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ANALYSIS OF MACRONUTRIENT IN TEXTILE MILL DYE SLUDGE + SAW DUST VERMICOMPOSTING

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ABSTRACT

Disposal of Textile Mill Dye Sludge is a greater problem. *Perionyx excavatus* were cultured under laboratory condition with 60-80% moisture in a tank mixing in equal proportion by weight 2kg each of Textile Mill Dye Sludge (TMS) and 2kg of Saw Dust (SD) designated as X (1:1). Inoculum like Effective microorganisms (EM) and Cow dung (CD) were mixed separately combined and control to the X (1:1) for the production of nutrient in the vermicompost Analysis were carried over for 60 days. NPK of vermicompost were determined and analysed statistically. On the basis of the efficiency of four treatments for the production of the nutrient in the vermicompost using *Perionyx excavatus*. Macronutrient observed in the mixed ratio of TMS+SD (1:1) ratio with the above treatments were determined and better combination of mixed ratio with appropriate inoculums were determined. The mixture of TMS+SD + (EM+CD) gave good quality vermicompost done by selected vermiculture *Perionyx excavatus*. Hence (TMS + SD) in (1:1 ratio) can be used for production of vermicast with the inoculums of (EM+CD).

KEYWORDS

Macronutrient, *Perionyx excavatus*, Saw Dust, Cow Dung, Textile Mill Dye Sludge and Effective Microorganisms.

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INTRODUCTION

Textile dye sludge is another environmental problem which poses a great threat (Balasubramanian *et al.*, 2006)[1]. Wastage of organic and inorganic nutrients present in the sludge might be put to good use (Elvira *et al.*, 1985)[2]. Disposal of industrial sludge by environmentally acceptable means poses a very great challenge worldwide. Use of earthworms in the management of sludge has been suggested and shown good result, (Elvira *et al.*, 1998)[3]. *Perionyx excavatus* is a tropical earthworm extremely prolific for use in vermiculture. It is commercially produced earthworm, they are also known as "blues" or "Indian blues". This species is particularly good for vermicomposting in tropical and sub-tropical region (Chaudhuri, P.S. and Bhattacharjee, G. *et al.*, 2002)[4]. Vermicomposting stabilize the organic material, involve in the joint action of earthworms and microorganisms. Microbes are responsible for biochemical degradation of organic matter and earthworms are important derivers of the process, conditioning the substrate and altering the biological activity (Aira *et al.*, 2002)[5]. Important plant nutrients such as NPK and calcium present in the feed material are converted through microbial action into forms that are much more soluble and available to plants than those in the parent substrate (Ndegwa and Thompson *et al.*, 2001)[6].

MATERIAL AND METHODS

Textile Mill Dye Sludge (Secondary Sludge)

The (TMS) was collected from Textile mill industry in Sivasakthi Textile Mill, Tiruppur, Tiruppur district, Tamilnadu, India. The collected sludge was the secondary sludge from the decanter unit of the treatment plant.

Agro- industry (Sawdust)

The Saw Dust (SD) was collected from the nearby Ranga saw mill located in Chidambaram, Cuddalore district, Tamilnadu, India.

Cow dung

The Cow Dung (CD) was collected from the local dairy farm in Sivapuri, Cuddalore district, Tamilnadu, India.

Effective microorganism

Microbial inoculum used in this investigation was obtained from Institute of Microbial Technology (IMTECH), Chandigarh. This microbial inoculum is commercially available by the name Maple1. The microbial inoculum was prepared as prescribed by the manufacture. (EM) was used in the composting process as a inoculums to accelerate the processes. The precise composting of the preparation is not classified, but is made of Lactobacillus, Saccharomyces Sps and pseudomonas.

Vermicomposting study

To find out the best proportion from 1:1 ratio of TMS+SD feed substrates that can give good quality vermicompost with high level of nutrients, higher microbial population the present investigation the vermicomposting studies using *Perionyx excavatus* were carried out. The vermicomposting experiments conducted with different proportion of TMS+SD mixtures are designated as (XC1- XC4) TMS and SD was weighted (dry weight) in specific proportion is given in Table No.1 mixed using well water. So as to have 60-70% moisture, transferred to cement tanks (52 X 36 X 32cm**)** 4kg in each tank and allowed 15 days for pre-decomposition to facilitate feed acceptance by earthworms (Edwards and Bohlen *et al.*, 1996)[7]. The feed substrates were given three to four times in two week time, to enable temperature stabilization and uniforms initial degradation of organic matter before introducing the worms as suggested by (Kale and Sunitha *et al*, 1993)[8].

