Bharath
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Declared as Deemed-to-be University under section 3 of UGC Act, 1956)
(Vide Notification No. F.9-5/2000 - U.3, Ministry of Human Resource Development, Govt. of India, dated 4th July 2002)
Accredited by NAAC
NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL
Phone : 044-22290742 / 22290125 . Telefax : 044-22293886
Website : www.bharathuniv.ac.in
173, Agaram Road, Selaiyur, Tambaram,
Chennai - 600 073. Tamil Nadu.

Ref No.SMS-2018-O-18 Date: 22/07/2019

TO

Mrs. B. Saritha,

Asst. Professor/Civil Engineering,

BIHER.

Thro: Concern Head of the Department

Greetings!!!

We are happy to announce that the Research Advisory Committee has approved your proposal for Seed Money Scheme-2018 which was presented by you. You are requested to complete the proposal and send the progress report to the Dean Research in the prescribed time period.

Title of the Project: Synthesis of Photocatalytic Composite for Enhanced Treatment of Textile Industry Wastewater

Seed Money Amount: Rs.1, 00,000/- (Rupees One Lakh Only)

Approved on: 17/07/2019

Payment details:

Cheque No.375320 **Dated: 17/07/2019**

Bank Name: Indian Bank, Selaiyur, Chennai.

With Regards

Dean-Research

इंडियन बैंक
Indian Bank

सेलैयूर (तांबरम) शाखा, चेन्नई – 600 073
SELAIYUR (TAMBARAM) BRANCH, CHENNAI - 600 073
IFS Code: IDIB000S246

"VALID FOR THREE MONTHS ONLY"

1	7	0	7	2	0	1	9
D	D	M	M	Y	Y	Y	Y

Ms. B. Sarina — या धारक को OR BEARER

रुपये One Lakh Only — अदा करें ₹ 1,00,000/-

CA 6670628110

HMCIA
CBS Code: 02505

: AT PAR AT ALL OUR BRANCHES"

Please sign above

⑈375320⑈ 600019250⑆ 29

PROPOSAL SUBMISSION

1. **Details of Principal Investigator**

Name	: Mrs.B.Saritha
Designation	: Assistant Professor
Highest Qualifications	: M.Tech
Department	: Civil Engineering
E-mail	: sarichaks@gmail.com
Contact no	: 9840346201
Date of Joining	: 19/01/2009

2. **Details of Co - Principal Investigator**

Name	: Dr.R.Venkata Krishnaiah
Designation	: Professor
Highest Qualifications	: Ph.D
Department	: Civil Engineering
E-mail	: venkatapec@gmail.com
Contact no	: 9840261276
Date of Joining	: 07/07/2017

Technical details

1 Introduction

Pollution of water bodies by the untreated effluents discharged from textile dyeing industries is an important problem in developing countries. Several physicochemical and biological methods have been evaluated for the removal of dyes from the water. Physical methods like adsorption on activated carbon and other low-cost adsorbents are reported to be efficient for dye removal. However, they produce a lot of solid wastes, and hence the safe disposal of spent adsorbents itself is a problem for effluent treatment plants. Conventional chemical oxidation and biological methods are also not efficient in the detoxification of the textile effluents due to the complex structure of dyes.

Photocatalysis has been found to be an economical and eco-friendly method for the treatment of various organic pollutants in industrial effluents. In this process, illuminated semiconductor absorbs light and generates active species which oxidize the organic components in wastewater to less toxic compounds like CO2 and water. A distinctive advantage of the photocatalysis lies in its ability to utilize solar energy in the production of hydroxyl radicals. Among various photocatalytic materials, TiO2 has been recognized as the most active photocatalyst in UV light irradiation.

2 Review of status of Research and Development in the subject

Marziyeh Salehi et al, has studies the degradation of methylene blue as a dye pollutant in presence of TiO2 nanopowders using photolysis and sonolysis systems separately and simultaneously.

