Comparative Physicochemical Analysis of Degrading Parthenium (*Parthenium Hysterophorus*) and Saw Dust by a New Approach to Accelerate the Composting Rate

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Abstract—Parthenium are fast growing weeds of India were converted to useful product compost, with characteristics analysis at each stage. The temperature increased from 29ºc to 56ºc on 45th day and reached 30ºc on the 90th day. Shift of pH from 6.8 to 7.4 on 60th day caused a shift of micro flora from 34.68×106 to 21.73×107 on 30th day and 43.91×105 on 60th day and 36.75×106 on 90th day. The cellulose concentration reduced from 12.05% to 8.61% to 6.84%. Lignin concentration reduced from 11.43% to 6.12% within 90 days. A comparative analysis of saw dust degradation had constant temperature for 90 days. Whereas, combination of parthenium and sawdust had s faster degradation rate within 45 days. The study reveals that the combination of parthenium and saw dust in composting takes relatively short time for degradation for preparing a complete compost of good quality.

Keywords— Composting, Parthenium, Sawdust.

I. Introduction

THE present study deals with the degradation of a waste plant that is menacingly threatening agriculture and environment, with high biomass which exploiting soil improvement and economic crop production. Among these parthenium (Parthenium hysterophorus) are fast growing which came up in abundance, After accidental introduction of parthenium in India in the mid-1950s through imported food grains, it has been documented as invasive weed in this continent[1]. Then it has spread over most parts of the of Punjab, Khyber Pakhtoon Khawa and Kashmir[2]. Growing profusely in open spaces, grassland, wasteland and also sometimes in cultivated areas in different parts of the country[3-6] . At present, it is one of the most troublesome weeds in India, spreading rapidly in forests, pastures and agricultural lands. Several attempts have been made for its prevention, eradication and control, but to date without success[7].

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Hence, huge quantities of this weed are annually produced in India, but its economic use as food source is impaired by its toxicity. This is why composting might be a useful alternative to convert biomass from this species to a useful material that could be used as soil conditioner.

Airborne sawdust and sawdust accumulations present a number of health and safety hazards. Wood dust becomes a potential health problem when, for example, the wood particles, from processes such as sanding, become airborne and are inhaled. Wood dust is a known human carcinogen. The development of a proper crop residue management minimization system is the only alternative method to provide optimum soil consistency with the of environmental pollution.

II. Methodology

Fresh and dry undecomposed sawdust samples and parthenium were collected and Chopped. The waste (parthenium and sawdust) were added uniformly in the separate pits. Three pits with equal volume of parthenium and saw dust in the ratio of 1:1 is made. The degradable matter was shredded into small pieces and spread in layer of one foot and exposed to the sun for predigestion. The content was mixed with cow dung (1:1) and dumped in pits in triplicate. The compost was turned once in15 days. Finally the top of the cistern was covered with soil slurry to prevent exchange of gases and loss of heat. Biochemical composition namely cellulose, lignin, labile fraction were determined by the method proposed by Van Soest[8] .

The sample of compost was collected at a depth of 25 cm for determination of moisture, ash content, analysis of nitrogen and carbon, and assay for bacterial and fungal contents as well as cellulose activity. The temperature was determined by inserting the thermometer 25 cm deep into the pile or composting wastes. The samples were collected from 6 parts of composting wastes with long forceps. pH was analysed using pH meter by using distilled water as control. 10 mg of sample was weighed and heated in a heating mantle at 550˚C for 3 hours and the remnant was weighed for ash content analysis. 10 mg of sample was weighed and kept in hot air oven at 100˚C for 72 hours and the reminants was weighed and moisture content was calculated.

