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ALTERNATIVE REMEDY FOR REDUCTION OF *BYSSINOTICS*, A LUNG DISEASE, AMONG WORKERS IN TEXTILE MILLS AROUND COIMBATORE

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ABSTRACT
Human activity affects the environment with social, technological and economic development. Consumption of various natural resources has increased the level of pollutants such as air, soil, water pollution etc., which is increasing at an exponential rate, thus endangering our country's rich ecology and environment. The textile industry occupies a unique place in our country. Cotton wastes used for the study were directly procured from textile mills in and around Coimbatore and Erode districts. These cotton dusts has no resale value, less degrading capacity, barrier in absorption of rainwater by soil when dumped and emission of high amount carbon as pollutant when burned. The People are not aware of Health & safety is due to the workers are uneducated and management have not given importance due to promote Occupational Health and Safety (OHS) in Textile industry thus becomes a barriers in implementing OHS. Composting was done using Effective microorganism under aerobic condition and the compost was used as alternative of soil. Pot studies were done and the results were noted for physical parameter such as seed germination %, root length, shoot length etc., Obtained results clearly give a solution for the solid waste management(SWM) in textile industry as well as cheap and nutrient rich soil to cultivate plants organically.

KEYWORDS: pollutants, Cotton wastes, resale value, Composting, OHS, Effective microorganism, seed germination, solid waste management.

1. INTRODUCTION
The Indian textile industry is one the largest and oldest sectors in our country and among the most important in the economy in terms of output, investment and employment.[10] It is the world's third largest producer of cotton after China and the USA,[3]. There are 1371 textile mills in Tamilnadu with working employees of 38461 workers.[21] Coimbatore, the Manchester of South India has emerged as a major industrial center of the South India and has over 50,000 small, medium and large industries and textile mills.[9] These industries are facing a lot of problems in disposal of cotton gin waste.[1]

Cotton based textile mills generate huge volumes of fibrous cotton waste during the processing of cotton in cotton industry. In India, the total cotton fiber consumption is estimated to be 26 lakh tons per year, of which approximately 2, 10, 000 tons of cotton dust (micro dust, a non-saleable waste), is produced during yarn manufacturing process.[14] These wastes pollute the atmosphere if not degraded properly and leads to infectious diseases and release of foul odour.[9] However, most of them are disposed off by burning, which in turn increase carbon dioxide level in the atmosphere which adds on to the global warming [7.] Many types of waste like willow fly, raising fly, flat strip, dirty oily cotton, combernoilare produced during the processing of textiles.[2] Due to lack of landfill sites and its related problems, we need to reduce our landfill waste drastically.[16] Manufacturing processes using new or waste cotton fibers or cotton fiber by-products from textile mills produce cotton dust.

Cotton dust means dust present in the air during handling or processing of cotton. This dust is a complex mixture of components which may include ground-up plant matter, cotton fiber, bacteria, fungus, soil, or pesticides.[25] It may include other contaminants that have accumulated during the growing, harvesting, and subsequent processing or during storage periods. Working with cotton exposes people to dust and endotoxin, a substance produced by bacteria that can trigger inflammation in the airways.[1-12] Composite of microbial genera identified in cotton dust, cotton plant parts, and/or textile mill air. It's known that workers in the industry have increased rates of breathing problems, including chronic cough and chronic bronchitis persistent inflammation in the lungs that causes symptoms like

breathlessness and wheezing. However, it has been unclear whether those effects are at least partly reversible.[14-22]

Over 25 years, the researchers periodically measured the workers' lung function using a standard test that gauges the amount of air a person can forcibly exhale in one second. They also questioned the workers about any respiratory symptoms. In the new study, reported in the American Journal of Respiratory and Critical Care Medicine, researchers followed 447 Chinese men and women working in the cotton textile industry, along with 472 workers in the silk industry where workers are not exposed to high levels of endotoxin. Byssinosis caused by inhalation of cotton dust, and is a continuing problem and occurs world wide. Cotton production and use have expanded rapidly in developing countries. The Symptoms are chest tightness, breaking problem, asthma and irritation in the Respiratory track.[9-12]