After 15 days, non-clitellated *Perionyx excavatus* worms about 10 days old with the total weight of 1.25gm / kg were introduced into each experimental tank (XC1- XC4) for each treatment, a control was also maintained without earthworms. For all treatment and control three replicates were maintained for a period of 60 days. The represents experiments (XC1-XC4). The cement tanks were covered with wooden framed wire mesh and maintained at room temperature 28 ± 2ºC with 60-70% moisture in the vermiculture lab. The feed mixtures were checked for moisture (judge by touch) and water was sprinkled as and when required so as to maintain the moisture level between 60% to 7 0%. Once in 15 days up to 60 days, the total weights of the worms were recorded.

Macronutrient - NPK an OC analysis of vermicompost

The chemical analysis of Organic Carbon (OC), Total Nitrogen (N), Total Phosphorus (P), Total potassium (K), calculated values of C:N and C:P ratio of *Perionyx excavatus* worked vermicompost and control compost produced from Saw dust and four different mixing inoculum ratio of TMS + SD (XC1 - XC4) were presented in Table No.1 and Figure No.1. In general the chemical analysis of control (WU) and vermicompost (WW) indicated that among the chemical parameters tested, OC, C: N ratio and C: P ratio showed decreasing trend over control, whereas NPK showed increasing trend over control. Further the comparison of nutrient level in between the vermicompost produced from TMS+ SD mixture showed that all the parameters tested increases or decreases (over corresponding control) almost in the same magnitude. The analysis of variance (ANOVA) showed that NPK content were increased significantly ($P < 0.01$) in the vermicompost obtained from all the treatments (XC1 - XC4) (especially XC4 1:1 ratio) than control. On the hand the organic carbon content, C: N ratio were decreased significantly ($P< 0.01$) in the vermicompost obtained from all the treatments (XC1 - XC4) than the control.

RESULTS AND DISCUSSION

The level of NPK and organic carbon in control compost and from four different proportions of TMS + SD by the action *Perionyx excavatus* with the selected optimum mixing ratio.

Npk

The comparison of result between treatments (XC1-XC4) and (TMS+SD) different mixing inoculums of EM and CD indicated the following observations: N content increased over control to the range of minimum 8.19% to maximum 17.07%, P content increased over control to the range of minimum 26.71% to maximum 47.12%, and K content increased between 7.40% to 13.33%, in the vermicompost obtained from treatments (XC1-XC4) the C:N and C:P ratio decreased significantly ($P< 0.05$) compared to control values. The maximum narrowing down of C: N ratio was obtained in the treatment XC4 (52.13%) followed XC3 (49.20%) is shown in Table No.2 and Change in macro nutrients NPK content of the Vermicompost (WW) produced from four different mixing inoculum ratios of TMS+SD (1:1) over worm unworked control compost (WU) NPK content of the Vermicompost is shown in Figure No.2.

Organic carbon (OC)

Many earlier investigator had reported and confirmed the reduction of OC content in organic wastes after vermicompost into vermicompost (Satchell, and Martin *et al.*, 1984)[9], (Ramaligam and Thilagar *et al.,* 2000)[10], (Ramalingam and Ranganathan *et al.*, 2001)[11] and (Loh *et al.*, 2005)[12], (Suthur *et al.*, 2006)[13]. The observed reduction in the level of OC in the present study falls in line with the earlier reported results. Drop in the level of OC due to combined action of earthworm and microbes during vermicomposting revealed that earthworm accelerate the composting of organic matter. The result revealed that during the process of vermicomposting, the revealed that during the process of vermicomposting the level of OC was reduced to a less extent. OC % content of the Vermicompost is shown in Table No.2. The final product vermicompost obtained from various treatments retained the quality of OC ranging between 25.93%-29.85%. OC % content of the Vermicompost is shown in Figure No.3.

