ORIGINAL RESEARCH PAPER
Volume - 9 | Issue - 11 | November - 2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

BIO CONVERSION OF DOMESTIC SOLID WASTES INTO BIO COMPOST USING A BACTERIAL CONSORTIUM

Biochemistry

Ms.Mrudula.S. Kulkarni*	Shivchhatrapati College N-3 Cidco Aurangabad.431009. *Corresponding Author
Dr.Vandan.S. Gothoskar	Shivchhatrapati College N-3 Cidco Aurangabad.431009.
Ms.Komal.R. Kushwah	Shivchhatrapati College N-3 Cidco Aurangabad.431009.
Mr.Changdev. R. Chavan	Shivchhatrapati College N-3 Cidco Aurangabad.431009.
Ms. Shilpa. S. Borkar	Shivchhatrapati College N-3 Cidco Aurangabad.431009.

ABSTRACT

Urban domestic solid waste in India contains 75-85 % organic substances. The uncontrolled dumping of this waste is a significant health concern. To solve this issue, degradation of organic waste by using microbial consortium is safe, efficient, and economical. Therefore, this study is done to recycle the domestic, green solid waste into active compost using a microbial consortium.

Antagonism assay is used to develop Bacterial consortia, thereby determining the concomitant enzyme production. A suitable consortium is further used to degrade 2 kg of organic solid waste producing compost. Analysis of the compost, showed: C-22.1%, N-0.78%, K-0.62ppm, P-0.51ppm, and S-0.24ppm. The proposed consortia had the highest decomposing capability compared to other consortia. Compost so produced, was reduced to 86% in mass, dark colored, with grainy texture lacking foul smell. It was observed that the C: N::21:1;and increased percentage of K, P, S, thereby contributing to enhance soil fertility.

The bacterial consortium so prepared serves as a vital tool in removing organic solid waste from environment. Further the compost produced can be used to increase fertility of soil.

KEYWORDS

Domestic Solid waste, Microbial consortia compost, Soil fertility.

INTRODUCTION

In urban India organic matter in Domestic Solid Waste (DSW) ranges from 75-80% (Bandara et al.,2007). The varying content of organic matter in waste, depends on the economic condition of the country from where it is generated (Bandara et al., .2007). Rapid increase in population, accelerating economy, and rampart urbanization has led to exponential growth in waste generation every year (Goveia and Prado 2009).

According to Gupta and Arora (2016), Urban India generates approximately 189,000 tons of Domestic Solid Waste per day, annually 68.8 million Tons! Mostly the solid wastes are dumped in areas demarcated as dumping grounds. This leads to pervasive pollution of the soil and air due to exuding toxic substances and engenders diseases in plants, cattle as well as human beings. Thus, micro-organisms present in dumping ground are subjected to a variety of substrates and chemicals. This raises the possibility of screening capable bacterial strains with valuable applications. In order to disintegrate the DSW, micro-organisms with enhanced enzyme activity are required, thereby breaking complex polymers into simple degradable molecules. Hence inoculating DSW with microorganisms, producing extracellular enzymes such as amylase, cellulase, protease, pectinase & lipase increase the rate of waste degeneration. It also helps in maintaining the waste degradation rate to that of waste dumping (Saha and Santra 2014).

The disintegration of organic wastes using microbial consortium is considered highly efficient, and the capability of waste degeneration by a consortium depends on its functional and structural stability (Miradamadian et al.,. 2011). The requirement can be fulfilled with the co-operation of many micro-organisms, each of which contributes by secreting different enzymes.

Antagonistic studies (competition for substrate among different microbes present in consortium) as well as synergistic studies (co-operation of microbes for better degeneration of waste) reveal the stability of consortium for degrading the DSW.

The objective of this study was to develop a microbial consortium that can act as a vital tool for the removal of organic solid wastes from the environment, and application of the compost generated from the degradation to increase the fertility of the soil. Biodegradable waste refers to the organic matter commonly found in DSW.

MATERIALS AND METHODS

Collection of sample:

Soil samples from the dumping land of Aurangabad municipal plant situated near the TV center, Hudco, Aurangabad, Maharashtra, India, in-sterile "WHIRL-PAK" plastic bags maintaining aseptic conditions. They were immediately transported to the laboratory for further tests.

