

**UNIVERSITY GRANTS COMMISSION**  
**BAHADUR SHAH ZAFAR MARG**  
**NEW DELHI – 110 002**

**STATEMENT OF EXPENDITURE IN RESPECT OF MINOR RESEARCH PROJECT**

1. Name of Principal Investigator : Dr. Manu V
2. Deptt. of PI : Chemistry  
 Name of College : St. Gregorios College, Kottarakara, Kerala
3. UGC approval Letter No. and Date : **2340-MRP/15-16/KLKE022/UGC-SWRO**  
**Dated 25/04/2016**
4. Title of the Research Project : **Novel Organo-Functionalized Mesoporous Silica Based Materials Synthesized for the Eco-friendly Applications**
5. Effective date of starting the project : 01/06/2016
6. a. Period of Expenditure : From 01/06/2016 to 31/05/2018  
 b. Details of Expenditure

Sl.No.	Item	Amount Approved (Rs.)	Expenditure Incurred (Rs.)
1	Books and Journals	20000/-	24563/-
2	Fieldwork and Travel (Give details in the Proforma)	20000/-	20550/-
3	Contingency	50000/-	50500/-
4	Chemicals and Glassware	200000/-	201000/-
5	Any other / Special Needs	60000/-	60500/-
<b>Total</b>		<b>350000/-</b>	<b>357113/-</b>

Total Amount Approved : 350000  
 Total amount received from UGC : 185000  
 Total amount including interest : 350000  
 Total amount received : 185000

Total expense : 357113/-

**Balance approved amount to be received from UGC : 350000 – 185000 = Rs. 165000**

7. If as a result of check or audit objection some irregularly is noticed at later date, action will be taken to refund, adjust or regularize the objected amounts.
  
8. It is certified that the grant of **Rs. 350000/- (Rupees Three Lakh Thirty Five Thousand Only)** received from the University Grants Commission under the scheme of support for Minor Research Project entitled **Novel Organo-Functionalized Mesoporous Silica Based Materials Synthesized for the Eco-friendly Applications** vide UGC letter No. F. **2340-MRP/15-16/KLKE022/UGC-SWRO** dated **25-04-2016** has been fully utilized for the purpose for which it was sanctioned and in accordance with the terms and conditions laid down by the University Grants Commission.

**SIGNATURE OF PRINCIPAL INVESTIGATOR**

**PRINCIPAL**

**(Seal)**

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**STATEMENT OF EXPENDITURE INCURRED ON FIELD WORK**

**Name of the Principal Investigator: Dr. Manu V**

Name of the Place visited	Duration of the Visit		Mode of Journey	Expenditure Incurred (Rs.)
	From	To		
Trivandrum	09.07.2016	09.07.2016	Taxi	2300
Trivandrum	06.08.2016	06.08.2016	Taxi	2300
Trivandrum	22.10.2016	22.10.2016	Taxi	2300
Ernakulum	27.02.2017	27.02.2017	Taxi	4450
Trivandrum	26.10.2017	26.10.2017	Taxi	2300
Trivandrum	27.10.2017	27.10.2017	Taxi	2300
Trivandrum	6.11.2017	6.11.2017	Taxi	2300
Trivandrum	28.4.2018	28.4.2018	Taxi	2300
<b>Total Expenditure Incurred (From 01/06/2016 to 31/05/2018)</b>				<b>20550/-</b>

Certified that the above expenditure is in accordance with the UGC norms for Minor Research Projects.

**SIGNATURE OF PRINCIPAL INVESTIGATOR**

**PRINCIPAL**

**(Seal)**

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**Utilization certificate**

Certified that the grant of **Rs. 350000/- (Rupees Three Lakh Thirty Five Thousand Only)** received from the University Grants Commission under the scheme of support for Minor Research Project entitled **Novel Organo-Functionalized Mesoporous Silica Based Materials Synthesized for the Eco-friendly Applications** vide UGC letter No. F. **2340-MRP/15-16/KLKE022/UGC-SWRO** dated **25-04-2016** has been fully utilized for the purpose for which it was sanctioned and in accordance with the terms and conditions laid down by the University Grants Commission.