The moisture and carbon was estimated by the method suggested by Jackson[9]. Carbon [10] and total N content was determined following the micro kjeldahal method as outlined by Jackson [9]. Microbial load was enumerated by standard plate count method from 10-1 to 10-12 dilutions using plate count agar, nutrient agar Sabraouds Dextrose Agar, PBYG medium.. Estimation of degrading efficiency cellulose was done by Kiyohika method. Bacteria, Fungi and Actinomycetes were isolated and identified by carrying out a ten fold dilution of the wet decomposing sawdust. Antifungal agent, nystatin[12] was incorporated into nutrient agar. The discrete colonies were sub cultured and the pure cultures were stocked and stored until needed.[13] . Finally, one-way ANOVA was employed to compare the effects of the different amendments effects within the sawdust compost and Parthenium compost on biometrics parameters of combined treatment.

III. Results And Discussion

The odour of the compost reduces from fishy smell or rotten smell in the beginning to a tolerable level and to pleasant earthy smell at the end of degradation process .The odour will originate from sources like, odourless raw material, ammonium. But in the present sample the odour was tolerable during 90th day this explains that decomposition is not complete even after 90 days and the process of degradation is slow.

The outdoor temperature varied from 25 ºC during the experiment. However, the composting temperatures increased during 5 days to over 50ºC at the feeding end. The ranges of temperature were measured and show highest during 45th day but still did not reach the room temperature and had a rotten odour even after 90th day for parthenium(Table 1) and the temperature raise was found still on 90th day in samples of sawdust(Table 2). The combination of sawdust and parthenium showed an elevated temperature level on 45th day and subsequent reduction of temperature from the 60th day. The cellulose content was reduced as time increases but the cellulose content of sawdust is much high when degraded separately but in combination analysis the cellulose content was comparatively high but the degradation rate is very high similar is the case with lignin (Table 3). The changes in ash content reflect trends in mineralization of organic matter. The ash content of the compost was analysed and showed significant increases with the time (Table-1). The compost show decrease in their organic carbon content with time. The decrease of C:N ratio with incubation time is indicative of compost maturation progress. The compost show increase in the bacterial load up to 60th day and slight reduction on 90th day. Fungal load increased up to 60th day and slight reduction on 90th day. This corroborates the findings of Godliving and Yoshitoshi that bacteria and fungi degrade wood sawdust[14]. Focher et al. also reported the biodegradability of cellulose[15]. This agrees with the finding of Dosoretz et al[16], when they reported the reduction in carbon content of sawdust when subjected to microbial degradation. Cellulose (µg/ml) concentration of parthenium compost was found to be decreased from 34.42 on Control and reduced to16.54 on 45th day and 13.21 on 90th day (table 1). This is also enhanced by the activity of aerobic and heterotrophic microbial population and its degradation activity in compost. Availability of partially digested nutrient rich organic wastes contributes to the proliferation of microbes and causes an increase in pH which causes the shift of microbial population that decreases to 36.75X106 and 94.61X104 CFU of bacteria and fungi g-1 of compost. The results of our investigation demonstrate the feasibility of using the ash as an additive in composting of catering waste. Rapid degradation of the organic matter was also seen as the black ash-like colour of the composting mass. A further finding was that ash reduces the formation of H2S, which confirms our earlier observations that ash decreases the formation of odorous compounds in composting.. According to our experiment it seems that the combination of parthenium and sawdust will speed up the process of degradation rather than sawdust and parthenium individually.