Characterization of the soil sample

Characterization of the soil sample is done by determining moisture content (%) in it. The soil sample is taken in per-weighed containers, and the weight is recorded as initial weight. The soil sample is dried in Hot air oven at 110^{0}C. The weight of the sample is recorded at regular interval till constant weight is recorded. The moisture content is derived using the following formula (Payel Sarkar, Rounak Chourasia 2017).

MC (%) = W-ww x100 (where MC is moisture content, W is original weight & w is constant weight after oven drying.

Chemical analysis of soil samples:

The chemical characteristics of the soil sample are tested using the

following parameters:

Organic carbon (%), nitrogen (%), potassium (ppm), sulfur(ppm), phosphorus(ppm), pH and electric conductivity. Organic carbon, nitrogen, potassium, phosphorus, sulfur is determined by rapid titration method (Walkey and Black 1934), Kjeldahl procedure (Bremner 1960), barium chloride colorimetric method (Jackson 1973), and flame photo-metric method. A digital pH meter is used to determine pH.

Isolation of bacteria from the soil samples:
Isolation of bacteria from the soil samples is carried out from the waste dumping land by serial dilution method. 1gm of soil sample is added to a flask containing 100ml of sterile Nutrient Broth. This flask is incubated at room temperature for 24hours, followed by the subsequent ten-fold dilution by transferring 1ml solution to pure 9ml de-ionized water or (NaCl-0.85w/v%) containing tubes until a dilution of 10^{-6} to 10^{-8} is obtained. 0.1ml of the sample from the last three dilutions is transferred to sterile nutrient agar culture media plates (pH-7) via the spread plate method and incubated at (37°C) for 24 hours. Bacterial colonies are selected based on colony morphology and pigmentation. These isolated colonies were purified by streaking and preserving on Nutrient agar slants at 4° C.

Composition of Nutrient Agar:
Peptone-0.5w/v% , Beef extract/yeast extract-0.3w/v%, Agar-1.5%w/v-,Sodium Chloride-0.5%w/v-, Distilled water-100ml, pH adjusted to neutral (7.0+/-2) at 25°C (77°F).

Screening of bacteria for the production of extracellular enzymes and morphological characterization:
The isolated strains were further characterized based on their substrate specificity (starch, casein, Pectin, N_2 free, PSB) and Gram's characteristics. The inoculated plates were incubated overnight at 37°c and checked for a zone of clearance around each bacterial isolate. For the starch, the region of consent is observed after flooding the plates with Gram's iodine reagent. Caseinase positive bacterial isolate will show a clear hydrolysis zone around the intellectual growth in skimmed milk agar. Pectinase positive bacterial isolates will show a clear area around culture growth due to a lack of formation of the pectinase iodine. The increase was present on the N_2 free medium, which is specific for nitrogen-fixing bacteria and phosphate solubilizing bacteria. In this way, they were applied for consortia to increase the amount of nitrogen and phosphorus in the compost.

Composition of Screening Media:

Starch Agar: Nutrient Agar+ 1%w/v Starch

Skimmed Milk Agar: Agar- 15 g/L, Casein enzymatic hydrolysate-5 g/L, Dextrose-1 g/L, Skim milk powder-28 g/L,pH adjusted to neutral (7.0+/-2) at 25°C (77°F).

Pectinase Screening Agar Medium (PSAM): (G/L; $NaNO_3$-2g, KCl-0.5g, $MgSO_4$-0.5g, K_2HPO_4 -1g, Krypton0.5g, Agar-20g, and Pectin -10g), pH adjusted to neutral (7.0+/-2) at 25°C (77°F).

Azotobacter Medium(N_2 free): Glucose- 5.00 g, Mannitol- 5.00 g, $CaCl_2$ 2 H_2O -0.10 g, $MgSO_4$ 7 H_2O- 0.10 g, Na_2MoO_4 2 H_2O- 5.00 mg, K_2HPO_4- 0.90 g, KH_2PO_4 - 0.10 g, $FeSO_4$ 7 H_2O- 0.01 g,$CaCO_3$ -5.00 g, Agar- 15.00 g, Distilled water- 950.00 ml, Adjust pH to 7.3. Sterilize glucose and Mannitolseparately (in 50 ml H_2O) and add to the medium after autoclaving.

