MINOR RESEARCH PROJECT PROPOSAL

PART – A : GENERAL INFORMATION				
1	Basic Subject area of Research	:	Biological Science (Environmental Microbiology)	
2	Title of the Proposed Project	:	Sustainable approach for municipal wet waste management and to analyse efficacy of the prepared compost by pot culture method	
3	Name, Qualification and Designation of the Principal Investigator/Co-Investigator	:	Dr. Sonal C. Upadhyay (Principal Investigator) Ph. D (Microbiology) Assistant Professor	
			Prof. Yogesh Salavi (Co-Investigator) M.Sc. (Botany-Plant Physiology & Biochemistry) Assistant Professor	
4	Teaching and Research Experience of Principal Investigator	:	12 years (Teaching) 07 years (Research)	
5	Name and address of the institution where the proposal will be executed	:	Vikas College of Arts, Science & Commerce Kannamwar nagar -2 Vikhroli (E), Mumbai 400083	
6	Whether the College / University is approved by the UGC	:	YES Approved	
7	Details of Facilities provided/to be made available at the College / University	:	(1) Infrastructure- Laboratory (2) Instruments- Laminar air flow, BOD Incubator, Hot Air Oven, Microscope, Colorimeter, Autoclave, Incubator, Temp. Controlled Shaker, deep freezer (-20^{0}C), PAGE Unit etc. (3) Computer- with Internet & Printer	

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8	Have you ever applied before for Minor Research Project If yes, give details	:	Nil	
9	Whether the Project or part of Project is approved by the University for the Doctoral Degrees If Yes, give details	:	Nil	
10	Details of the Research Project and research funding (Major/Minor) received in the past and/ongoing projects.	:	Nil	

PART – B : PROJECT DETAILS	
1	Details of the proposed project to be undertaken: (Attach additional Pages if required)
	Origin, Need and Objective of the Research Proposal : **<u>Origin & Need:</u>** The research aims to minimise municipal waste collection and to manage the biodegradable wet organic waste in the various residential society, research institutes, shopping hub etc. later it can be utilised either commercially or as a natural fertiliser for the green campus. **<u>Objective:</u>** The major objective of this study is to develop the sustainable method of the municipal wet waste management and to analyse the efficacy of the prepared compost by pot culture method using *Vigna mungo* (Black gram) as a test model plant. Further study will be conducted for biochemical and microbiological analysis and proper utilisation of the prepared compost for making the campus clean and green.

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Rationale for taking up the proposed project and its interdisciplinary relevance :

The Indian cities have always been a poor performer in waste management and garbage disposal and the situation is getting worse by the day. This garbage having large amount of organic waste residue, this organic waste coming from Municipal solid waste, Food industries, Institutions, commercial sectors etc. This organic waste has creating lots of environmental pollution and having adverse effect on human life. Since this is a biodegradable we can recycle this waste and use for developing agriculture sector. It would help in management of organic solid waste created from all sector. From this waste compost is prepared by pit composting technique. It is important to use renewable resources and minimize the environmental hazards associated with the generated waste. Composting is an age old practice for the biological conversion of organic waste to a humus-like substance which can enhance physical, chemical and biological soil properties (Pan, 2011), which serves as a natural sustainable, safe and economical method of waste management (de Guardia et al. 2002). In modern times, the size of the town and cities are increasing at a very fast rate and therefore solid waste generated daily has a very high magnitude and therefore its collection and disposal is necessary, to maintain good hygienic condition in the society as well as in the research/academic institutions. Solid wet waste is largely made-up of kitchen and yard waste. This research is based on conversion of biodegradable waste into compost by an effective method and thereby checking the efficacy of prepared compost by studying the growth parameters of the Black Gram (*Vigna mungo*) as a test model plant.

Since decomposition is a natural process, it will eventually occur, however slowly. The primary objective is to create an optimum environment for the microorganisms for proper decomposition. Bacteria are the first to break down plant tissue. The microorganisms in the compost pit require the same basic essentials of most living organisms: nutrients, air, and water. If the microbes are abundant, the compost pit will decompose rapidly. Biodegradation is significantly improved by increasing the temperature of the medium, thus, the use of thermophile microbes that thrive in high-temperature environments, will render this process more efficiently. For instance, various thermophilic enzymes have been used in industrial biotechnology because of their unique catalytic properties.