Effect of different parameters such as catalyst dosage, initial concentration of dye, UV power, pH and type of catalyst on the removal efficiency was ascertained. The results showed that basic pH is proper for the photocatalytic removal of the dye. Furthermore higher UV power and lower initial concentration of dye leads to higher removal percent.

The results revealed that the dye removal was inversely proportional to the initial methylene blue concentration in all processes.

Siew-Teng Ong et al, has studied a photocatalytic decolorization system equipped with immobilized TiO2 to remove a commercial dye from aqueous solution.
The effectiveness of using immobilized TiO2 to remove Methylene Blue was investigated under various operational parameters. The percentage of dye removal increased with increasing irradiation time. The results revealed that the TiO2 loading plays an important role in determining the photocatalytic decoloring efficiency of MB.

G.M. Madhu et al, has studied the aqueous solution of methylene blue(MB) which is subjected to Photocatalytic degradation by UV radiation in presence of TiO2 photo-catalyst containing different concentrations of H2O2.
The experiments conducted at different dye concentrations (12 and 20 ppm), catalyst loading, pH and H2O2 dosage (1-10 ml l-1), revealed that the degradation rate is strongly influenced by respective experimental parameters.

N.P.Mohabansi et al. (2011) studied on photo catalytic degradation of MB using TiO2 & ZnO powder as a photo catalyst under UV radiation.
It was observed that pH; catalyst dosages and H2O2/COD ratio all significantly affect the photo catalytic degradation of MB. The Results of the study indicate that ZnO is very effective & suitable alternative to TiO2.

Shamalah Munusamy et al, has conducted study on photocatalytic activity of TiO2, TiO2/Zn and TiO2/Cu microparticles on Brilliant Green (BG) and their physical and chemical characterization were done and concluded that unmodified TiO2 is a good choice for cationic dye such as BG.
The nature and structure of dye are important parameters to choose a suitable photocatalyst. On the other hand, catalyst loading should be considered as a parameter. For different dyes different loading of catalyst is required. The degradation efficiency of

unmodified TiO2 is 99% for BG at 2g/L of catalyst loading during the period of 120 minutes under UV exposure.

R.M.Mohamed et al, has studied the activity of photocatalytic activity of Fe/ZnO/SiO2 catalysts under visible-light irradiation for the degradation of methylene blue was evaluated.

The effect of pH, illumination time, amount of catalyst loaded, and initial dye concentration on the degradation efficiency of methylene blue was investigated. The results reveal that the optimum photocatalytic oxidation conditions of methylene blue are as follows: pH = 4 and illumination time is 30min, the amount of catalyst loading is 0.075g/L and 50ppm methylene blue dye concentration. Under these conditions, the removal efficiency of methylene blue was 100%.

2.1.International Status:

Advanced oxidation processes (AOPs), which rely on the generation of highly reactive and oxidizing hydroxyl radicals (•OH), are considered as highly competitive wastewater treatment technologies. As an important technology of AOPs, photocatalytic oxidation has attracted increasing attention in recent years because of its excellent performance on pollutants removal, low cost and photochemical stability and without addition of toxic chemicals. More importantly, TiO2-mediated solar photocatalytic oxidation is low cost and environmental friendly and thus may be a promising solution for wastewater treatment.