***Pikovskaya agar (PKA) medium*:** Glucose- 10g, Tri-calcium phosphate(TCP)- 5g, Yeast extract-0.5g, Ammonium sulfate-0.5g, Potassium chloride-0.2g, Sodium chloride- 0.2g, Magnesium sulfate-0.1g, Ferrous sulfate trace, Manganese sulfate trace, Agar-agar- 15g, Distilled water -1L, the pH was adjusted to 7.0±0.2 before sterilization.

***Gram's iodine reagent*:** Iodine-1.00g, Potassium Iodide- 2.00g, Distilled water-300ml.

***The proposed combination of the consortium*:**
A set of microbial consortia is prepared by a combination of isolates considering their concomitant enzymes production and Gram's character. The compatibility of the bacterial strain within the consortia is checked by antagonism assay.

Antagonism of bacterial strain:
The cross streaking method is used to test the antagonism among the selected bacterial strains by using this consortium was prepared. Each bacterial culture (24hrs old)(Payel Sarkar., Rounak Chourasia., 2017) was inoculated in sterile nutrient agar media plates as a 1.5 cm wide streak (full streak to obtain inhibiting zone in case of antagonism) diametrically across the plate and incubated at 37°c for 24hrs. After incubation, the indicator organism (to be present in the potential consortium) was streaked right angle to the original inoculum. This process is followed to the test of each organism antagonism against the other members of the consortium.

Determination of organic waste (Kitchen) degradation (Laboratory trials with 2kg of wastes)

Change in temperature: Temperature changes are observed at three levels of the surface top, center, and bottom. It is done by making holes in the wall of the bucket to find temperature gradations of the three levels concerning the degradation by using a laboratory thermometer.

***Determination of moisture content in waste*:**
Waste degradation is associated with a reduction in moisture content. Moisture content estimation was similar to the protocol followed during moisture content analysis of the soil.

Physical observation of waste:
After conducting the degradation study for 30days with 2kg organic waste, inoculation waste is observed for changes in color and odor.

***Chemical analysis of garbage*:**
The 2 kg organic waste inoculated with the best consortium is subjected to composed analysis after 30 days of degradation study. It includes tests for the quantitative analysis of factors: pH, electrical conductivity (E.C.), organic matter, C: N ratio, phosphorus, potassium, and sulfur. The test is performed to observe the ability of degraded organic waste to be used as manure to increase soil fertility.

RESULTS AND DISCUSSIONS

Chemical Analysis Of The Soil Sample:

The chemical characteristics of the soil samples were determined initially for the following parameters: pH, organic carbon (%), nitrogen (%), potassium (ppm), electrical conductivity(EC), phosphorus (ppm), sulfur (ppm), and organic matter(%) (Table 1). Soil pH is hydrogen ion activity measurement and depends on relative amounts of absorbed metallic ions and hydrogen. As per work carried out by Rieuwerts J.S. et al. in 1998 on soil, which is directly exposed to these ions via the soil solution, and is ideally reflected in environmental quality. The pH is determined with soil to water ratio of 1:2.3. The pH of the soil sample was 6.39, which is slightly acidic. As per Bezdicek et al. in 2002, the reason for this can be attributed to very high levels of available sulfur (32ppm), resulting from organic matter degradation as the soil is collected from the organic waste rich dumping site.

The EC of soil depends on salts and sodium content level. Uncontrolled discharge of wastes results in the significant increase of EC that can be toxic to plants, preventing their ability to obtain water from the soil is supported by Eric C. Brevik et al. in 2014. The EC of the soil sample was 0.15 m mho/cm, which was considered safe for plant growth.

A proper C: N ratio must be present in the soil for organisms to grow (Long Lin et al. 2019). Fuller M.E. in 2005 studied about excess of carbon soil means a sulfur presence of energy and microbial cells will draw a more considerable amount of nitrogen to make use of available carbon. It is known as `robbing` the soil of nitrogen, and it delays the availability of nitrogen as fertilizers in soil (Meuser 2010). A C:N ratio of less than 20 is good for the growth of organisms in the ground, similar to the findings of Long Lin et al. in 2019. However, Rauvat et al. (2008) found the C: N ratio of Indian dumpsites varies between 11 and 30, which are in support of the result. The level of nitrogen was 0.22 %, which was relatively low. It is found that the nitrogen content of waste dumping sites to range between 0.34 and 0.54%. However, higher levels of potassium and phosphorus is observed due to the high solubility of K and P in solid wastes that get readily reached to the soil. Messier et al., in 2011, presented work on sources of these minerals that is considered to be the organic material in wastes.The sulfur content of the soil sample is reported at 32ppm. Pillai et al. carried out further work on sulfur. In 2014 and levels are considered very high and

is suitable for the growth of annual crop such as cabbage. A high level of sulfur indicates the presence of decaying organic matter in the soil similarly.