Byssinosis, also referred to as "Brown lung disease" and "cotton worker's lung", is a chronic occupational lung disease.[2] Byssinosis causes narrowing of the airways due to the inhalation of cotton, flax, hemp, or jute fibers/dusts. Byssinosis symptoms may appear as quickly as a couple of hours after exposure, and diminish when leaving the manufacturing environment.[6] Long-term exposure to cotton, flax, hemp, or jute fibers/dusts may cause permanent scarring of the lungs and airways leading to debilitating lung diseases.[3,4,5] Persons with byssinosis generally experience the following symptoms throughout the workweek, during exposure to such fibers/dusts: wheezing, shortness of breath, tightness of chest and coughing.[1] They occur due to smooth muscle contraction after histamine release induced by the dust, which most likely contains bacterial endotoxins. People who smoke suffer the most severe impairment from byssinosis since the combination of dust/fibers and smoke both aggravate the lungs and airways. Individuals with asthma are also particularly badly affected by exposure to cotton dust.

2.0 MATERIALS AND METHODS

2.1 Collection of cotton dust waste

The cotton dust waste was collected from spinning mills of Coimbatore district including mills around Sowripalayam, Then-Thirumalai, Onampalayam, Annur, Punjai Puliyampatti, Sri Perundurai and Kalapatti.

2.2 Collection of other substrate

Agricultural waste (sugarcane baggage) and saw dust were also collected in and around Coimbatore for the present study for better composting

3.0 RESULTS

3.1 Collection of cotton dust waste and other substrate: The collected cotton wastes were stuffed into gunny bags and transported properly to the laboratory in sealed condition and stored at room temperature until use. Fig.1 denotes the raw materials for composting.

2.3 Preparation of Effective microorganism (EM)

The liquid culture of the EM used in the study was supplied by Environ Biotech and contained a mixture of lactic acid bacteria *Lactobacillus plantarum* ($1.0 X10^4$) yeast with $1.0X10^5$ CFU/ml *Candida utilis*, actinomycetes *Streptomyces albus* ($3.0X10^3$CFU/ml), fermenting fungi *Aspergillus oryzae* ($1.1X10^5$ CFU/ml).

2.4 Compost Preparation

Cow dung, which act as precursor, was calculated as one part of different ratio. The collected waste material (cotton waste, saw dust, agricultural waste and cow dung) was mixed in different ratio such as 1:1:1:1, 2:1:1:1, 3:1:1:1, 4:1:1:1 and 5:1:1:1.

2.5 Evaluation of persistence and microbial density

1g. of the soil sample from respective treatment taken from depth of 3cm and serially diluted with sterile phosphate buffer and 0.1 ml of the aliquote was spread plated on trypticase soy agar plates (Bacteria), Starch casein agar (actinomycetes) and sabouraud dextrose agar (mold and yeast). After incubation, the number of colony forming units (CFU) per gram was determined to estimate number of viable microbial cells.

2.6 Physicochemical study of the compost

Each aliquot of these representative compost samples the following physico-chemical analyses such as pH, Total Organic Carbon, Nitrogen, were studied. The pH was determined on a suspension of sample in water (10 g/15 ml), the total organic carbon (TOC) was measured according to the nelson's method,(1996), the total nitrogen (Kjeldahl method), inorganic nitrogen, the humic carbon extracted by 0.1 M NaOH solution was measured after oxidation by KMnO4. The rate of decomposition was calculated after ignition of the dry sample at 550oC (16 h). For the available P the Olsen method was used. Available Ca, Na, K, Mg were determined using ammonium acetate. Total P, Ca, Na, K, Mg, Fe and Mn were determined after ashing. P was measured colorimetrically and other elements were analysed in the extracts using atomic adsorption and flame photometry.

2.7 Pot Seed Germination

In this experiment, the effect of prepared compost was evaluated on germination of seeds of green gram; the seeds were germinated in pots containing 350 g of compost soil. All pots were kept in room temperature (28±2 °C) near the sunlight for the period of 4 to 6 days. Germination of seeds was daily recorded. At the end of the germination experiment, the shoot and root length of seedlings was measured.

