International Journal of Agriculture Innovations and Research
Volume 3, Issue 2, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received : 25/08/2014 | Accepted on : 04/09/2014 | Published : 16/09/2014

Comprehensive Analysis of Different Particle Sizes of Organic Manure

Somasundari, G.
M. Tech. Student, Dept. of Biotech. and Genetic Engg., Bharathidasan University,Tiruchirapalli-24

Jenny, S.
Research Scholar, Dept. of Marine Biotechnology, Bharathidasan University, Tiruchirapalli-24

Rajakumar, S.
Assistant Professor, Dept. of Marine Biotechnology, Bharathidasan University, Tiruchirapalli-24

Malliga, P.
Professor, Dept. of Marine Biotechnology, Bharathidasan University, Tiruchirapalli-24
Email: malli62@yahoo.com, Tel:+914312418591; Mobile: 09487549118; Fax: +91431- 2407084

***Abstract* – This paper aims to analyse three different particle sizes of organic manure (cyanopith mixed with jiwamrita) during the composting process. The nutrient status of organic manure was enriched by the addition of jiwamrita. The HPLC analysis revealed the more number of peaks and hence, the presence of lignin derived compounds on the final day.**

***Keywords* – Cyanopith, HPLC, Jiwamrita, Organic Manure.**

I. Introduction

Organic manure is the manure prepared from the animal and plant wastes after properly decomposing the raw material [1]. Cyanobacteria are one of the major components of nitrogen fixing biomass in paddy fields and provide a potential source of nitrogen fixation. Due to the important characteristic of nitrogen fixation, cyanobacteria have a unique potential to enhance productivity in a variety of agricultural and ecological situations[2].

Normally, the coirpith is dumped as agricultural waste and accumulates as a waste products as heaps of course and fine dust [3].Reference[4] reported that the coirpith as an excellent and inexpensive carrier for cyano bacterial fertilizers. Cyanopith is an organic fertilizer produced by biodegradation of coirpith using fresh water cyanobacterium, *Oscillatoriaannae* [5]. Application of jiwamrita increased the activity of microbes thereby solubilisation and uptake of nutrients were enhanced[6]. Hence, the present study aims to convert the partially degraded coirpith by cyanobacterium into three different particle sizes of organic manure. These have been enriched with jiwamrita for further degradation process. The physicochemical parameters were analysed and the presence of compounds were observed by HPLC technique.

II. Materials and Methods

Organic manure was prepared by three different particle sizes [7] (a- 1-2cm; b- 0.1-1mm; c- 0.01-0.1mm) of cyanopith fertilizer [5] mixed with jiwamrita and incubated for composting process under shadow for 30 days. The physicochemical parameters such as pH (Potential metric method), EC [8], phosphorus, chloride, nitrate, nitrite and ammonia [9], calcium and magnesium [10], nitrogen and potassium [11]were estimated.

HPLC Analysis

The HPLC analysis (waters model no.2690,USA) of three different particle sizes of organic manure was carried out with C_{18} column(symmetry,4.6x250nm) using methanol as a solvent with flow rate of 1ml/min at 10 mins. retention time with 270-310 detection wavelengths[12].

Statistical analysis

All treatments were performed randomly in triplicates. The data were subjected to one way analysis of variance (ANOVA) with SPSS version 16.0 by using Duncan's test at $p<0.05$ level of significance.

III. Results and Discussion

Estimation of pH

The pH values in three different particle sizes of organic manure were increased after 30 days of incubation when compared to initial day estimation. However, Fig. 1 showed that there is no significant variation among all the particle sizes of organic manure on 30th day.

Reference [13] stated that at the end of aerobic and anaerobic decomposition process, the pH was increased in poultry manure with sorghum straw composting and [14]reported increased pH level in cattle dung vermicompost. The increased pH of vermicompost from different wastes has also been reported like sheep manure [15] and sewage sludge[16]. Theincreased pH of vermicompost and pit compost was also reported by [17] and these evidences concordance with the present investigation.