Table 1: Chemical Analysis Of Soil (initial).

pH	O r g carbo n(%)	E.C.(Mmh o/cm)	N%	K_2o (ppm)	P_2O_5 (ppm)	Sulfur (ppm)	Org.m atter (%)
6.39 6.40 6.41	1.18 1.20 1.19	0.15 0.17 0.15	0.21 0.22 0.23	78.5 77.5 76.9	17 18 19	32 33 31	3.27 3.3 3.5
Average =6.39	1.19	0.15	0.22	77.63	18	32	3.35

Isolation Of Bacteria From Soil Sample:

Twenty different bacterial colonies were isolated from the soil sample by the serial dilution method after 24 hrs incubation at 37°C (Fig:1). The bacterial isolates are screened according to colony characteristics such as shape, margin, elevation, texture, and pigmentation (Table 2).

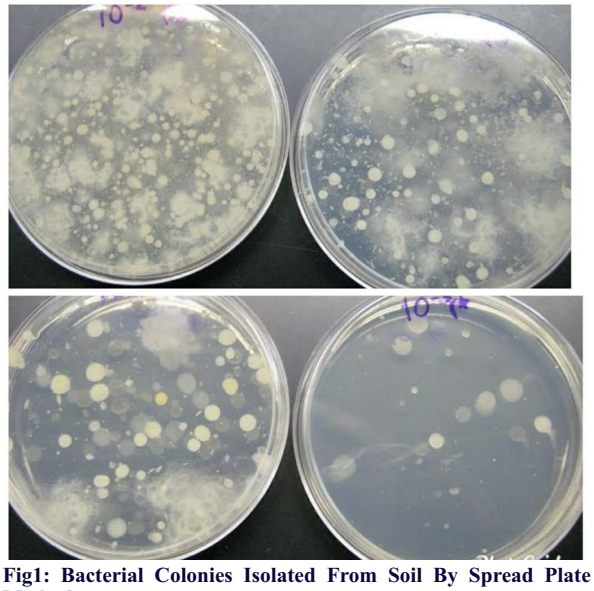

Fig1: Bacterial Colonies Isolated From Soil By Spread Plate Method

Table 2: Morphological Characterization Of The Isolated Strains From The Waste Dumping Site.

Bacterial colony	Shape	Margin	Elevation	Pigmentation	Texture	Gram's Nature & Morphology
AM1	Circular	Entire	Flat	Pale	Dry	Gram + ve rods
AM2	Circular	Entire	Convex	White	Rough	Gram - ve rods
AM3	Irregular	Entire	Convex	White	Rough	Gram + ve rods
AM4	Circular	Entire	Flat	White	Dry	Gram - ve rods
AM5	Circular	Entire	Flat	White	Dry	Gram + ve rods
PR1	Irregular	Irregular	Flat	Creamy White	Mucoid	Gram + ve rods
PR2	Circular	Entire	Flat	White	Mucoid	Gram - ve rods
PR3	Circular	Entire	Flat	Pale	Dry	Gram + ve rods
PR5	Irregular	Irregular	Flat	White	Dry	Gram + ve rods
PE1	Circular	Entire	Flat	White	Dry	Gram + ve rods
PE2	Circular	Entire	Flat	White	Dry	Gram– ve short rods
PE3	Spindle	Entire	Convex	White	Dry	Gram + ve rods
Pe4	Spindle	Entire	Convex	White	Dry	Gram - ve rods
PE5	Circular	Entire	Flat	White	Dry	Gram – ve short rods
AZO1	Circular	Entire	Flat	White	Rough	Gram - ve rods
AZO2	Irregular	Entire	Convex	White	Rough	Gram - ve rods
AZO3	Irregular	Lobate	Flat	White	Rough	Gram - ve rods
AZO4	Circular	Entire	Convex	White	Rough	Gram - ve rods
AZO5	Irregular	Lobate	Raised	White	Rough	Gram - ve rods
PSB1	Irregular	Undulate	Raised	White	Mucoid	Gram - ve rods
PSB2	Round	Undulate	Raised	White	Mucoid	Gram - ve cocci
PSB3	Round	Entire	Raised	White	Mucoid	Gram - ve cocci
PSB4	Irregular	Undulate	Flat	White	Mucoid	Gram - ve rods
PSB5	Round	Entire	Raised	White	Mucoid	Gram - ve cocci

Where AM =Amylase, PR=Protease, PE=Pectinase, AZO = Azotobacter, PSB= Phosphate solubilizing bacteria.