Review of Research and Development in the field :

Due to enhanced economic activities and rapid urbanization, waste generation has increased dramatically in the last few decades. Municipal solid waste management (MSWM) is a challenging problem for developing countries. India produces 42 million tones of municipal solid waste annually at present. Municipal solid waste (MSW) in Mumbai is highest being 5355 tons per day followed by Delhi and Kolkata being 4000 and 3692 tons per day respectively. When solid waste is disposed off on land in open dumps or in improperly designed landfills (eg. In low lying areas), it causes and adverse impact on the environment, such as ground water contamination, generation of inflammable gases, acidity to surrounding soil, release of green house gases etc.(CPCB, 2017)

Namasivayam and Bharani (2012), had studied on the plant growth promoting effect of compost derived from decomposed fruit wastes by commercial formulation of Effective Microorganisms (EM) on plant growth parameters. EM, a culture of co-existing beneficial microorganisms predominantly consisting of lactic acid bacteria, photosynthetic bacteria, yeast, fermenting fungi and actinomycetes that are claimed to enhance the decomposition of organic matter which in turn improves the soil fertility. In the present study, the fruit wastes were effectively decomposed by applied effective microorganisms with complete reduction of volume of wastes, development of pleasant odour and formation of finely dispersed nutritious compost with 672.0, 708.0, 2927.0, 13.02 mg/kg and 35.1% of total nitrogen, phosphorous, potassium, humic acid and organic carbon. The plant growth parameters such as shoot length, leaf surface area, and total chlorophyll, height of the plant, total leaves and branches emerged in the plant, total foliage density/plant was increased in compost treated plants and distinct reduction in pest infestation and disease spots were recorded. As in plant growth parameters, compost treated plot reveals maximum phyllosphere, soil heterotrophic microbial population and soil nutrients via total nitrogen, phosphorous, potassium, organic carbon and humic acid. Total yield and cost benefit ratio was also increased in compost treated plots.

Shyamala and Belagali (2012) studied the changes occurring during the decomposition of municipal solid waste, through the estimation of some typical physico-chemical, biological characteristics and heavy metal concentrations. Changes in the composition characteristics of the compost over-time, included increased electrical conductivity, bulk density, water holding capacity and total soluble solids etc., during the decomposition process, whereas the moisture content got reduced towards the end of composting (with final moisture content being around 29 %). The changes in these characteristics appeared to reflect the microbial activity and biomass present. The successive levels of composting process, pathogenic bacterial populations decreased, physico-chemical analysis of compost from the point of view

References

1. CPCB. CPCB annual review report. Ministry of environment, forests & climate change, Delhi. May, 2017.
2. Pan, I. Dam, B. (2011). Composting of common organic wastes using microbial inoculants. Springerlink.com
3. Shyamala D.C, Belagali S.L (2012). Studies on Variations in Physico-Chemical and Biological Characteristics at Different Maturity Stages of Municipal Solid Waste Compost. International journal of environmental sciences volume 2, No 4, ISSN 0976 – 4402.
4. Niño, Rivera and Ramirez (2012). Production of organic fertilizer with Macro-Micronutrients from the solid waste generated at home. Pelagia Research Library. European Journal of Experimental Biology, 2012, 2 (1):199-205.
5. Shwetha n. And Ganajaxia (2017). Growth and yield of urdbean *(Vigna mungo l. Hepper)* as influenced by sunflower (helianthus annuus l.) Residue management. International Journal of Agriculture Sciences. ISSN: 0975-3710&E-ISSN: 0975-9107,
6. S. Karthick Raja Namasivayam, R.S. Arvind Bharani (2012). Effect of Compost Derived from Decomposed Fruit Wastes by Effective Microorganism (EM) Technology on Plant Growth Parameters of Vigna mungo. Journal of Bioremediation & Biodegradation. DOI: 10.4172/2155-6199.1000167.

Relevance to social benefit by this R&D in the proposed area :

1. This study has a various purpose: to identify challenges inherent to municipal solid urban wet waste management and disposal and developing a sustainable method.
2. Environment and Health protection by minimisation of wet waste in to a ecofriendly product as natural fertilizer using the optimum environmental conditions in the composting pit.
3. Economical benefit of the prepared compost and utilisation of the prepared compost in maintaining the city clean and green.