Estimation of EC

Electrical conductivity (EC) can be related to the water holding capacity, cation exchange capacity (CEC), porosity, texture and particle size. In this present study, 0th day results showed very low EC in all particle sizes of organic manure and the elevated EC was observed on 30th day. Nevertheless, the maximum EC was noticed in the minimum particle sizes of organic manure (Fig. 2). Degradation of manure by the microbes present in jiwamrita released nutrients to the surrounding environment. This could be attributed to increased EC in different particle sizes of organic manure when compared to initial day. Furthermore, the minimum particle size among all the three the EC was significantly increased and it is indicated that it was equally proportional to the minimum particle size. This could be as a result of the minimum particle sizes favoring microbial degradation.

Results revealed that electrical conductivity of planting media substituted with vermicompost increased EC over control [18]. The chicken manure has a high electrical conductivity, organic matter and available plant nutrients when compared to rice husk got very low electrical conductivity and was also low in organic matter and other nutrients [19]. Increased EC in cattle manure vermicompost was reported by [20].The increased EC during the period of the composting and vermicomposting processes is in agreement with that of earlier workers [21], [22] which was probably due to the degradation of organic matter releasing minerals such as exchangeable Ca, Mg, K and P in the available forms, that is, in the form of cations in the vermicompost and compost [22], [23].

Estimation of NPK

The Nitrogen, Phosphorous and Potassium (Fig. 3) contents in three different particle sizes of organic manure were increased after 30 days of incubation. Among the three particle sizes, the minimum size (0.01-0.1mm) showed rich (six fold) in NPK than the other two particle sizes. It could be due to the N_2 fixing bacteria present in jiwamrita which easily degraded the minimum particle size when compared to other sizes.

These results correlated with the following investigations. The organic fertilizers and soil enhancers were used for their organic matter contribution and nutrients, mainly total P [24], [25] and nitrogen [26]found in soils are associated with organic matter. The composting of poultry manure blended with straw would enable to enhance the N, P and carbon status of the manure and thus improving its quality [13]. Increase in the total P content of poultry saw dust manure was observed by [27] up to 7 weeks and [28] shows a similar result and has reported an increase in total 'P' content due to aerobic decomposition than anaerobic decomposition. The poultry manure had increased NPK level than cocoa pod ash [29]. The nitrogen and phosphorus contents were increased in poultry droppings than the municipal waste and cow dung whereas, the potassium level was increased in cow dung than the other organic manures [30].

Estimation of biochemical parameters

The biochemical parameters showed significant effects on three different particle sizes of organic manure on 30th day.Fig.4 indicated that the minimum particle size of organic manure (0.01-0.1mm) has increased nitrate, nitrite and ammonia contents than the other two particle sizes. Presence of microbial load in jiwamrita could have easily degraded the minimum particle size when compared to other sizes.

Pig manure compost with maximum ammonia content can be considered as mature compost [31],[32].According to[33], increased ammonia nitrogen results in composting and maturation process were achieved (125 days) and the nitrate content of compost I (75% poultry manure and 25% exhausted olive cake) increased than the compost II (25% Poultry manure and 75% exhausted olive cake).The peat based substrate showed increased nitrate level than the compost and vermicompost whereas the ammonial nitrogen level was increased in vermicompost than the peat based substrate and compost [34].

Fig.5 showed the calcium, magnesium and chloride contents in filtrate from three different particle sizes of organic manure. Among these, the minimum particle size of organic manure showed elevated level of calcium and magnesium content than the other two particle sizes. Supporting evidences supported that the calcium and magnesium were increased in T4 treatments (coirpith + *Pleurotus sajor caju* + cow urine)when compared to other treatments [35]. The calcium content were increased in poultry dropping incubated for 42 days than the other organic residues (*Chromoleana odorata*, *Pennisetum purpureum,* maize stoves,soybean straw and cow dung) whereas,the magnesium content was increased in *Pennisetum purpureum* than the other organic residues [36].

HPLC analysis

HPLC methods were used for the extraction and separation of lignin derived compounds present in filtrate of three different particle sizes of organic manure with 10 mins. retention time. The result revealed that the more number of peaks were observed in the finest among all the three particle sizes (Fig.6). During incubation, the microbial activity was increased with the addition of jiwamrita thereby the lignin compounds could be degraded.