Screening Of Bacteria For The Production Of Extracellular Enzyme:

The isolated bacteria are screened for the production of an extracellular enzyme (amylase, protease, pectinase) that is required for the active degradation of organic solids waste. The organisms are streaked on plates with respective screening media, and the zone of hydrolysis is observed after incubation at 24hours. Gram's characteristics of the isolates were also determined. Twenty different bacterial strains are screened, out of which five bacterial isolates are based on extracellular enzyme production and Gram's characteristics (Table 2). Sarkar et al. in 2011 reported 80 bacterial strains, out of which 35 isolates that showed similar enzyme production. The soil from dumping sites consists of a high concentration of organic material, which contains various kinds of substrates for the indigenous Soil microflora. Thus the supply of substrates develops mechanisms to secrete enhanced extracellular enzyme concentration to utilize the available substrate. As per the findings of Raja and Divakar (2013), the production of enzymes like amylase, protease, and pectinase depends on primary - secondary sources of carbon & nitrogen available in substrates.

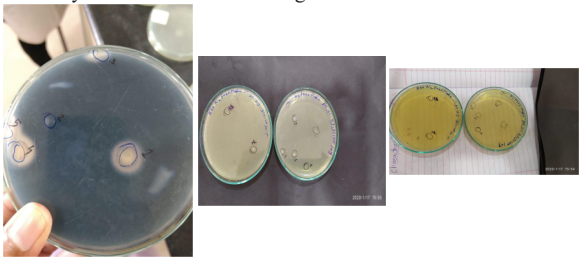

Fig:2 Soil Isolates Showing Amylase Activity Protease Activity Pectinase Activity

Table3: Screeningof The Isolates Based On Enzyme Production And Cell Morphology.

Bacterial colony	Amylase	Protease	Pectinase	Aztobacter	PSB
AM1	+	NA	NA	NA	NA
AM2	+	NA	NA	NA	NA
AM3	++	NA	NA	NA	NA
AM4	++++	NA	NA	NA	NA
AM5	+++	NA	NA	NA	NA
PR 1	NA	+	NA	NA	NA
PR 2	NA	++	NA	NA	NA
PR 3	NA	++	NA	NA	NA
PR 4	NA	++++	NA	NA	NA
PR 5	NA	+++	NA	NA	NA
PE 1	NA	NA	-	NA	NA

PE 2	NA	NA	+	NA	NA
PE 3	NA	NA	++	NA	NA
PE 4	NA	NA	++++	NA	NA
PE 5	NA	NA	+++	NA	NA
AZO 1	NA	NA	NA	-	NA
AZO 2	NA	NA	NA	+	NA
AZO 3	NA	NA	NA	++	NA
AZO 4	NA	NA	NA	++++	NA
AZO 5	NA	NA	NA	++	NA
PSB 1	NA	NA	NA	NA	-
PSB 2	NA	NA	NA	NA	++
PSB 3	NA	NA	NA	NA	++
PSB 4	NA	NA	NA	NA	+++
PSB 5	NA	NA	NA	NA	+++

(-)no enzyme, (+) Poor, (++)Fair,(++++) Excellent enzyme production, NA-Not applicable

Proposed Composition of Consortium:

Bacterial cultures must be compatible with each other to prepare a successful microbial consortium, and they can produce all these enzymes necessary to degrade organic waste. Four different microbial consortia were developed by permutation and combination (Table:3), by considering concomitant enzyme production and Gram's character for consortia preparation. Antagonism assay is used to check the compatibility of the bacterial strains within the consortia. Payel Sarkar. Rounak Chourasia (2017) supported this work by using four different microbial consortia, which were prepared by permutation and combination, and compatibility of the bacterial strains within the consortia is checked by antagonism assay.