SIGNATURE OF THE  
PRINCIPAL INVESTIGATOR

PRINCIPAL

(Seal)

STATUTORY AUDITOR

(Seal)

## 11. OBJECTIVES OF THE PROJECT: **Novel Organo-Functionalized Mesoporous Silica Based Materials Synthesized for the Eco-friendly Applications**

The major objective of this project was synthesis and characterization of mesoporous silica based hybrid materials for their real applications like metal adsorption and drug delivery system

## 12. WHETHER OBJECTIVES WERE ACHIEVED: **Yes**

These adsorbent is very effective for the removal of contaminated metals from effluent water system.

13. ACHIEVEMENTS FROM THE PROJECT: One manuscript is published for publication in Materials today proceedings . There is a paper presentation in a UGC funded national seminar. Six MSc Chemistry students were motivated and trained to obtain dissertation thesis from this work and submitted to Kerala University as part of their curriculum.

## 14. SUMMARY OF THE FINDINGS (IN 500 WORDS )

The major goals of this project were to create and characterize organic/inorganic hybrids structure, for their real applications. Two silica based materials were selected for these studies; MCM-41 and SBA-15. This material was synthesized under pre-optimized conditions. Surface of MCM-41 and SBA-15 were functionalized with amino (-NH<sub>2</sub>) group using 3-aminopropyltrimethoxysilane (APTMS). Characterization of this mesoporous material before and after functionalization was done using various analytical method..

Adsorption studies of Cu<sup>2+</sup> ions on the amino functionalized MCM-42 and SBA-15 have been investigated. The equilibrium adsorption. Monolayer capacity, function error, distribution coefficient and percentage removal of the metal ions on organo functionalized materials are studied. Effects of various parameters like type and surface concentration of the functional groups on the adsorption behavior of metal ions have been studied.

The synthesis and design of mesoporous silica (MCM-41) for drug delivery applications. The drug loading was confirmed by the decrease of specific surface area and pore volume between MCM-41 and the drug loaded compound. The studies reported here established the ability to load drugs and analytes into the mesopores/alginate composites and release by controlling the morphology and stimuli responsiveness. The compounding of the MCM-41 materials with AL led

to the decrease in the delivery rate appreciably of amitriptyline. The release profiles of AT from composites were best fitted in Higuchi kinetic model, and Korsmeyer–Peppas model suggested non fickian diffusion release mechanism.

**15. CONTRIBUTION TO THE SOCIETY : Yes**

The accumulation of  $\text{Cu}^{2+}$  at high concentrations in the human body causes skin, brain, pancreas, and heart diseases and also causes liver and kidney damage. Copper metal readily corrodes in water to yield copper ions ( $\text{Cu}^{2+}$ ), which are of greater concern to the Environmental Protection Agency (EPA) than copper metal. Copper is commonly used in the electrical and electroplating industry, in agricultural poisoning, and as an algicide in water purification. As heavy metals are not biodegradable like organic pollutants, the removal of heavy metals is very important in environmental remediation and cleanup efforts for the removal of metal ions. Functionalized MCM-41 and SBA-15 are very effective adsorbent for the removal of contaminated metals from effluent water system. Drug delivery system also useful for the society.

**16. WHETHER ANY PH.D. ENROLLED/PRODUCED OUT OF THE PROJECT: No**

**17. NO. OF PUBLICATIONS OUT OF THE PROJECT:**

One manuscript is published in Materials today: proceedings the title “ Mesoporous silicate/alginate composites as a carrier for amitriptyline 4 hydrochloride and in vitro release” [41](#), [3](#), 2021, 752-757. Six MSc Chemistry students submitted their dissertation to Kerala University as part of their curriculum.

**(PRINCIPAL INVESTIGATOR )**

**(PRINCIPAL)**

**(Seal)**