Work plan (Month)

1. Pit construction and preparation of compost: For composting, two concrete pit of dimensions 1m width, 2m length and 2m depth was constructed. Wet waste sample from the collage canteen and dry leaf waste from college compound was segregated and layered on the pit. Fermentative organisms culture and fruit waste were added to initiative the process. 500g of soil was sprinkled to charge the pit with diversified variety of soil organisms which convert the wet waste into simple forms so they can be easily get converted and utilised by the organisms into humus like substances. Moisture content was maintained by watering the pit on alternate days. Churning and mixing of whole mixture was done as per the protocol. Once the first pit was filled, it was partially covered with a banana or palm leaf and left for few days to get mature compost. Later on the second pit was used in the similar way. The first pit compost gets ready to be used now for testing. (July 2019-Sep 2019)

2a. Physicochemical analysis of the prepared compost: The prepared compost sample were analysed for various tests like pH, Moisture content, specific gravity C-N content, Calcium content, P content etc. using standard methods. (Oct. 2019)

2b. Microbiological analysis of the prepared compost: CFU counts will be performed and isolation of microorganisms from various depths and stages of composting will be performed using a suitable culture media. (Nov.2019)

3. Biochemical characterisation of bacteria using standard methods will be done in the laboratory such as gram nature, oxidative fermentative test, nitrate reduction urease production, cellulase production, amylase production, etc. The bacteria dominating with the multiple types of enzyme production will be identified as a biodegradable microorganisms useful in the wet waste composting process. (Dec. 2019)

4. To check the efficacy of prepared composed by Pot culture method: Pots of approx. 2kg capacity will be used for the study with different concentrations of compost : soil along with the soil and compost control. Healthy *Vigna mungo* seeds were surface sterilised and fixed number of seeds will be planted in the various set of above pots. As per the requirement the pots were watered uniformly. The growth of the plants will be studied and later the twigs will be harvested for the chlorophyll content, protein content and carbohydrate content by standard methods. (Jan 2020-March 2020).

Expected Results, Conclusion and Future plans :

Expected Results: The segregation of wet waste from the institution campus will minimise municipal waste generation and will be helpful to maintain our campus as a clean, green and zero waste generation and its management. The potential isolates from the compost can be beneficial for inoculation in a municipal waste dumping ground for the huge waste bioconversion at a faster rate.

Conclusion: The potential isolates can be also utilised by the industries for their solid waste management program. Municipal wastes dumped area can be biodegraded and bio-converted into the compost. This compost has an economical value too and can be utilised in organic farming. It can be further utilised by the Municipal corporations for making the city green. The outcome of this project will help to maintain each campus more clean and more green. This technique will help to maintain hygienic condition of the city and also supports the clean India movement of the government. This project can benefit various residential societies not only in Mumbai but in our whole country.

Future plans: The pit composting method can be practised in small cities and rural areas also by making them aware with the proper technique of wet waste & agri-waste composting in a stipulated time and its utilization. Hence making and supporting the Clean India Drive of our government.

2 **Collaboration for the proposed project (if any) :** Nil

3 **Details of financial requirements with justification** :

Sr. No.	Head	Amount
1	Consumables and Chemicals	35,000/-
2	Equipments (minor)	15,000/-
3	Travel	12000/-
4	Books & peripheral	15,000/-
5	Contingency	20,000/-
	Total	97,000/-

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4	**Any other information in support of the proposed project :** 1. Biochemical and microbial analysis may provide some relevant microbial enzymes associated with bioconversion of the waste into compost. Further exploration of the microorganisms may enhance the biodegradation of various pollutants into various economical valued products such as fertilizer, biofuel etc. and thereby supports in "Clean India Drive" a project of Govt. of India. 2. This study will provide a cost effective fertiliser in rural areas to farmers for agriculture and fields. 3. Municipal wet waste dumping grounds in highly populated cities like Mumbai will be losing its soil fertility and trees because of huge quantity of mixed biodegradable and recyclable waste generation (5355 tons per day). For restoration of the lost greens this study will be surely beneficial in Mumbai and other cities with huge waste generation. 4. This study will benefit environment by reducing pollution load and in the reduction of nuisance smell created near dumping ground. 5. The findings are having ecofriendly approach to various residential, commercial & institutional campuses in wet waste management and thereby making the campus clean and green. 6. This study is having global impact to protect the environment and ecosystems & therefore, reduce carbon credit.