Antagonism Assay:

A cross streaking method is used to test antagonism among the bacterial strains. The best consortia plates are observed after incubation for a zone of inhibition, which would indicate the presence of antagonism between organisms. Among the four combinations, two combinations of a body (consortium) showed no hostility with each other (Fig:3) (Misbah Ajaz, Mohammad Yousuf Zargar, and Malik Asif, 2019)

The preparation of a successful consortium requires the micro-organism in the consortium to grown in the presence of each other without hampering the activities of other native micro-organisms. Antagonistic relations between micro-organisms of a consortium lead to instability of the consortium, and the expected functioning of the consortium is not observed. It is supported by Kaustuvmani Patowary et al. (2016) while working on bio-degradation capacities of native bacterial consortia toward total petroleum hydrocarbons (TPH).

Micro-organisms grow in various associations with other organisms. One of them lacked antagonism, and this is selected for further consortium preparation. The consortium was prepared by inoculating 150ul of each tube (containing 18 hours old culture) in 20ml sterile nutrient broth.

Fig:3 antagonism assay Was AM =Amylase, PR=Protease, PE=Pectinase, AZO=Azotobacter, PSB= Phosphate solubilizing bacteria

Determination Of Organic Waste Degradation (2kg Laboratory Trials).

Consortia is subjected to 2kg of organic waste degradation for 28 days. The degradation capabilities is tested based on various parameters at constant intervals of 7 – 28 days.

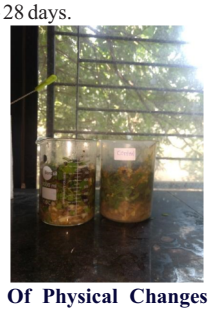

Fig:3 Determination Of Physical Changes In Waste (volume Density And Mass):

A rapid decrease in waste volume is observed in both the consortia and with control after first week. However, a reduction in size for the consortium was more significant than that in control. After 28 days of trials, a decrease in the volume of waste by 84% - 72% in the case of consortium & control, respectively (Navarro Ferronato & Vincenzo Torretta., 2019).

Density and volume are inversely related, and a rapid decrease in volume indicates increasing frequency. As expected, the rate of 2 kg of waste increased in the consortium, as it exhibited an 84% decrease in the amount of garbage. An increase in density is significant during composing as it indicates a reduction in particle size due to waste degradation, and composed supplemented with consortium showed a substantial increase in thickness compared to the control. Payel Sarkar, Rounak Chourasia, in 2017 while working on a density of 5kg waste increased in consortium 2, as it exhibited an 85% decrease in the volume of garbage. Compost supplemented with consortium 2 showed a significant density increase in comparison to consortium one and the control and thus reported a 50% density enhancement of bio-treated MSW, resulting in compaction of the compost. Mass reduction is a primary objective of waste treatment processes. Organic matter is utilized by degrading organisms and incorporated into cells and is also released as a gas, which causes a reduction in waste mass.

Determination Of Moisture Content In Waste:

Water is a critical factor during composting supported by Tiquia S.M. et al. in 1997. Compost moisture content above 80% leads to a decrease in oxygen diffusion, resulting in the composting process to slow down and become anaerobic. The moisture content of 40–60% is maintained during the composting process for the proper microbial process; similar findings are observed by Sarkar Payel and Chourasia., Rounak in 2017. The reduction in moisture content was uniform for the first seven days in both test consortia and control composts, indicating a decrease of moisture is due to drying and evaporation. After 28 days of degradation study, total moisture content observed is 40% in consortium while it was 55-65 % in case of control. An increase in moisture reduction in the consortium was more due to temperature rise, resulting from increased microbial degradation activities. Gautam et al. (2010) performed composting of MSW of Jabalpur City and observed a final moisture content of 36% in the final compost. This moisture content of humus is within the quality parameters set by international standards.

Changes In Temperature:

Temperature changes of three levels of the waste are observed at every seven days intervals. The temperature of the compost reached a peak at day 14 (Table no-4) for all the test and control compost. Consortium attained the highest temperature, in the center layer (42° C), a rise in temperature is associated with vigorous microbial activity and rapid organic matter degradation. Temperature increase leads to a reduction in pathogenic organism population, though turning off the compost pile at the regular intervals was employed to prevent the rise in temperature to such extents that would kill the degrading organism and stop the degradation process. This result supports the mass and volume reduction results.

Table 4: Determination Of Temperature Changes In 2kg Compost.