The HPLC analysis of water extract of the decomposed rice straw at different treatments in various intervals (15 days) revealed the production of organic acids (citric acids, oxalic acid, maleic acid, and formic acid) [11]. HPLC analyses used to monitor the presence of humic substances during the incubation (95 days)of compost with lignocellulolytic microorganisms[37]. The HPLC analysis confirmed the presence of fungicide residues in commercial compost (barks+ pruning residues+ urban and industrial sludges) and traces of some metabolites [38].

IV. Conclusion

The present study deals about three different particle sizes of organic manure (cyanopith and jiwamrita) incubated for 30 days. During incubation, the nutrient status was enriched and the compounds were analysed and separated by HPLC. Results showed increased nutrient status on 30th day in three different particle sizes of organic manure. Hence, the present study concluded that the minimum particle size (0.01-0.1mm) of organic manure has released more nutrients as compared to that of other particle sizes.

References

[1] Anonymous. 2012. What is the difference between biofertilizer and organic matter? http:// wiki,nswers.com/Q/what the difference between biofertilizer and organic fertilizer#slide 1.

[2] D. Sahu, I. Priyadarshani, and B. Rath, “Cyanobacteria-as potential biofertilizer,”*CIB Tech. J. of Microbiol.*, vol. 1(2-3),2012,pp. 20-26.

[3] P. K. Ghosh, U. S. Sarma, A. D. Ravindranath, S. Radhakrishnan, and P. Ghosh, “A novel method for accelerating composting of coir pith”,*Energy fuels*,vol. 21,2007, pp. 822-827.

[4] P. Malliga, and V. Viswajith, Biodegradation of Lignin: A search for valuable Products. *In*: Biotechnological Applications in Environmental Management (eds.) R.K.Trivedy and Sadhana Sharma. BS Publications, Hyderabad, India.2005, pp. 232-239.

[5] P. Malliga, A. D. Ravindranath, and U. S. Sarma, Hand book of Preparation and Application of Coir Pith Based Cyanobacterial Biofertilizer (Cyanopith and Cyanospray) for field. Priya publication. 2012, pp. 19 -20.

[6] G. S. Manjunatha, S. N. Upperi, B. T. Pujari, N. A. Yeledahalli, and V. B. Kuligod, “Effect of farm yard manure treated with jeevamrutha on yield attributes, yield and economics of sunflower (Helianthus annuus L.)”,*Karnataka J. Agric. Sci.* vol. 22(1),2009, pp. 198-199.

[7] S. Jenny and P. Malliga, “Influence of organic manure on growth and yield attributes on *Solanum lycopersicum* (tomato) plants”, International Journal of Innovative Research in Science & Engineering, vol.2(8),2014, pp. 1-6.

[8] G.E. Rayment, and F.R. Higginson,Australian Laboratory Handbook of Soil and Water Chemical Methods, Melbourne, Inkata Press. Australian Soil and Land Survey Handbooks, vol. 3,1992.

[9] APHA, 1998. Standard Methods for the Examination of Water and Wastewater, 20th edn. Washington, D.C.

[10] AOAC, 2000. Official method of analysis. 17th Ed. Agricultural chemistry, Washington, DCPP.

[11] R. G. Jackson, L. Eng-Kiat, Y. Li, K. Mariusz, S. Göran, A. J. H. David,Ashford, and D. J. Bowles, “Identification and Biochemical characterization of an *Arabidopsis* indole-3-acetic Acid Glucosyl transferase”,*J. Biol. Chem*., vol. 276(6),2001, pp. 4350-4356.

[12] A.Kumari, K. K Kapoor, B. S. Kundu, and R. K. Mehta, “Identification of organic acids produced during rice straw decomposition and their role in rock phosphate solubilisation”,*Plant soil environ.,* vol. 54(2),2008, pp. 72–77.

[13] M. M. Amnuallah, “Nutrient release pattern during composting poultry manure”,*Res. J. Agric. and Biol. Sci*., vol. 3(4), 2007, pp. 306-308.

[14] J.Rakesh, and P. V. Adarsh, “Effect of vermicompost on growth, yield and Quality of tomato *(Lycopersicum esculentum* L.)”,*African J. of Basic & Appl. Sci*., vol. 2(3-4),2010, pp. 117-123.