2.2. National Status:

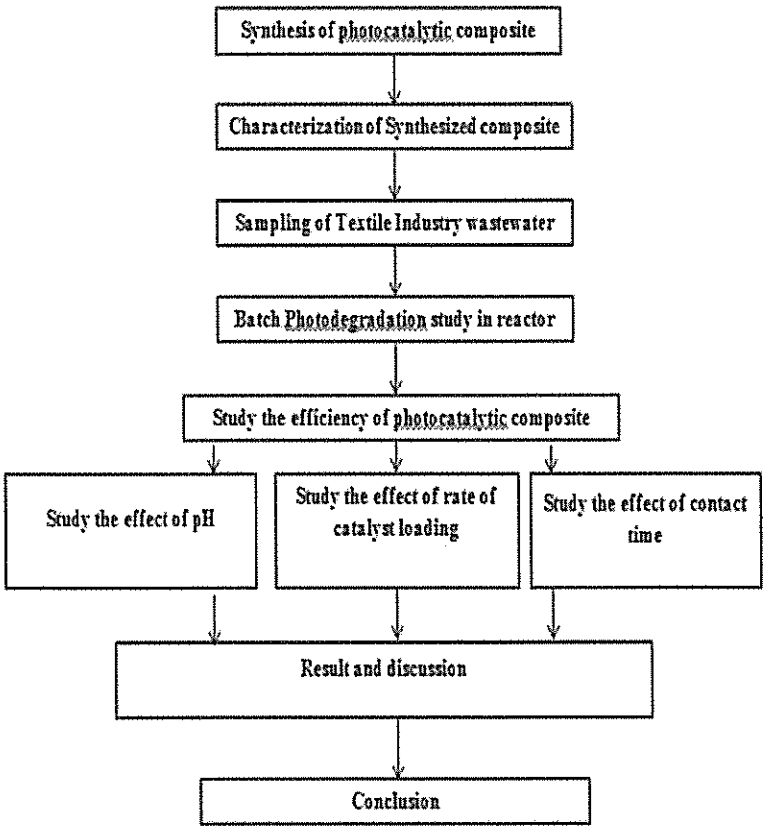
Pollution of water bodies by the untreated effluents discharged from textile dyeing industries is an important problem in developing countries. Several physicochemical and biological methods have been evaluated for the removal of dyes from the water. Physical methods like adsorption on activated carbon and other low-cost adsorbents are reported to be efficient for dye removal. However, they produce a lot of solid wastes, and hence the safe disposal of spent adsorbents itself is a problem for effluent treatment plants. Conventional chemical oxidation and biological methods are also not efficient in the

detoxification of the textile effluents due to the complex structure of dyes. In recent years, various novel technologies such as membrane technology, electrochemical method, and membrane bioreactor (MBR) have been proposed for the treatment of industrial wastewater. Unfortunately, these treatment processes still face several problems, for example, complicated technical requirements, high operational cost, and long reaction time, which severely restrict their applications.

3 Progress/achievement so far,

a) Reference papers were collected.
b) Literatures reviewed. Furthermore literatures to be studied.
c) Proposal work has been started in synthesis of novel Photocatalytic Composite.

4 Work Plan:



4.1 Methodology:

- Synthesis of photoctalyst is based on solgel procedures
- Study of morphology, chemical composition, size and shape of prepared photocatalyst.
- Photocatalytic process is used in which dye wastewater is degraded by the photocatalytic material.
- Documentation, PowerPoint presentation

4.2 Materials

Titanium (IV) Isopropoxide, Ferric Nitrate, Iso Propyl alcohol, ethanol, ethylene glycol and commercial activated carbon were obtained from Lobo chemie, India Pvt Ltd and used as such for the preparation of the photocatalytic composites Methylene blue, Malachite green, Methyl orange and Eriochrome Black-T (EBT)-dyes were used as model pollutants, and all the dyes are of commercial grade, purchased from SRL Chemicals India Ltd. NaOH and H_2SO_4 were used for modifying the pH of the solutions. Potassium dichromate, Ferrous ammonium sulphate, silver sulphate, mercury sulphate, concentrated H_2SO_4 and 99% ferroin indicator were used for chemical oxygen demand analysis (COD). Double de-ionized water was used for the preparation of the dye solutions.

4.3 Synthesis of Photocatalytic Composite

TiO_2 solution was prepared by sol-gel method by mixing 20 ml of Titanium Isopropoxide with 130 ml of Isopropanol. The mixture was vigorously stirred and 5 ml of distilled water was added drop wise to obtain TiO_2 solution. Then few ml of ethanolic solution of Ferric Nitrate (2 % solution) were added to it and the mixture was sonicated for 2 hours and dried in oven at 100 °C for 10 hours. Then it was calcinated at 450°C for 5 hours to obtain Fe/TiO_2 photocatalytic composite.

