Development of Thermostatic Closed System Microwave Reactor (TCSMR) Synthesis of Low Molecule Weight Chitosan/Chitosan nanoparticles/nano Composite"

MAHARASHTRA POLLUTION CONTROL BOARD

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By: RPAD/ Email

No. MPCB/MS/BMW/B- 210205-FTS-0121 Date: 05/02/2021

To,
The Director General
Vasantdada Sugar Institute,
Manjari (BK), Tal.Haveli,
Dist.Pune – 412307

WORK ORDER

Sub : "Development of Thermostatic Closed System Microwave Reactor for Synthesis of Low Molecule weight Chitosan/ Chitosan Nanoparticles" – reg.

Ref: 1. Email dated 29.09.2020 and 20.10.2020 received from Director General of M/s Vasantdada Sugar Institute, Manjari (BK), Tal.Haveli, Dist.Pune
2. Online Presentation by VSI to MPCB through video conferencedated 26.10.2020
3. Proposal received from Principal Investigator, VSI vide email dated 09.11.2020

With reference to the presentation conducted on 26.10.2020 and proposal submitted by you vide above referred email for "Development of Thermostatic Closed System Microwave Reactor for Synthesis of Low Molecule weight Chitosan/ Chitosan Nanoparticles" it is to inform you that your proposal dtd. 9.11.2020 is accepted by Maharashtra Pollution Control Board (MPCB) as per terms and conditions mentioned here below,

1. **Preamble:**

Effect of climate change has increased vulnerability of agriculture production. Extreme climate changes such as drought, excess rain, effect of pollution on land, water and air is causing stress to agricultural crops and its productivity. And therefore, use of growth promoting , stress tolerance inducing compounds of natural origin are gaining lot of importance in sustainable agricultural practices.

Sea food industry generates huge quantity of crustacean shell waste which has good source of chitosan, the polymer with amazing properties and applications in field of Chemical, Pharmaceutical, Biomedical, Agriculture, etc. In agriculture chitosan is effective in managing abiotic and biotic stress and improve the productivity. Use of Chitosan Nano particles are widely applied for sustainable agricultural.

VSI, Pune and BARC, Mumbai has optimised and recommended through JOINT AGRESCO-2018 the irradiated chitosan (Oligo chitosan) using gamma irradiation and electron beam. There is huge demand for oligo chitosan for different applications, however commercial production of oligo chitosan has limited due to limited availability of gamma radiation/ electron beam facility. Therefore, the proposed project intends to use microwave technology and develop and optimised microwave of 500 lit. capacity for production of Oligo chitosan.

2. **Project Title :-**

"Development of Thermostatic Closed System Microwave Reactor for Synthesis of Low Molecule weight Chitosan/ Chitosan Nanoparticles"

3. **Objective & Scope:-**

i) Design and develop Microwave Reactor System for large scale production of LMWC / CNP
ii) Optimization of process requirements for obtaining derivatives of LMWC / CNP with specific molecular weight / polymeric length / size / zeta potential.
iii) Invitro and field evaluation of LMWC / CNP derivatives for healthy, nutritional food production with sugarcane and allied intercrops.
iv) Development and evaluation of chitosan or other biopolymeric nanocomposites formulations with Silver, Copper, Zinc compounds and their field evaluation.

4. **Project Duration :-Three years.**

I Year

1. Inviting tenders & Selection of competent microwave manufacturers for job work.
2. Designing the prototype for microwave for desired process output.
3. Scaling up the system for large volume with monomode or multimode system with suitable magnetrons.
4. Selecting the proper material/insulation and vents for the use in acid alkali condition, high pressure irradiation, Selecting coolant for maintaining temperature, Fiber optical sensor system indicating perfect temperature Monitoring and data interface system with USB port
5. Irradiation of chitosan with different forms and concentrations.
6. Determination of process outputs and preliminary testing the work efficacy
7. Optimization of dosimetry and process controls for subsurface depth profile for obtaining the low molecular weight chitosan (LMWC)/ chitosan nanoparticles

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8. Characterization of low molecular weight chitosan/ chitosan nanoparticles obtained with UV visible spectroscopy, Viscometery FTIR, , SEM, DLS, XRD, Zeta potential etc techniques

II Year

1. Optimization of process parameters for production of LMWC/ chitosan nanoparticles with different size, shape / molecular weight using different initiators, different concentrations and forms (paste, colloidal or acid solubilized) chitosan.
2. Characterization of LMWC/nano chitosan derivatives produced with UV visible spectroscopy, Viscometery, FTIR, SEM, DLS, XRD, Zeta potential etc
3. Optimization of effect of different derivatives on growth of Tissue Culture Plantlets (TCP's) under laboratory and Green house conditions.
4. Optimization of effect of different derivatives on growth of Singe Eye Bud Settlings (SEB's) production.
5. Evaluation of induced abiotic and biotic stress tolerance by biochemical and gene expression studies.
6. Evaluation of induced abiotic and biotic stress tolerance by biochemical and gene expression studies with TCP's and SEB's