Days	Level	Temperature (°C) control			Temperature (°C) Consortium (sample)		
		1	2	3	1	2	3
1	Surface	30	31	30	30	31	32
	Center	32	31.5	31	32	31	32
	Bottom	35	34	34	35	35	36
7	Surface	33	33	34	35	36	35
	Center	35	34	34	37	37	37
	Bottom	36	35	37	39	37	38
14	Surface	34	34	33	37	38	37
	Center	37	36	36	40	41	39
	Bottom	38	37	37	39	38	39
21	Surface	36	35	36	39	38	39
	Center	38	37	38	42	41	42

	Bottom	38	37	37	40	41	39
28	Surface	37	36	37	38	37	39
	Center	39	38	38	44	43	44
	Bottom	37	37	36	42	41	42
Average		35.66	35.03	35.2	37.93	37.66	38

Changes In Color And Odor Of The Waste:

Waste inoculated with consortium and control varied in color, texture, and other characteristics after 28 days. Waste inoculated with the consortium (sample) was dark ,had a grainy texture and had a very low smell, whereas the control had a sharp rotten stench (Zaved H. K. et al. 2008). It might be due to the domination of anaerobic bacteria in the controlled waste, which produces hydrogen sulfide in addition to organic and amines.

Chemical analysis of the compost:

Fig:4 Determination of color and texture changes in 2 kg waste after 30 days of degradation

The waste inoculated with consortium is subjected to further compost analysis after the successful degradation of 2 kg wastes. It included tests for the quantitative analysis of factors: pH, electrical conductivity, E.C., Organic matter, C: N ratio, Phosphorus, Potassium, Sulfur. The result of compost analysis is tabulated in Table-5

The pH of the control compost (6.64) was lower than that of the test compost (6.78), indicating the dominance of anaerobic organisms instead of thermophilic degrades in control. The results are slow and less degradation of waste in the control compost compared to the test. Reports also suggest that the production of organic acids and other anaerobic degradation products leads to the generation of foul odor and a decrease in pH. The pH of the test compost 6.78 is an ideal property of the compost to be used to increase soil fertility. The EC of the test compost was 2.16 m mho/cm.

After 28 days of incubation organic matter content of the sample compost was 14.27 %, which was lesser than that of the control compost, i.e., 17.65 %. Organic matter content decreases with composting as the degrading organisms utilize the organic carbon for energy generation and biosynthesis. This reduction of organic matter in positive test compost explains a definite decrease in volume and mass of the compost.

A-C: N ratio of 28:2 before composting is considered desirable. Higher C: N ratio causes initial N immobilization, and a deficient C: N ratio causes an overabundance of N, resulting in the accumulation of ammonia. The C: N ratio decreases during composting as organic carbon is converted to CO_2 by degrades and lost in is a gaseous phase, whereas the nitrogen is converted to other forms by the organism. The C: N ratio of the test compost reported to be 21.05. Suggesting it to be useful for the enhancement of soil fertility. A final C: N ratio of less than 25:1 is considered suitable for the compost for its applicability to increase the productivity of the soil. There was a slight increase in the percentage of Phosphorus, Potassium, and Sulfur in the test compost as compared to fresh waste phosphorus increased from 0.33 to 0.51 ppm; potassium rose from 0.56 to 0.76 ppm, and sulfur increased from 0.19 to 0.29ppm.

As per the findings of Mansi Rastogi et al. (2020), Chemical analysis for a compost included pH, temperature, C/N ratio, moisture & organic matrix. In these, temperature monitoring is the fastest and straightforward method to evaluate compost quality. A subsequent decrease in pile temperature at the end of composting correlates well with other characteristics of a compost used to assess stability or maturity in a fertilizer. The C/N ratio is another key parameter to induce compost maturity within composting and co-composting processes.