TiO_2 solution was prepared by sol-gel method by mixing 20 ml of Titanium Isopropoxide with 130 ml of Isopropanol. The mixture was vigorously stirred and 5 ml of distilled water was added drop wise to obtain TiO_2 solution. Then few grams of commercial activated carbon were added to TiO_2 solution .The mixture was sonicated for 2 hours and dried

in oven at 100 °C for 10 hours. Then it was calcinated at 450°C for 5 hours to obtain AC/TiO_2 photocatalytic composite.

4.4 Photocatalytic Degradation Studies

The photocatalytic batch study was conducted in a photo reactor which consisted of a 500 ml beaker provided with UV lamp and an aerator which has been shown in Figure 3.1. An 8 watts lamp from Phillips emitting UV light of wavelength 254 nm was used as the UV light source. The diameter and height of the beaker were 5 cm and 30 cm respectively. The aqueous solution of dyes of 20 mg/l concentration and the reaction volume of 200 ml were taken.

The degradation was studied with photocatalyst which were added in the reactor. The reaction mixture was then subjected to UV irradiation. Aliquots were taken at different time intervals and analyzed for dye degradation after centrifugation. The dye degradation (decolorization) was monitored by UV-Visible spectrophotometer at the maximum wavelength for dyes. The dye degradation was determined using Equation (3.1)

$$\% \text{ Degradation} = (A_0 - A_t) / A_0 \times 100 \qquad (3.1)$$

Where A_0 is the absorbance at zero time and A_t is the absorbance at any time 't'. The degree of mineralization of the real textile industry wastewater was as certained by measuring the COD removal at different time intervals using closed reflux titrimetric method.

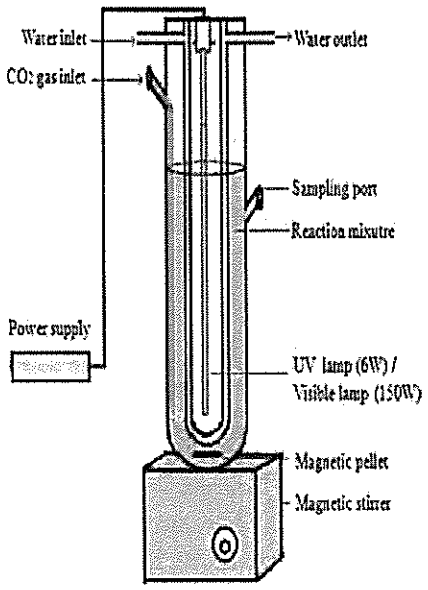


Figure 3.1 Photocatalytic Reactor

4.5 Characterization of Synthesized Photocatalytic Composites

To study the crystal structure and crystallinity of the synthesized photocatalysts and reference samples, X-ray diffraction (XRD) analysis was performed on X'Pert PRO using Cu Kα (λ = 1.5406 Å) radiation. Fourier transform infrared spectroscopy (FTIR) was carried out using Thermo Scientific Nicolet 6700 spectrometer to detect the presence of carbon group on the samples. The energy dispersive system spectra (EDS) were also analyzed. The EDS analysis was performed to find the elemental compositions of synthesized photocatalysts.

4.6 Time Schedule of activities giving milestones through BAR diagram.

Work plan (including detailed methodolo4gy and time schedule)

Sl. No.	Activity / Milestone	1st Year		2nd Year	
1.	Literature review	1-6			
2.	Synthesis / Characterization of Photocatalyst		7-12		
3.	Photocatalytic study			13-18	
4.	Final Report				19-24

4.7 Expected outcome within the time period of Seed Money Scheme

a) Identification of an appropriate novel photocatalyst for degradation of textile wastewater.
b) Stable and Reusable photocatalyst.
c) Publications of the research in the refereed journals.