TABLE I
PHYSICOCHEMICAL CHARACTERISTICS OF PARTHENIUM COMPOST AT INTERVALS OF 15 DAYS

TREATMENTS	TEMPERATURE °C	Ph	CARBON (mg)	NITROGEN (mg)	CELLULOSE %	ASH %	LIGNIN %	C:NRATIO
PS1	29±0.2	6.8±0.1	**38.03**±0.01	1.72±0.01	12.084±0.9	13.5	11.4±0.01	22.6±0.01
PS2	39±0.1	7.1±0.2	**38.91**±0.01	1.65±0.01	11.84±0.03	14.1	10.14±0.01	23.5±0.14
PS3	47±0.3	7.2±0.1	**37.12**±0.05	1.41±0.01	10.45±0.04	14.3	9.32±0.01	26.3±0.27
PS4	56±0.2	7.3±0.4	**33.91**±0.03	1.25±0.01	8..61±0.12	16.3.	7.13±0.01	26.4±0.01
PS5	42±0.1	7.4±0.2	**28.96**±0.01	1.10±0.01	7.9±0.12	18.2	7.92±0.01	29.3±0.04
PS6	34±0.1	7.2±0.1	**26.81**±0.05	0.9±0.01	6.92±0.01	19.7	5.42±0.01	29.4±0.05
PS7	30±0.0	7.1±0.3	**26.06**±0.06	0.9±0.01	6.84±0.01	21.6	6.12±0.01	27.3±0.05

PS1-7: Parthenium compost sample 1 to 7 withdrawn on 0,15,30,45,60,75,90 days. All the values are mean of the triplicate.

TABLE II
HYSICOCHEMICAL CHARACTERISTICS OF SAWDUST COMPOST AT 15 DAYS INTERVAL

TREATMENTS	TEMPERATURE °C	Ph	CARBON (mg)	NITROGEN (mg)	CELLULOSE %	ASH %	LIGNIN %	C:NRATIO
SS1	9±0.21	6.9±0.1	62.09±0.05	0.43±0.15	53.2±0.9	13.4	44.13±0.05	157.2±0.01
SS2	0±0.01	7.3±0.21	**61.65**±0.10	±0.07	53.1±0.03	13.41	43.34±0.03	154.0±0.14
SS3	0±0.03	7.2±0.01	**61.33**±0.05	0.50±0.15	52.8±0.04	13.6	43.12±0.01	122.2±0.15
SS4	1±0.21	7.5±0.02	61.04±0.03	0.61±0.06	52.6±0.12	15.2	36.56±0.07	101.6±0.06
SS5	1±0.01	7.3±0.14	**60.83**±0.05	0.71±0.01	52.5±0.12	19.3	32.63±0.09	86.86±0.01
SS6	2±0.01	7.1±0.01	**60.66**±0.01	0.71±0.22	52.2±0.01	19.9	29.12±0.13	86.5±0.22
SS7	3±0.05	7.1±0.2	**60.33**±0.16	0.71±0.03	51.6±0.01	21.1	25.53±0.16	86.14±0.05

TABLE III
PHYSICOCHEMICAL CHARECTERISTICS OF PAFTHENIUM AND SAWDUST COMBINATION COMPOST AT INTREVALS OF 15 DAYS

TREATMENTS	TEMPERATURE °C	Ph	CARBON (mg)	NITROGEN (mg)	CELLULOSE %	ASH %	LIGNIN %	C:N RATIO
CS1	29±0.2	6.8±0.1	**101.3**±0.13	2.12±0.16	35.76±0.17	12.76	26.78±0.09	48.08±0.16
CS2	34±0.1	7.3±0.2	100.5±0.02	2.0±0.27	32.64±0.03	13.2	26.2±0.01	49.02±0.27
CS3	37±0.3	7.2±0.1	**98.42**±0.16	1.9±0.001	31.50±0.04	114.5	25.72±0.03	51.92±001
CS4	42±0.2	7.4±0.4	**94.12**±0.01	1.85±0.01	30.69±0.01	15.9	21.84±0.09	50.87±0.01
CS5	35±0.1	7.1±0.2	89.76±0.02	1.71±0.18	30.35±0.06	18.9	19.77±0.01	52.49±0.18
CS6	33±0.1	7.1±0.1	87.41±0.03	1.61±0.3	29.25±0.04	20.3	17.27±0.08	54.2±0.3
CS7	32±0.0	7.0±0.3	**86.36**±0.12	1.61±0.3	29.2±0.07	21.5	15.32±0.01	53.97±0.05

CS1-7: combination sample 1 to 7 withdrawn on 0,15,30,45,60,75,90 days. All the values are mean of the triplicate.

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