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Detailed Bio data

1. **Name of the Applicant:** Dr. Sonal C. Upadhyay

2. Mailing Address (Indicate Telephone, Fax E-mail, etc.):

Department of Biotechnology, Vikas College of Arts, Science & Commerce, Kannamwar Nagar 2 Vikhroli (E), Mumbai 83

Mb.: 9892359207

E Mail: sonal.su@gmail.com, sonal_itrc@yahoo.com

3. Date of Birth: 18th March 1976

4. Educational Qualification (Starting from Graduation onwards):

Sr. No.	Degree	University	Year	Subjects	Percentage
1	B.Sc. (Microbiology)	Pt. RSSU, Raipur (CG)	1997	Microbiology Chemistry, Botany, G. A.	57.84%
2	M.Sc. (Microbiology)	Pt. RSSU, Raipur (CG)	1999	Microbio, Biochem, Mol.bio, Immuno, Env. micro. etc.	55.08%
3	Ph.D. (Microbiology)	CSIR-IITR, Lucknow Pt. Ravishankar Shukla University, Raipur	2009	(Microbiology)	Awarded

5. A. Details of Professional Training and Research Experience, specifying period.

Research Experience: 7 years

(1) Research Scholar for Ph. D research work in CSIR- Indian Institute of Toxicological Research, Lucknow, (U.P.) India, in DBT Project & Ministry of Environment New Delhi (Four years & eight months)

(2) Research Scholar in Department of Oceanography, Xiamen University, Xiamen, Fujian Province, P.R. China (One and half years)

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(3) R&D Incharge in Multinational Taiwanese Company at Xiamen Fwusow Ind. & Co. Ltd., Xiamen, P.R. China & Head office (Tiawan). (One and half years)

B. Details of Employment (past & present)

Sl. No.	Designation	Organization	Year	Nature of work
1	Lecturer (Microbiology)	SOS in Life Science, Pt. RSSU, Raipur	July 1999 to Jan 2001	Lectures & practicals of M.Sc. (Microbiology)
2	Research Scholar (DBT Project)	Indian Institute of Toxicological Research (CSIR), Lucknow, U.P.	Feb 2001 to Feb 2003	Ph.D Research work
3	R & D Incharge	Xiamen Fwusow Ind. & Co. Ltd. , Xiamen, P.R. China	Mar 2003 to Feb 2004	QA & QC, Import & Export Incharge
4	Research Scholar	Dept. of Oceanography, Xiamen University, Xiamen, P.R. China	Mar 2003 to Feb 2004	Ph.D Research work
4	Research Scholar	Indian Institute of Toxicological Research (CSIR), Lucknow, U.P.	Mar 2004 to Aug 2005	Ph.D Research work
5	R & D Incharge	Xiamen Fwusow Ind. & Co. Ltd. , Xiamen, P.R. China & Head office (TAIWAN)	Sep 2005 to Feb 2006	QA & QC, Import & Export Incharge
6	Research Scholar	Indian Institute of Toxicological Research (CSIR), Lucknow, U.P.	Mar 2006 to Mar 2007	Ph. D Research work
7	Lecturer(UGC-FIP) (Microbiology)	Elphinstone College, Mumbai	Aug 2007 to Mar 2009	Lectures & practicals of UG (Microbiology)
8	Asst .Professor (Biotechnology)	Vikas College of Arts, Sci. & Com., Vikhroli (E), Mumbai	Since July 2010 **[Continued]**	Lectures & practicals of UG + PG (Biotech.)

C. List of significant publications (Research Papers and Books) during last five Years (with details)

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(1) "Comparative effect of phenol and melanoidin on heavy metal bio-accumulation in potential wetland plant (*Typha latifolia*)".In National Conference proceedings on "Recent Trends & Innovations in Microbial World" organized at CHM College, Ulhasnagar, Thane on Jan. 15-16, 2015

(2) "Bio-efficacy of prepared compost on growth rate, chlorophyll, protein and carbohydrate contents of *Vigna radiata*." In International Conference proceedings jointly organized by Thakur College Mumbai & Academy of Environmental Biology Lucknow on Dec. 21-23, 2015

(3) "Bioaccumulation of heavy metal by Zinc resistant bacteria isolated from metal industry effluent". In Multidisciplinary International Conference on "Science, Sustainability and Society in the Current Scenario: Challenges & Opportunities" organized by Vikas College, Mumbai on Feb. 20, 2016

(4) "Influence of compost amendment with steel industry effluent on growth rate of Foxtail millet (*Setaria italica*)". In Multidisciplinary International Conference on "Science, Sustainability and Society in the Current Scenario: Challenges & Opportunities" organized by Vikas College, Mumbai on Feb. 20, 2016.

