malek, Y.; M. Monib and M.N. Zayed (1961). Bacteriological and chemical studies in rice straw compost. *Egypt J. Soil Sci., 1: 51-66.*

Abdel-Malek, Y. (1971). Free living nitrogen fixing bacteria in Egyptian soils and their possible contribution to soil fertility. *Plant and Soil, Special Volume, pp. 423- 442.*

Abdel-Wahab, A.F. (1999). *Iron-Zinc-Organic Wastes Interactions and Their Effects on Biological Nitrogen Fixation in Newly Reclaimed Soils. pp. 123-130,* Ph.D. Thesis, Fac. of Agric., Ain Shams Univ., Cairo, Egypt.

Abdel-Wahab, A.F.; H.A. Anber; A.M. Biomy; M.Y. Abou-Zeid and A.M.A. El-Naggar (2002). Influence of sewage sludge and bacterial inoculation on corn plants cultivated in newly reclaimed soil. *J. Agric. Sci. Mansoura Univ., 27: 5835–5850.*

Abdel-Wahab, A.F.; A.M.M. Biomy and W.M. El-Farghal (2003). Effect of some natural amendments on biological nitrogen fixation, growth and green yield of pea plants grown on sandy soil. *Fayoum J. Agric. Res. and Dev., 7: 1-8.*

Abou Bakr, M. (1994). Production of peat moss like substance from local organic wastes. 1- Chemical and physical properties. *Egypt. J. Soil Sci., 34: 1-5.*

Bangar, K.C.; S. Shanker; K.K. Kapoor; Kamlesh and M.M. Mishra (1989). Preparation of nitrogen and phosphorus enriched paddy straw compost and its effect on yield and nutrient uptake by wheat. *Biol. Fertil. Soils, 8: 339-342.*

Bar-Ness, E. and Y. Chen (1991). Manure and peat based iron-organo complexes. I. Characterization and enrichment. *Plant and Soil, 130: 45- 50.*

Black, C.A.; D.D. Evans; J.L. White; L.E. Ensminger and F.E. Clak (1965). *Methods of Soil Analysis* (1st Ed., Part 9) Madison, Wisconsin *American Society of Agronomy No. 9: 1171-1174.*

Brink, N. (1993). Composting of food waste and waste paper with top soil for nitrogen catching. *Acta Agric. Second. Sec. B. Soil and Plant Sci., 43: 238–243.*

Chaney, R.L. (1992). Land application of composted municipal solid wastes: Public Health Safety and Environmental Issues. *In: Proc. Solid Waste Composting Conf.* **pp. 61-83**. Solid Waste Composting Council, Washington, DC.

Chen, Y. and F.J. Stevenson (1986). Soil organic matter interactions with trace elements. *In: The Role of Organic Matter in Modern Agriculture*. pp. 73-116. Eds. Chen Y. and Y. Avnimelech. Martinus Nijhoff Publishers. Dordrecht.

Conacher, J. and A. Conacher (1998). Organic farming and the environment, with particular reference to Australia: A review. *Biological Agriculture and Horticulture., 16: 145-171.*

Dewes, Th. (1995). Nitrogen losses from manure heaps. *Biological Agriculture and Horticulture, 12: 309-317.*

El-Nadi, A.H.; R.K. Rabie; H.M. Abdel-Magid; R.E.A. Sabrah and Sh.I. Abdel-Aal (1995). Chemical, physico-chemical and microbiological examination of town refuse compost and chicken manure as organic fertilizers. *Journal of Arid Environments, 30: 107-113.*

Gardiner, D.T.; R.W. Miller; B. Badamchian; A.S. Azzari and D.R. Sisson (1995). Effects of repeated sewage sludge applications on plant accumulation of heavy metals. *Agric. Ecosys. Environ., 55: 1-6.*

Gaur, A.C. (1986). Recent trends in recycling of crop residues. *Maharashtra Agric. Univ., 11: 127-133.*

Gaur, A.C. (1987). *Recycling of Organic Wastes by Improved Techniques of Composting and Methods. Resources and Conservation, 13: 157-174.* Elsevier Sci: Pub. B.V., Amsterdam – Printed in the Netherlands.

Kaloosh, A.A. (1994). Changes in composition of compost prepared from different organic materials and its effect on *Vicia faba* yield. *J. Agric. Sci., Mansoura Univ., 19: 829-836.*

Mahimairaja, S.; N.S. Bolan and M.J. Hedley (1994). Dissolution of phosphate rock during the composting of poultry manure: An incubation experiment. *Fertilizer Res., 40: 93-104.*

Mench, M.J. (1998). Cadmium availability to plants in relation to major long term changes in agronomy systems. *Agric. Ecosys. Environ., 67: 175-187.*

Mishra, M.M. and K.C. Bangar (1986). Rock phosphate composting: Transformation of phosphorus forms and mechanisms of solubilization. *Biological Agriculture and Horticulture, 3: 331-340.*

Nuntagij, A.; C. de Lassus; D. Sayag and L. Andre (1989). Aerobic nitrogen fixation during the biodegradation of lignocellulosic wastes. *Biological Wastes, 29: 43-61.*

Otabbong, E.; L. Sadovnikova; O. Iakimenko; I. Nilsson and J. Persson (1997). Sewage sludge: Soil conditioner and nutrient source. II. Availability of Cu, Zn, Pb and Cd to barley in a pot experiment. *Acta Agric. Sect .B. Soil and Plant Sci., 47: 65-70.*

Page, A.L.; R.H. Miller and D.R. Keeney (1982). *Methods of Soil Analysis*. Part 2: *Chemical and Microbiological Properties, Agronomy, 9: 301-943*, A. S. A. Inc., Madison, Wisconsin, USA.