Table 5: Chemical Analysis Of The final Compost

	pH	Org carbon(%)	E.C.(Mmho/cm)	N%	K_2o(ppm)	P_2O_5(ppm)	Sulfur (ppm)	Org.matter(%)
Fresh Waste	6.62	34.15	1.86	0.61	0.48	0.42	0.18	34.39
	6.60	33.05	1.66	0.75	0.56	0.33	0.25	33.79
	6.75	32.05	1.76	0.81	0.65	0.25	0.15	32.25
Control	6.51	18.00	1.90	0.72	0.57	0.52	0.18	17.25
	6.66	18.70	1.80	0.86	0.66	0.47	0.28	17.45
	6.75	17.50	1.70	0.79	0.45	0.62	0.32	18.25
Compost	6.83	16.00	2.14	0.93	0.76	0.61	0.25	15.03
	6.78	15.00	2.24	0.84	0.89	0.69	0.35	13.03
	6.74	14.50	2.10	0.75	0.65	0.71	0.27	14.75
Average	6.69	22.1	1.90	0.78	0.62	0.51	0.24	21.68

CONCLUSION:

The consortia prepared for organic waste degradation had degrading capability and highly significant. The compost produced after 30 days of degradation had a dark color and a lack of foul smell. The consortium was consistent in degrading a higher quantity of waste and reduces the period of degeneration. It can be employed for composting a large number of residues in the future. Compost analysis of 2kg residues inoculated with consortium showed C: N of 21:1 and increased percentage of K, P, and S, which is required to enhance soil fertility. The current study indicates that the proposed consortia can serve as an important tool to remove the organic solid waste from environment. The compost so generated,can be applied to increase the fertility of the soil and will find applications as it is nutrient rich.

REFERENCES:

1) Bremner J.M., 1960. Determination of nitrogen in soil by the Kjeldahl method. Journal Agriculture Sci; 55(1), 11–33. DOI:10.1017/ S0021859600021572
2) Elango D, Thinakaran N, Pannerselvam P, Sivanesan S.2009. Thermophilic composting of municipal solid waste. Journal of Applied Energy; (86):663–668.
3) Eric C. Brevik, and Lynn C. Burgess.2014. The Influence of Soils on Human Health.Soil Agriculture & Agriculture technology.
4) Jayani R. S., Saxena S., and Gupta R. 2005. Microbial Pectinolytic enzymes: are view" Process Biochemistry; vol.40(9): 2931– 2944.
5) Kaustuvmani Patowary, Rupshikha Patowary, Kalita M.c. & Deka S.2016.Development of an Efficient Bacterial Consortium for the Potential Remediation of Hydrocarbons from Contaminated Sites. front Microbiol; (7)
6) Long Lin.Yebo Li., 2019.Biological treatment of organic materials for energy Nutrients Production. Advances in Bioenergy.
7) Misbah Ajaz, Mohammad Yousuf Zargar, and Malik Asif 2019.Development of microbial consortia of cold-tolerant microbes for solid waste management.International Journal of Chemical Studies 2019; 7(4): 148-155
8) Navarro Ferronato & Vincenzo Torretta. 2019.Waste Mismanagement in Developing Countries: A Review of Global Issues. International Journal of Environmental Research & Public Health; 16(6):1060.
9) Payel Sarkar ., Rounak Chourasia. 2017. Bioconversion of organic solid wastes into biofortified compost using a microbial consortium. International Journal of Recycling of Organic Waste in Agriculture; (6),321–334.
10) Rastogi Manasi, Nandal Meenakshi, and Khosla Babita. 2020. Microbes as vital additives for solid waste composting.Heliyon. 6(2).
11) Sarkar P, Meghvanshi M, Singh R.2011. Microbial consortium: a new approach ineffective degradation of organic kitchen wastes. International Journal Environment Sci Dev; 2(3):170–174.
12) Toth S, Prince A.L. 1949. Estimation of cation-exchange capacity and exchangeable Ca, K, and Na contents of soils by flame photometric techniques. Soil Sci; 67(6):439–446.
13) Tequila S.M., Tam N.F.Y., Hodgkiss I.J. 1996. Effect of Moisture Content on the Composting of Pig-Manure Sawdust Litter Disposed Of the Pig-on-Litter (POL)System; The Science Composting:1361-1364.
14) Rieuwerts J.S., Thornton I.S., Farago M.E. & Ashmore M.R. Factors influencing metal bioavailability in soils: preliminary investigations for the development of a critical loads approach for metals. Chemical Speciation & Bioavailability ;(Print) 2047-6523 (Online): 64-75.
15) David H. K., Mizanur Rahman M., Mashiar Rahman M., Rahman Atiqur S.M.Y. Arafat, and Safiur Rahman M.2008.Isolation and Characterization of Effective Bacteria for Solid Waste Degradation for Organic Manure. KMITL Sci. Tech. J. Vol. 8(2).

Books.

1) Fuller M.E. 2005. Encyclopedia of Soil Environment.