3.2 Preparation of Effective microorganism (EM)

One litre of 'instant solution' is made by mixing 10 ml of EM (Fig 4), 40 ml of molasses and 950 ml of water and

leaving it for five to seven days, depending on temperature. The solution is then added to 1 litre of molasses and 98 litres of water to obtain 100 litres of ready-to-use EM solution. The EM solution functioning as accelerator reduces the composting period from three months to one month. This prepared solution is called as working solution. This solution is been added to the raw materials while preparing the compost.

3.3 Compost Preparation

Trails of compost was piled at different ratios of substrates were prepared and left for complete degradation. The pile were turned each 10 days and moisture when it becomes dry. At first the compost pile was moist and the temperature was around 29±2 °C but it gradually increased during 15-30 days around 45±2 °C but decreased after 35 days. Figure 2 denotes the final compost soil and graph 1 denotes the days taken for compost.

3.4 Evaluation of persistence and microbial density

To study the persistence of microbial members of EM, the soil samples were analyzed for the occurrence of individual microbial members by soil dilution technique.

3.5 Physicochemical study of the compost

The tested biocompost showed the values; Humidity 51.4, 59.4 51.478.0 and 67.0, pH 6.8 6.6, 7.6, 6.3 and 6.5, EC0.42, 5.50, 1.60, 0.39 and 0.52 ds/m, OM 67.3, 65.0, 54.1, 96.7 and 85.9%, TOC 35.4, 32.5, 26.3, 47.3 and 80.40%, Total nitrogen 5.79, 2.17, 4.59 0.42 and 1.2%, C/N ratio7/3, 4/6, 5/5, 8/2 and 7/3, water soluble carbon 2.77, 3.24, 1.64, 2.28 and 2.98 mg/kg for A, B**,** C, D and Frespectively.

3.6 Pot Seed Germination

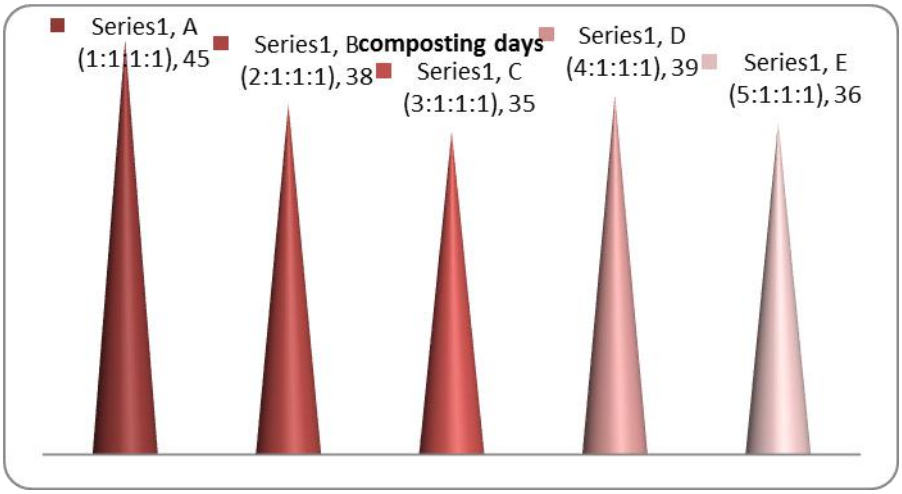
Green gram plant was chosen for study as their life span period is less. 30 seeds of green gram were sowed and growth rate was monitored for 3 weeks. Physical parameter such as length of root, shoot length, number of leaves and weight of seeds/pods.