[15] F. Gutiérrez-Miceli, J. Santiago-Boraz, J. A. M. Molina, C. C Nafat, M. Abdul-Archila, M. A. O. Llaven, R. Rincón-Rosales, and L. Dendooven, “Vermicompost as a soil supplement to improve growth, yield and fruit quality of tomato (*Lycopersicum esculentum*)”,*Bioresoure Technology*, vol. 98,2007, pp. 2781-2786.

[16] G. Masciandaro, B. Ceccanti, V. Roachi, and C. Bauer, “Kinetic parameters of dehydrogenase in the assessment of the response of soil to vermicompost and inorganic fertilizers”,*Biology and Fertility of Soils*, vol. 32, 2000, pp. 479-483.

[17] K. Amir, and I. Fouzia, “Chemical nutrient analysis of different composts (vermicompost and pit compost) and their effect on the growth of a vegetative crop*Pisum sativum*”,*Asian J. plant Sci. Res*., vol. 1(1), 2011, pp. 116-130.

[18] K. A. Klock, “Growth of salt sensitive bedding plants in media amended with composted urban wastes”, *Composts science and utilization*, vol. 5, 1997, pp. 55-59.

[19] S. Panchaban, M. Ta-oun, and S. Sanunmuang, “Effect of organic and inorganic fertilizers on yield and quality of ruzi grass (*Brachiaria ruziziensis*) grown on saline sandy soils of the northeast, Thailand”,*In*: Management of tropical sandy soils for sustainable agriculture, FAO- Bangkok. Thailand, 2007, pp. 383-386.

[20] G. Peyvast, J. A. Olfati, S. Madeni, and A. Forghani, “Effect of vermicompost on the growth and yield of spinach (*Spinacia oleracea* L.)”,*J. of food, Agriculture and Environment*, vol. 6(1), 2008, pp. 110-113.

[21] Kaviraj and S. Sharma, “Municipal solid waste management through vermicomposting employing exotic and local species of earthworms”, *Bioresource Technol*., vol. 90(2), 2003, pp.169–173.

[22] C. D. Jadia, and M. H. Fulekar, “Vermicomposting of vegetable waste: a bio- physicochemical process based on hydro-operating bioreactor”,*African J. of Biotech.,* vol.7, 2008, pp. 3723–3730.

[23] C. Tognetti, F. Laos, M. J. Mazzarino, and M. T. Hernandez, “Composting vs. vermicomposting: a comparison of end product quality”,*Compost Science and Utilization*, vol. 13 (1), 2005, pp. 6–13.

[24] B. Fuente, N. Bolan, R. Naidu, and M. Mora, “Phosphorus in organic waste-soil systems”, Revista de la Ciencia del Suelo y Nutrición Vegetal.,vol. 6(2), 2006, pp. 64-83.

[25] V. B. Ortiz, and C. A. Ortiz, Edafologia,Universidad Autonoma de chapingo, Departamento de Suelos, chapingo, Mexico, 1990, pp. 148-150.

[26] J. Z. Castellanos, J. X. Uvalle-Bueno, and A. A. Santelises,Manual de interpretación de análisis de suelos, aguas agrícolas, plantas y ECP. 2ª ed. INIFAP, Chapingo, México, 2000.

[27] R. Nodar, M. Acea, and T. Carballas, “Poultry slurry microbial population: Composition and evolution during storage”, *Bioresource Technol*., vol.40, 1992, pp. 29-34.

[28] H. Krickmann, and E. Witter, “Composition of fresh aerobic and anaerobic farm animal dungs”, *Bioresource Technol*., vol. 40, 1992, pp. 137-142.

[29] L. S. Ayeni,M. T. Adetunji, S. O. Ojeniyi, B. S. Ewulo, andA. J. Adeyemo, “Comparative and cumulative effect of cocoa pod husk ash and poultry manure on soil and maize nutrient contents and yield”,*Am. - Eurasian J. Sustain. Agric.,* vol.1, 2008, pp. 92-97.