Pare, T.; E.G. Gregorich and H. Dinel (1997). Effects of stockpiled and composted manures on germination and initial growth of cress (*Lepidium sativum*). *Biological Agriculture and Horticulture, 14: 1-11.*

Rai, S.N. and V.D. Mudgal (1987). Associative effect of sodium hydroxide and steam pressure treatment on chemical composition of rice straw and its fiber digestibility in rumen. *Indian J. Anim. Nutr., 4: 5-11.*

Rai, S.N. and V.D. Mudgal (1988). Synergistic effect of sodium hydroxide and steam pressure treatment on composition changes and fibre utilization of wheat straw. ***Biological Wastes*, 24: 105-113**.

Rynk, R.; M. Van de Kam; G.B. Willsom; M.E. Singley; T.L. Richard; J.J. Kolega; F.R. Gouin; L.L.Jr. David kay; D.W. Murphy; H.A.J. Hoitink and W.F. Brinton (1992). ***On Farm Composting Hand book***. Technical ed. Marty Sailus, ***Northeast Regional Agric. Eng. Servicea*, Chapter 5, pp. 233-267**, 152 Riley-Robb Hall, Co. Exten. Ithaca, NY.

Schukking, S. (1976). The history of silage making. ***Dutch Nitrogenous Fertilizer Review*, 19: 2-11**.

Sharma, S.N. and R. Prasad (1996). Mussoorrie rock phosphate–pyrite mixture as phosphate fertilizer. ***Fertilizer Res.*, 45: 187-191**.

Snedecor, G.W. and W.G. Cochran (1980). ***Statistical Methods*. pp. 233-237**, Seventh Ed., Iowa State Univ. Press, Ames, Iowa, USA.

Tiwari, V.N.; A.N. Pathak and L.K. Lahri (1989). Effect of cattle dung and rock phosphate on composting of wood waste. ***Biological Wastes*, 27: 237-241**.

Verdonck, O. (1988). Composts from organic wastes materials as substitutes for the usual horticultural substrates. ***Biological Wastes*, 26: 325-330**.

Vuorinen, A.H. and M.H. Saharinen (1997). Evolution of microbiological and chemical parameters during manure and straw co-composting in a drum composting system. ***Agric. Ecosys. Environ.*, 66: 19-29**.

Witter, E. and J. Lopez-Real (1988). Nitrogen losses during the composting of sewage sludge and the effectiveness of clay soil, zeolite, and compost in adsorbing the volatilized ammonia. ***Biological Wastes*, 23: 279-294**.

Zucconi, F.; A. Pera; M. Forte; A. Monaco and M.de Bertoldi (1981). Biological evaluation of compost maturity. ***Biocycle*, 22: 27-29**.

مجلة حوليات العلوم الزراعية ، كلية الزراعة ، جامعة عين شمس ، القاهرة ، م٤٨ ، ع(٢)، ٥٦١ - ٥٧٢ ، ٢٠٠٣

إنتاج مركب حيوى عضوى كمحسن للتربة وبيئة نمو

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تمت معالجة بعض المخلفات النباتية (قشر السودانى و نشارة الخشب) وبعض المعادن و الصخور (البنتونيت و تراب المنجنيز و صخر الفوسفات) وذلك على مراحل متتابعة الأولى بإستخدام التحميض الجزئى بمحلول حمض كبريتيك ٥% والمرحلة الثانية المعاملة الطبيعية بالتعرض للبخار تحت ضغط والمرحلة الثالثة عمل كمر لهذا الخليط composting. بعد ذلك تم إضافة بعض الكائنات الحية الدقيقة المفيدة وذلك بغرض تحضير مواد عضوية غير تقليدية. ولقد تم تقييم المراحل المختلفة لعملية المعالجة كيميائياً ثم تم تقييم خواص المنتج النهائى الطبيعية و الكيميائية والبيولوجية.

ولقد أظهرت النتائج المتحصل عليها تغيرات ملحوظة فى قيم رقم الحموضة والتوصيل الكهربى و الكربون العضوى والنيتروجين الكلى وكذلك الكميات الميسرة من العناصر الغذائية الكبرى والصغرى متأثرة فى ذلك بالمراحل المختلفة لعملية المعالجة. وبعد المرحلة الأخيرة كانت قيم جميع الصفات تحت الدراسة فى الحدود المقبولة.

وبالنسبة للمنتج النهائى فقد كانت قيم رقم الحموضة والتوصيل الكهربى ونسبة الكربون للنيتروجين فى الحدود المناسبة كما تبين احتواءه على كميات عالية نسبياً من العناصر الغذائية الكبرى والصغرى سواء فى الصورة الكلية أو الميسرة. كذلك وجد أن لهذا المنتج درجة لنعومة وقدرة على الاحتفاظ بالماء عالية وكان له نشاط بيولوجى عالى والذى أنعكس من القيم المتحصل عليها النشاط انزيمى الديهيدروجينيز والنيتروجينيز و الأعداد الكلية للمجاميع الرئيسية للكائنات الحية الدقيقة.

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