5 Suggested Plan of action stating the name of funding agency where the project will be communicated for financial support within the time period of project. Nil

6 **Bibliography:** Nil

7 **List of Projects submitted/implemented by the Investigators (Separate for PI and Co-PI)** Nil

7.1 Details of Projects submitted to various funding agencies:

Sl. No.	Title	Cost in lakhs	Month of submission	Role as PI/ Co-	Agency	Status
	NA	NA	NA	NA	NA	NA

7.2 Details of Projects under implementation

Sl. No.	Title	Cost in lakhs	Duration	Role as PI/ Co-PI	Agency
	NA NA	NA	NA	NA	NA

7.3 Details of Projects completed during the last 5 years

Sl. No.	Title	Cost in lakhs	Duration	Role as PI/ Co-PI	Agency
	NA	NA NA	NA	NA	NA

8 **List of publications published by the Investigator, if any:**

a) **Principal Investigator**

S.No	Author Name	Paper Title	Journal Name	ISSN	Volume& Issue	Year
1	B.Saritha, M.P.Chockalingam	Photodegradation of methylene blue dye in aqueous medium by Fe-AC / TiO2 Composite	Nature Environment and Pollution Technology	0972-6268	17 (4)	2018
2	R. B. Shendge, Dr. M. P. Chockalingam, B. Saritha and A. Ambica	Swat modelling for sediment yield: A case study of Ujjani reservoir in Maharashtra, India	International Journal of Civil Engineering and Technology	0976-6308	9(1)	2018
3	A.Ambica, B.Saritha, Gokia Changring, Bimol Singh N, Mana Rajen, Md. Salman	Analysis of groundwater quality in and around Tambaram taluk, Kancheepuram district	International Journal of Civil Engineering and Technology	0976-6308	8(8)	2017

4	B.Saritha, M.P.Chockalingam	Adsorption study on removal of basic dye by modified coconut shell adsorbent	International Journal of Civil Engineering and Technology	0976-6308	8(8)	2017
5	B.Saritha, M.P.Chockalingam	Adsorptive removal of heavy metal chromium from aqueous medium using modified natural adsorbent	International Journal of Civil Engineering and Technology	0976-6308	8(8)	2017
6	B.Saritha, M.P.Chockalingam	Photodradation of malachite green Dye using TIO 2 /activated carbon composite	International Journal of Civil Engineering and Technology	0976-6308	8(8)	2017
7	Saritha, B., Rajasekhar, K.	Removal of malachite green and methylene blue using low cost adsorbents from aqueous medium-a review	Middle East Journal of Scientific Research	1779-1784	17(12)	2013
8	Saritha, B., Chockalingam, M.P.,Dr. T.E. Kanchanabhan, L. Mariasubashini	Batch Adsorption Study of Methyl Violet Dye in Aqueous Medium using Coconut Shell Adsorbent	International Journal of Civil Engineering and Technology	0976-6308	10(3)	2019
9	B.Saritha, M.P.Chockalingam	Photocatalytic Degradation of Anionic Dye using Fe/TiO2 Composite.	Research Journal of Pharmaceutical, Biological and Chemical Sciences	0975-8585	9(3)	2018
10	Saritha Banuraman , Meikandaan.T.P.	Treatability Study of Tannery Effluent by Enhanced Primary Treatment	International Journal of Modern Engineering Research	2249-6645	3(1)	2013
11	B. Saritha, A. Ambica , Dr. M.P. Chockalingam	Ground Water Analysis for Physical and Chemical Parameters in Chromepet Area	Civil and Environmental Research	2224-5790	8(6)	2016
12	B.Saritha Dr.M.P.Chockalingam Hiraj Jha	Chromium Removal from Aqueous Medium Using Modified Sawdust	Journal of Natural Sciences Research	2224-3186	6(11)	2016
13	B.Saritha, M.P.Chockalingam	Photodegradation of Eriochrome Black-T Dye From Aqueous Medium By Photocatalysis	International Journal of Pure and Applied Mathematics	1311-8080	116(13)	2017
14	B.Saritha, M.P.Chockalingam	Degradation of Malachite Green Dye Using a Semiconductor	International Journal of Pure and Applied	1311-8080	116(13)	2017