[30] J. M. Wapa, Effect of mineral fertilizer and different sources of organic manure combination on the growth and grain yield of maize in Sudano-sahelian Savanna, Nigeria. *Intl. J. agri. And Inno.Res.,*vol. 2(6),2014, pp.1096-1100.

[31] M.Mustin, Le compost: gestion de la matière organique, Dubusc F. (Ed.), Paris, 1987, pp. 117–242.

[32] G. F. Huang, M. Fang, Q. T. Wu, L. X. Zhou, X. D. Liao, and J. W. C. Wong, “Co-composting of pig manure with leaves”,*Environ. Technol*., vol. 22, 2001, pp.1203–1212.

[33] S. Hachicha, M.Chtourou, K.Madhioub, and E. Ammar, “Compost of poultry manure and olive mill wastes as an alternative fertilizer”,*Agron. Sustain. Dev*., vol. 26, 2006, pp. 135-142.

[34] C. Lazcano, J. Arnold,A. Tato,J. G. Zaller, and J. Dominguez, “Compost and vermicompost as nursery pot components: effects on tomato plant growth and morphology”, *Span. J. of Agri. Res*., vol. 7(4), 2009, pp. 944-951.

[35] R. Sureshkumar,and P. Ganesh, “Effect of different biocomposting techniques on physicochemical and biological changes in coir pith”,*Intl. J. of Recent Scientific res*., vol. 3(11), 2012, pp. 914-918.

[36] W. A. Moliando, “Determination of the nutrient status of the soil after incubation with organic residues for different day in Benin City, Nigeria”,*World J. of Agric. Sci.,* vol. 4(6), 2008, pp. 731-736.

[37] N. Requena, T. M. Baca, andR. Azcon, “Evolution of humic substances from unripe compost during incubation with lignolytic or cellulolytic microorganisms and effects on the lettuce growth promotion mediated by *Azotobacter chroococcum*”,*Biol.fertil. Soils,* vol. 24, 1997, pp. 59-65.

[38] V. Adriano, F. Federica, G. Roberta and C. Adelaide, “Occurrence of dicarboximidic fungicides and their metabolites residues in commercial compost”, *Agronomie*, vol. 24, 2004, pp. 7-12.

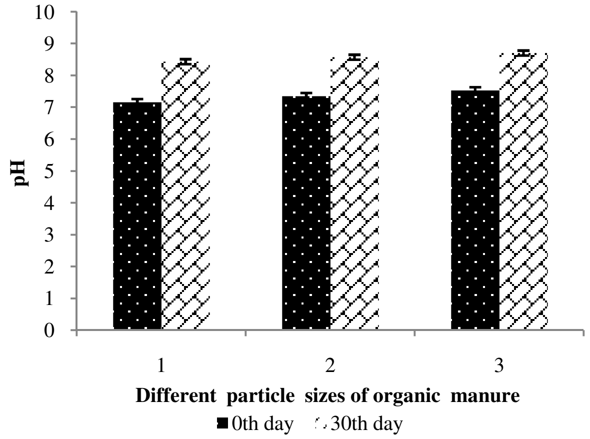


Fig.1. Determination of pH in filtrate from organic manure on 30th day

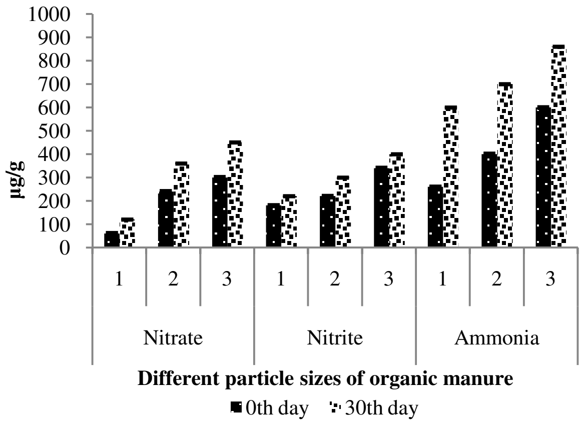


Fig.4. Estimation of biochemical contents in filtrate from organic manure on 30th day