III Year

1. Field evaluation of effect selected nanochitosan derivative as foliar sprays on cane yield and sugar production with quantitative and qualitative traits.
2. Optimization of process parameters for production of LMWC/ chitosan nanoparticles with different size, shape / molecular weight using different initiators/oxidizing agents, different concentrations and forms (chitosan paste, colloidal or acid solubilized) of chitosan.
3. The effect will also evaluated on vegetables as intercrops in sugarcane with pest and disease incidence as well as quantitative and qualitative crop yield parameters.
4. The copper nanocomposits synthesis will be attempted to see efficacy of synthesis under developed microwave system.
5. Zink nanocomposits synthesis will be attempted to see efficacy of synthesis under developed microwave system.
6. Multilocation large scale adaptive trials of nanochitosan applications on different crops for dissemination and popularization of technology.
7. Data compilation and report preparation and Filing IPR.

8. Cost of the Project :-

Total Cost of the Project inclusive of all expenditure for three years duration including GST is Rs. Eighty One lakh and forty thousand only.

Financial Budget

	Budget Budget estimates (as per the table given below) cost given in Lakh Rs.			
	I year	II year	III year	Total
Budget head				
A. Capital				
Prototype Designing and Model Microwave unit preparation	15.00	--	--	15.00
Micropipettes	0.50	0.00	0.00	0.50
GPC column for chitosan size exclusion chromatography	3.50	0.00	0.00	3.50
Total	19.00	0.00	0.00	19.00
GST@ 18%	3.42	--	--	3.42
			Grand Total	22.42
B. Recurring				
i) Temporary project staff				
ii) Junior Research Fellow (2 Nos) 1 Analytical Chemistry/ Chemical Engg.) Rs 31,000 + HRA (10 %) 2 M.Sc. Biotech/Agri Biotech /Biochem. Rs 31,000 + HRA (10 %)	8.19	8.19	8.97	25.35
iii)Material cost for experimentation with MRS	5	5	0	10
iv) Consumables and chemicals	1.00	2.00	3.00	6.00
v) Analytical Charges (FTIR, DLS, SEM, XRD etc)	2.00	4.00	2.00	8.00
iv) Travel in India	0.50	0.50	0.50	1.50
v) Contingencies/Miscellaneous	0.50	0.50	0.50	1.50
vi) Overheads	0.50	0.50	0.50	1.50
Total (i to vi)	17.69	20.69	15.47	53.85
GST@ 18% (except c. Salary component)	1.71	2.25	1.17	5.13
Grand Total	19.40	22.94	16.64	58.98

Total A+ Total B = 81.40 (Lakh Rs.)

Rs. Eighty one lakh and forty thousand only

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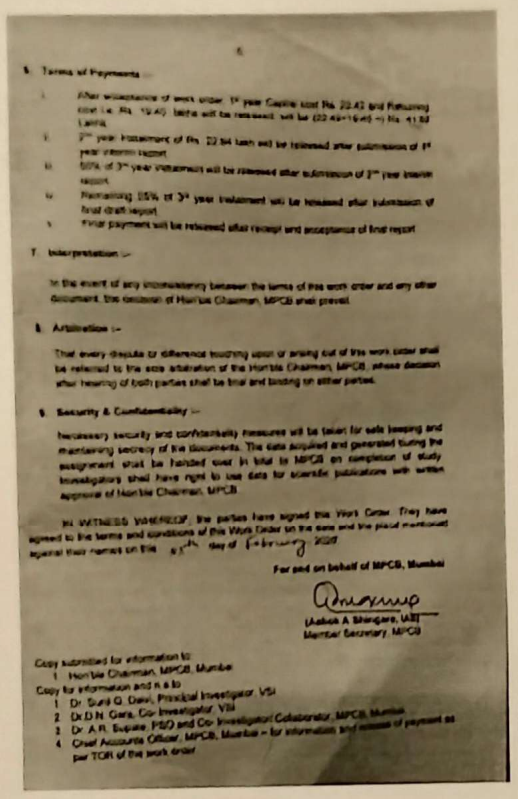

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5. Terms of Payments :-

i. After acceptance of work order, 1st year Capital cost Rs. 22.42 and Recurring cost i.e. Rs. 19.40 lakhs will be released, will be (22.42+19.40) = Rs. 41.82 Lakhs.

ii. 2nd year Instalment of Rs. 22.94 lakh will be released after submission of 1st year interim report.

iii. 50% of 3rd year instalment will be released after submission of 2nd year interim report.

iv. Remaining 05% of 3rd year instalment will be released after submission of final draft report.

v. Final payment will be released after receipt and acceptance of final report.