		Composite	Mathematics			
15	B.Saritha, M.P.Chockalingam	Photocatalytic Treatment of Textile Dye Wastewater Using TiO2 / UV Light	International Journal of Pure and Applied Mathematics	1311-8080	116(13)	2017
16	B.Saritha, M.P.Chockalingam	Synthesis of Photocatalytic Composite Fe-C /TiO2 For Degradation Of Malachite Green Dye From Aqueous Medium	International Journal of Pure and Applied Mathematics	1311-8080	116(13)	2017
17	B.Saritha, Abhishek Singh, Amson, Dhiraj Jha, Khriezo Kiso	Adsorption Of Chromium (VI) From Aqueous Solution Using Sugarcane Bagasse As Adsorbent	International Journal of Engineering Trends and Technology (IJETT)	2231-5381	2(3)	2011
18	Saritha Banuraman , Veda Madavan , Silari Venkatesh	Treatability Study of Tannery Effluent by Conventional Activated Sludge Process and Activated Sludge Process using Medium	International Journal of Biotech Trends and Technology (IJBTT)	2249-0183	3(4)	2013
19	B.Saritha, M.P.Chockalingam	Evaluation and Characterization of Tannery Wastewater	International Journal of Pure and Applied Mathematics	1314-3395	119(12)	2018
20	B.Saritha, K.Rajasekhar	Enhanced Removal of Turbidity From Wastewater by Ferric Chloride and Alum	International Journal of Engineering Trends and Technology (IJETT)	2231-5381	3(5)	2012
21	B.Saritha, A.Ambica, G.Sharmilaa , J.Chmundeeswari	Study of Efficiency of Ferric Chloride, Aluminium Sulphate and their Combination for Treatment of Tannery Effluent	International Journal of Engineering Trends and Technology (IJETT)	2231-5381	1(3)	2011
22	B.Saritha, G.Sharmilaa	Study of Removal of COD by Guargum With Coagulants Alum and Polyaluminium Chloride in Wastewater Treatment	International Journal of Biotech Trends and Technology (IJBTT)	2249-0183	2(2)	2012
23	B.Saritha, A.Ambica	Study of removal of Turbidity from Tannery Effluent by using	International Journal of Engineering	2231-5381	2(2)	2011

		Guargum with Coagulants Alum and Poly Aluminium Chloride	Trends and Technology (IJETT)			
24	Saritha Banuraman , Veda Madavan	Study of Ground Water in Perungudi Area of Chennai: Correlation with Physico-Chemical Parameters	Civil and Environmental Research	2224-5790	1(1)	2011
25	Saritha Banuraman , Veda Madavan , Silari Venkatesh	Study of Activated Sludge Process using Medium in Treatment of Wastewater	International Journal of Engineering Trends and Technology (IJETT)	2231-5381	1(2)	2011
26	Saritha.B, Kunguma Sathish M , Arunrajkumar R V	Experimental Study Of Tea Waste As Adsorbent Inremovalof Chromium(Vi) From Aqueous Solution	International Journal of Engineering Trends and Technology (IJETT)	2231-5381	2(2)	2011

b) Co-Principal Investigator

Sl. No.	Title of the Article	Name of the Journal	Page, Volume & Year
1	Experimental Study on Strength of High Volume High Calcium Fly Ash Concrete	IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)	Volume 5, Issue 4 (Jan. - Feb. 2013), PP 48-54
2	Mechanical and Durability Properties of HVHC Fly Ash Concrete	European Journal of Scientific Research	Volume 96 No 4 February, 2013 PP 582-590
3	Effect of Quarry Dust on Waste Plastic Fiber Reinforced Concrete-an Experimental Study	Research in Civil and Environmental Engineering	Volume 1 (04) 2013 PP 234-238
4	Analysis of Risk Management in Construction Sector Using Fault Tree Analysis	Research in Civil and Environmental Engineering	Volume 2 (02) 2014 PP 66-73
5	Strength Properties of Concrete Using Crumb Rubber with Partial Replacement of Fine Aggregate	International journal of innovative research in science, engineering and technology	Volume 4, Issue 3, March 2015
6.	Bulk Utilization of Flyash in Self Compacting Concrete	KSCE Journal of Civil Engineering (Annexure-1 of	Volume 19(7),pp 2116-2120