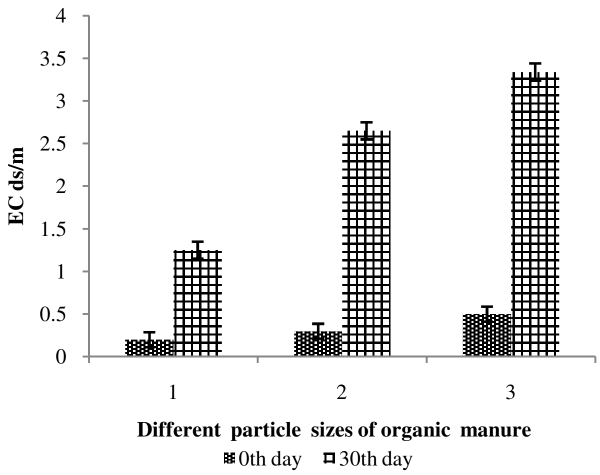


Fig.2. Effect on EC in filtrate from organic manure on 30th day

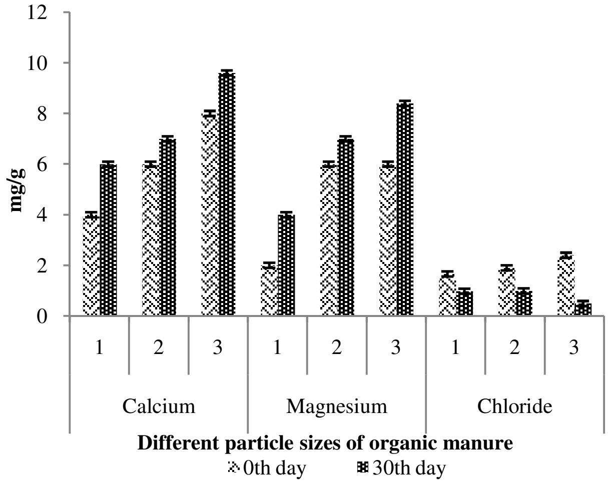


Fig.5. Estimation of biochemical contents in filtrate from organic manure on 30th day

1- 1-2cm; 2- 0.1-1mm; 3- 0.01-0.1mm

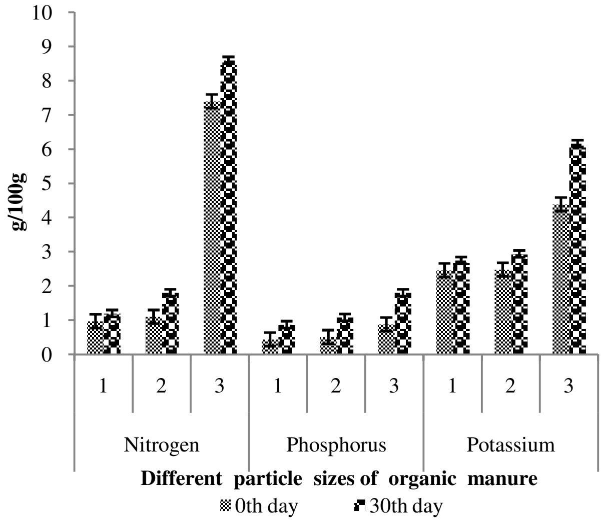
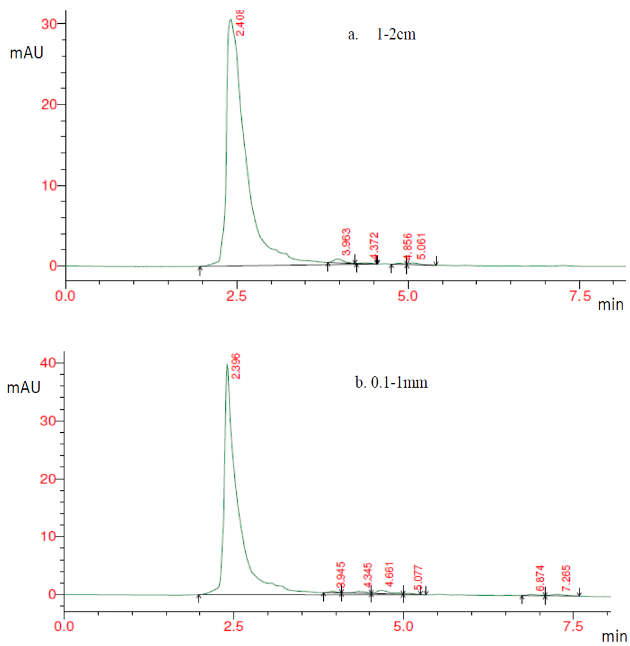