Fig 1. A) D_1 cotton waste B) saw dust C) Sugarcane Baggage D) Cow dung

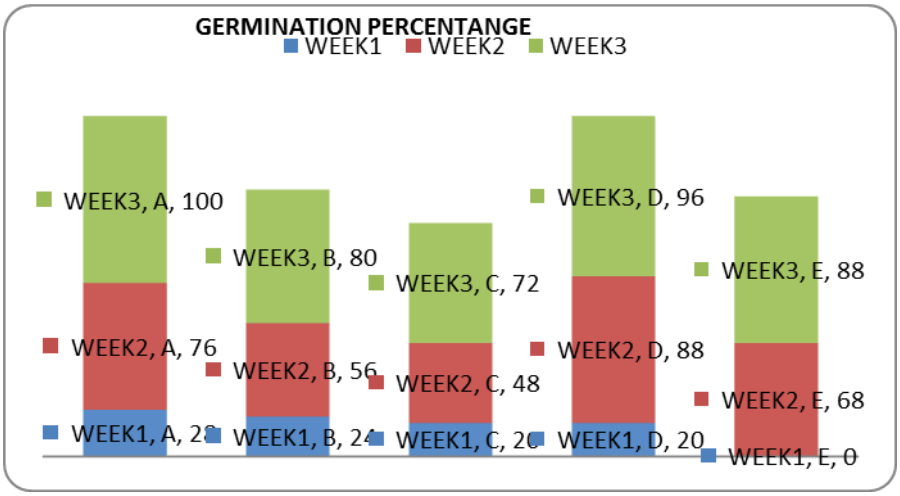
Fig 2. Compost soil

Fig 3. Seed Germination - Green gram

Fig 4. EM solution



Graph 1. Days taken for composting



Graph 2. Germination percentage of green gram

Table 1. Total viable count of Microorganism in different stage of compost soil

S. no	Age of compost	TSA	SDA	SCA
1	10th day	13.1X10 ^{4}	1.2X10^{3}	47.3X10^{2}
2	20th day	37.8X10^{5}	19.1X10^{4}	67.2X10^{3}
3	30 th day	45.4X10 ^{5}	24.1X10^{4}	71.2X10^{3}
4	40th day	12.1X10 ^{6}	21.3X 10 ^{5}	15.1X10 ^{4}

(A=1:1:1:1, B= 2:1:1:1**, C=3:1:1:1**, D=4:1:1:1 and F=5:1:1:1)

Table 2. Parameter Study Of Compost

parameter	Compost				
	A	B	C	D	E
humidity	51.4	59.4	**51.4**	78.0	67.0
pH	6.8	6.6	**7.6**	6.3	6.5
EC	0.42	5.50	**1.60**	0.39	0.52
OM	67.3	65.0	**54.1**	96.7	85.9
Total organic carbon	35.4	32.5	**26.3**	47.3	80.40
Total nitrogen	5.79	2.17	**4.59**	0.42	1.2
C/N	7/3	4/6	**5/5**	8/2	7/3
Water soluble carbon	2.77	3.24	**1.64**	2.28	2.98

(A=1:1:1:1, B= 2:1:1:1**, C=3:1:1:1**, D=4:1:1:1 and F=5:1:1:1)

Table -3: Percentage of seed germination

Seed Type	Compost	Percentage of germination						
		WEEK 1	WEEK 2	WEEK 3	Weight of seed/pods	No of leafs / plant	Average shoot length (cm)	Average root Length (cm)
Green gram	A	28	76	100	1.42 ± 0.01	17	17.9±0.351	3.5±0.351
	B	24	56	80	2.12 ± 0.01	27	16.1±0.833	2.6±0.436
	C	20	48	72	2.85 ± 0.01	35	14.2±0.100	2.8±0.361
	D	20	88	96	0.60 ± 0.01	29	24.3±0.577	2.2±0.265
	E	0	68	88	1.68 ± 0.01	32	19.8±0.764	3.5±0.500

(A=1:1:1:1, B= 2:1:1:1**, C=3:1:1:1**, D=4:1:1:1 and F=5:1:1:1)

CONCLUSION

Trails were performed to control the cotton dust waste from cotton mils in and around Coimbatore. The non-resalable microdust were one of the issues faced by the cotton mill industry as they cannot be dumped into environment as such or burn or dispersed in open land as they have very bad impact on environment and animal population. There have been numerous studies on effluent treatment let out from the industry. Thus this studies mainly foced on the control of this waste by composting. The change in the structure leads to form a high value compost which in turn can be used as biofertilizer in addition to soil for agricultural land or substitute to natural soil for gardening purpose. Thus results obtained give a strong support for the objective chosen for the study.

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