C: N and C: P

The significant reduction (-31.80% to -42%) XC1-XC4 and narrow range of C: N ratio below 20:1 as well as reduction in C: P ratio recorded in the present study reflected the efficient worm activity, leading to accelerated rate of organic matter decomposition and mineralization there by resulting in nutrient rich good quality vermicompost particularly from the treatment XC1-XC4 (1:1 ratio). The observed significant reduction in the levels of C: N and C: P ratios in the vermicompost obtained from treatments XC1-XC4 C: P content of the vermicompost is shown in Table No.2 and Change in OC, C: P, C: N of the Vermicompost (WW) produced from four different mixing inoculum ratios of TMS+SD (1:1) over worm unworked control compost (WU) C: N, C: P content of the vermicompost is shown in Figure No.3.

Table No.1: Detailed of the amendment used in Vermicomposting Studies X group

S.No	
1	XC1 - TMS + SD (Control)
2	XC2 - TMS + SD (Effective Microorganisms)
3	XC3 - TMS + SD (Cow Dung)
4	XC4 - TMS + SD (EM + CD)

Table No.2: Macronutrient - NPK and OC analysis of worm un worked control compost (WU) and worm worked vermicompost (WW) generated from four different mixing inoculum ratio of (TMS) + (SD) = (1:1) X group for a period of 60 days

S.No	Chemical parameters	XC1 TMS + SD (Control)		XC2 TMS + SD + (EM)		XC3 TMS + SD +(CD)		XC4 TMS + SD +(EM +CD)		ANOVA	
		WU	WW	WU	WW	WU	WW	WU	WW	F	CD value
1	N %	1.83 ± 0.007	1.98 ± 0.13 (8.19)	1.89 ± 0.007	2.11 ± 0.17 (11.64)	1.97± 0.002	2.24± 0.19 (14.21)	2.05± 0.007	2.40± 0.13 (17.07)	36.65*	0.190
2	P %	1.46± 0.032	1.85± 0.10 (26.71)	1.10± 0.027	1.44± 0.12 (30.90)	0.90± 0.014	1.25± 0.21 (38.88)	0.87± 0.032	1.28± 0.24 (47.12)	1706*	0.145
3	K %	0.27± 0.005	0.29± 0.007 (7.40)	0.26± 0.004	0.28 ± 0.013 (7.69)	0.29± 0.009	0.32 ± 0.005 (10.34)	0.30± 0.012	0.34 ± 0.014 (13.33)	25.32*	0.025
4	OC%	24.23± 0.094	18.02 ± 0.011 (-25.93)	26.22± 0.054	19.26± 0.009 (-26.54)	24.16± 0.023	16.90± 0.015 (-30.49)	25.12± 0.051	17.62± 0.014 (-29.85)	530.31*	0.980
5	C:P ratio	16.24± 0.013	9.45± 0.008 (-41.81)	18.65± 0.015	9.92± 0.006 (-46.80)	21.32± 0.011	10.83± 0.004 (-49.20)	23.42± 0.013	11.21± 0.008 (-52.13)	32582*	0.070
6	C:N ratio	14.37± 0.018	9.8± 0.013 (-31.80)	16.37± 0.017	10.85± 0.011 (-33.72)	16.88± 0.023	10.74± 0.019 (-36.37)	18.02 ± 0.018	10.45± 0.013 (-42)	160.21*	0.030

Values are mean of 3 observation ± S.E

Per cent increases (+) increases or decreases (-) over control are given parameter

*Indicates the statistical significance at 5 % level (P< 0.05)

Figure No.1: Vermicomposting cement tank containing the treatment XC1-XC4 (Each 4 Kg)