Fig.3. Estimation of NPK contents in filtrate from organic manure on 30th day



International Journal of Agriculture Innovations and Research
Volume 3, Issue 2, ISSN (Online) 2319-1473

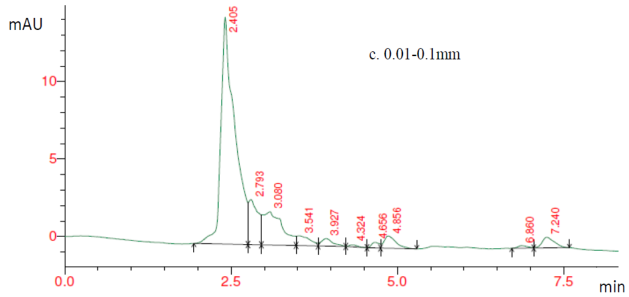


Fig.6. HPLC analysis for separation of compounds from organic manure (filtrate) on 30th day

AUTHOR'S PROFILE

Somasundari Ganesan
IV M.Tech. (6yr Integrated) Biotechnology, Department of Biotechnology and Genetic Engineering, Bharathidasan University, Tiruchirappalli – 620 024

S. Jenny
Research Scholar, Dept. of Marine Biotechnology, Bharathidasan University, Trichy- 9.
E-mail: jsjennysiva@gmail.com
Mobile: 8870270507
Educational Qualification:
Ph.D. (Microbiology): Full Time (on-going)

Degree	Field	University	Passing Year
M.Phil	Microbiology	Urumu dhanalakshmi College, Trichy	2009
M.Sc	Microbiology	Srimathi Indira Gandhi College , Trichy	2008
B.Sc	Microbiology	Srimathi Indira Gandhi College , Trichy	2006

Dr. S. Rajakumar
Assistant Professor, Department of Marine Biotechnology, Bharathidasa University, Tiruchirappalli-620024, Tamil Nadu, India
Email: kodairaj@gmail.com
Phone: 0452 – 6587762
Mobile: 91 9600342290

Academic Background
- Ph. D., Environmental Sciences, Bharathiar University, Coimbatore – 641046, India (2006)
- M. Sc., Environmental Sciences, Bharathiar University, Coimbatore - 641046, India (2001)
- B. Sc., Zoology, Pachaiyappa's College, Chennai – 600030, Tamil Nadu, India (1997)
- Hr. Sec., S.B.K. H.S.S, Kallurani – 626105, Virudhunagar (Dt). Tamil Nadu, India (1993)
- S.S.L.C., S.B.K. H.S.S, Kallurani – 626105. Virudhunagar (Dt). Tamil Nadu, India (1991)

Area of Specialization:
- Marine Microbiology, Environmental Microbiology, Bioremediation, and Coastal Zone Management

Dr. P. Malliga
Qualification: M. Sc., M. Phil., Ph. D
Institution : Bharathidasan University
Date of Birth: 31-05-1962
Permanent Address: GF-F, Padmavathy Block, State Bank Officers Colony, Lawsons Road, Contonment, Tiruchirappalli - 620 001
Phone +91-431-2415891, 09443208345, 9487549118
Address for Communication: Associate Professor, Department of Marine Biotechnology, National Facility for Marine Cyanobacteria (NFMC), Bharathidasan University Tiruchirappalli - 620 024
Phone: +91-431-2407084 (Off)
Email: malli62@yahoo.com
Educational Qualification:

Degree	University	Field	Passing Year
M. Sc.,	Bharathidasan University	Botany	1986
M. Phil.,	Bharathidasan University	Botany	1988
Ph. D.,	Bharathidasan University	Botany	1993

Area Specialization : Lignin Waste Degradation, Biofertilizers