(5) "Screening of lead resistant bacteria isolates for bioremediation of heavy metal polluted sites". In Multidisciplinary International Conference on "Integration of Science, Social Science, Humanities and Technology in Current Scenario: The global perspectives". Organized by Vikas College, Mumbai on April 22, 2017.

(6) Biosorption of zinc by metal resistant bacterial isolates from steel industry effluent. In International conference organized by Association of Microbiologists of India 58th Annual Conference at BBAU, Lucknow Nov. 2017

(7) Isolation and characterization of bacterial species from mangrove rhizosphere for microbial bioprospecting. In CSIR-Platinum Jubilee International Conference on. Biotechnological Research and. Innovation for Sustainable Development XV BRSI Convention held at CSIR-IICT, Hyderabad Nov. 22-25, 2018 .

(8) Ethics and Scientific Conduct, Ethics in Human & Animal Studies, Bioethics & Biosafety. In Workshop on "Research Methodology and Research Data Analysis" Organized by University of Mumbai & Recyclers Foundation February 25-26 , 2019

6. Professional recognition, awards, fellowships received:

Fellowship awarded of "Society of Applied Biotechnology" (2012)
Life membership of "Association of Microbiologists of India" (Since 2001)

7. Any other information.

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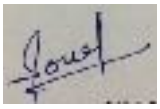
Citation index: 104
Total Impact Factor (2017): 5.409
Full length research publications: 06
Book Chapters: 04
Presented research papers in International &National conference: (18)
Seminars/Workshops/Symposium attended on: (14)
Guided M.Sc. (Biotechnology) Students Research Project: (15)
Organized International Conference/Workshop/Seminars: (05)
Ex-Chairperson Examination B.Voc. M.L.T. (2014-17)
Paper setter/Moderator/Examiner, Univ.of Mumbai for M.Sc.Biotech (Since 2014)
Co-chaired a Scientific session in an International Conference (Nov.16-19, 2017)

Mumbai: 28th Sept, 2019



Place & date: **Signature of the applicant**

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Vidya Vikas Education Society's

VIKAS COLLEGE OF ARTS, SCIENCE & COMMERCE

Affiliated to University of Mumbai
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ISO 9001 : 2008 CERTIFIED
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Dr. R. K. Patra
Principal

Hon'ble Shri. P. M. Raut
Chairman, V. V. Edu. Society

Email : vikascollegeprincipal@gmail.com

www.vikascollege.org

Ref. No. Off. 513/2019-20

Date: 28/9/19

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Dr. Sonal C Upadhyay is working in our college as Assistant Professor in Department of Biotechnology since July 2010 till date.

Her service in this college is more than five years.

This certificate is issued for the purpose of her Minor Research Project to be submitted in University of Mumbai.

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Dr. R. K. Patra
Principal

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Chairman V. V. Edu. Society

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Ref. No. Off. 312/2019-20

Date : 28/9/19

To,

The Assistant Registrar
Academic Planning and Development Section
Room No.132, First Floor
University of Mumbai
Fort, Mumbai 400032

Certified that

I. The University / College is approved under Section 2 (f) and 12- B of the UGC Act.

II. The institute welcomes participation of Dr. Sonal Chaturvedi Upadhyay, as the Principal Investigator in the Proposed Minor Research Project entitled "***Sustainable approach for municipal wet waste management and to analyse efficacy of the prepared compost by pot culture method***". And she will assume full responsibility for implementing the project.

III. The above research project / part of project is not funded by any other funding agency.

IV. The grant-in-aid received for the Research Project will be used to meet the expenditure of the project and the period for which the project has been sanctioned.

V. Institute undertakes the financial and other management responsibilities of the Project and undertake to submit Grant Utilization Certificate and Project Report to the University.

VI. The Institution will provide in-house equipments and basic infrastructure and other required facilities like administrative facilities to the investigator.

Seal

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