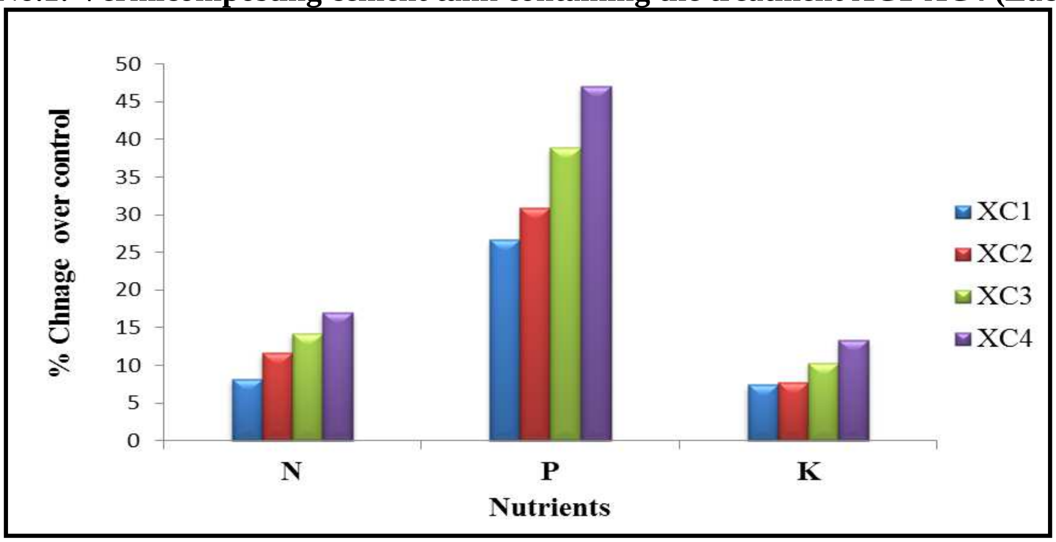

Figure No.2: Change in macro nutrients NPK content of the Vermicompost (WW) produced from four different mixing inoculum ratios of TMS+SD (1:1) over worm unworked control compost (WU)

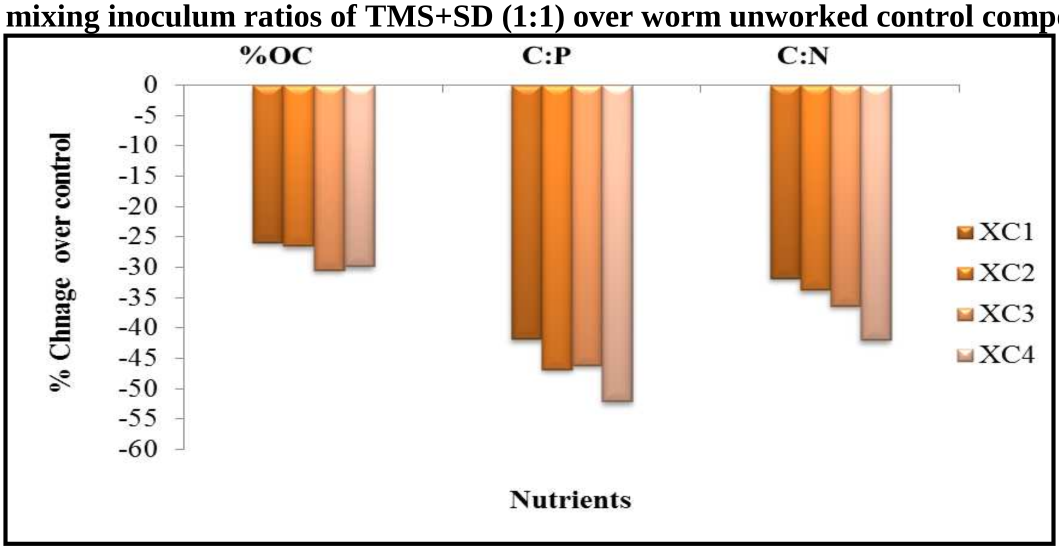

Figure No.3: Change in OC, C: P, C: N of the Vermicompost (WW) produced from four different mixing inoculum ratios of TMS+SD (1:1) over worm unworked control compost (WU)

CONCLUSION

The overall result indicated that among the four treatments XC1-XC4 maximum reduction in NPK content, Organic carbon content, C: N and C: P ratio were recorded in the XC4 (1:1 ratio) of TMS + SD + (EM+CD) and suggested to be good quality vermicompost. Macronutrient - NPK and OC analysis of worm unworked control compost (WU) and worm worked vermicompost (WW) generated from four different mixing inoculum ratio of (TMS) + (SD) with (1:1) X group for a period of 60 days.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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