		Anna university)	
7.	Management of waste minimization in construction industry using lean technology	International Journal of latest technology in engineering, management and applied science	Volume 4(3),pp53-57 March 2014
8.	Effect of Quarry Dust on Class C Fly Ash Concrete	International Journal of Engineering Development and Research	Volume 4 Issue 1 February 2016 PP 291-297
9.	Optimization of Resourced Demands in Construction of a Residential Building	International Journal of Engineering Research-Online	Volume 4 Issue 3 (May-June)2016 PP 483-487
10.	Use of Ceramic Waste Insulator as a Coarse Aggregate in Concrete	International Journal of Modern Trends in Engineering and Science	Volume 3 Issue 6 2016 PP 45-49
11.	Strength and Durability Characteristics of Concrete Using Metakaolin and Foundry Sand	International Journal of Modern Trends in Engineering and Science	Volume 3 Issue 7 2016 PP 143-146

9 Budget

Sl. No.	Equipment	Quantity	Amount in INR
1	Photocatalytic Reactor	1	50,000
	Glasswares	As per requirement	10,000
2	Consumables (Chemicals)	As per requirement	25,000
3	Travel support for the purpose of research work.	---	5,000
4	Contingency	---	5000
5	Others	---	5000
	Total		1,00,000

10 Name of at least two subject experts from the Institute and one from the outside Institute with their contact details:

Dr.M.P.Chockalingam– Professor, Dept. of Civil, BIHER, Chennai-600073.
Dr.S.Senthil Selvan – Professor, Dept of Civil, SRMIST, Chennai.

CERTIFICATE FROM THE INVESTIGATOR

Project Title: **Synthesis of Photocatalytic Composite for Enhanced Treatment of Textile Industry Wastewater**

It is certified that

1. I do hereby agree to submit a complete proposal for financial support to the external funding agency within the time period of SMS-2019
2. I undertake that spare time on equipment procured in the project will be made available to other users.
3. I agree to submit a certificate from Institutional Biosafety Committee, if the project involves the utilization of genetically engineered organisms. I also declare that while conducting experiments, the Biosafety Guidelines of Department of Biotechnology, Department of Health Research, GOI would be followed in to.
4. I agree to submit ethical clearance certificate from the concerned ethical committee, if the project involves field trails/experiments/exchange of specimens, human & animal materials etc.
5. I agree to abide by the terms and conditions of SMS-2019, BIHER, and Chennai.

Name and signature of
Principal Investigator
(B. SARITHA)

Name and signature of
Co-Principal Investigator
(Dr. R. Venkata Krishnaiah)

Date: 14/06/2019
Place: Chennai - 73

Forwarded by Head of the Department

Signature of the Head

PROJECT EVALUATION FORMAT

Recommendation Sheet

Name of the Principal Investigator	Mrs.B.Saritha
Name of the Co-Investigator	Dr.R.Venkata Krishnaiah
Name of the Department	Civil Engineering
Title of project	Synthesis of Photocatalytic Composite for Enhanced Treatment of Textile Industry Wastewater
Recommendation of the evaluation committee	Recommended
Financial allocation recommended	Rs. 1,00,000

Sl. No.	Equipment	Quantity	Amount in INR
1	Photocatalytic Reactor	1	50,000
	Glasswares	As per requirement	10,000
2	Consumables (Chemicals)	As per requirement	25,000
3	Travel support for the purpose of research work	---	5,000
4	Contingency	---	5000
5	Others	---	5000
	Total		1,00,000

Name and Signature of the Research Advisory Committee members with date

Dr. P. Nava[illegible]

Internal Quality Assurance Cell IQAC Selaiyur Chennai