7. Interpretation :-

In the event of any inconsistency between the terms of this work order and any other document, the decision of Hon'ble Chairman, MPCB shall prevail.

8. Arbitration :-

That every dispute or difference touching upon or arising out of this work order shall be referred to the sole arbitration of the Hon'ble Chairman, MPCB, whose decision after hearing of both parties shall be final and binding on either parties.

9. Security & Confidentiality :-

Necessary security and confidentiality measures will be taken for safe keeping and maintaining secrecy of the documents. The data acquired and generated during the assignment shall be handed over in total to MPCB on completion of study. Investigators shall have right to use data for scientific publications with written approval of Hon'ble Chairman, MPCB.

IN WITNESS WHEREOF, the parties have signed this Work Order. They have agreed to the terms and conditions of this Work Order on the date and the place mentioned against their names on this 27th day of February 2019.

For and on behalf of MPCB, Mumbai

(Ashish A Shirgare, IAS)
Member Secretary, MPCB

Copy submitted for information to:
1. Hon'ble Chairman, MPCB, Mumbai

Copy for information and n.a.to
1. Dr. Sunil G. Dixit, Principal Investigator, VSI
2. Dr.D.N. Gaikwad, Co-Investigator, VSI
3. Dr. A.R. Supate, PSO and Co-Investigator/ Collaborator, MPCB, Mumbai
4. Chief Accounts Officer, MPCB, Mumbai – for information and release of payment as per TOR of the work order

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Utilization Certificate

Certified that Grant-in-aid of **Rs. 81,40,000/- (Rupees Eighty one Lakh Forty thousand only)** was sanctioned by **Maharashtra Pollution Control Board, Mumbai-400022** vide their RPAD/Email no. MPCB/MS/BMW/B-210205-FTS-0121 dated 5th February.2021.

The Opening balance for the year 2022-23 is **Rs.36,64,072/-**. In the year 2022-23 the fund is not received & **Rs.8,80,747/-** is spent in the year 2022-23 from Opening Balance. The unspent balance of **Rs 27,83,325/-** for the year 2022-23. This unspent balance will be utilized in the year 2023-24.

Signature & Seal

Principal Investigator

FOR VASANTDADA SUGAR INSTITUTE

CHIEF ACCOUNTANT

Chief Accountant Institution

14/7/23

Head of Department

Vasantdada Sugar Institute PRI No. F-3728 (MUMBAI) Post Manjari Bk. Pin-412307.

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Principal
Vasantdada Sugar Institute
Manjari (Bk.), Tal. Haveli,
Dist. Pune - 412 307

STATEMENT OF ACCOUNT (SA) AS ON 31/03/2022

Sr. no.	Particulars	Sanctioned	Received	Spent	Unspent
1st year	(2021-2022)				
A. Capital					
	Prototype designing & model microwave unit preparation	15,00,000			
	Micropipettes	50,000			
	GPC coloumn for chitosan size exclusion chromatography	3,50,000			
	Total	19,00,000			
	GST @18%	3,42,000			
B. Recurring					
1.	Equipment	15,00,000			
2.	Staff salaries	8,19,000		3,06,900 /3,41000	
3.	Material cost for experimentation with MRS	5,00,000			
4.	Consumables and chemicals	1,00,000		1,85,672	
5.	Analytical Charges	2,00,000			
6.	Travel	50,00,000			
6	Contingencies/Miscellaneous	50,00,000			
7	Overheads	50,00,000			
	Total (1-7)	17,69,000			
	GST @18%	1,71,000			
	Total	19,40,000			
	Grand Total (A+B)	**41,82,000**	**37,56,712**	**4,92,572**	**32,64, 576**

Vasantdada Sugar Institute
PRT No. F-1728
(MUMBAI)
Post Manjari Bk. Pin-412307.

FOR VASANTDADA SUGAR INSTITUTE

CHIEF ACCOUNTANT

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STATEMENT OF ACCOUNT (SA) AS ON 31/03/2023

Sr. no.	Particulars	Sanctioned	Opening Balance (2022-2023)	Received	Spent	Unspent
2nd year	(2022-2023)					
A. Capital						
	Prototype designing & model microwave unit preparation	17,70,000.00	17,70,000.00	-	-	17,00,000.00
	Micropipettes	59,000.00	59,000.00	-	32,684.00	26,316.00
	GPC coloumn for chitosan size exclusion chromatography	4,13,000.00	4,13,000.00	-	-	4,13,000.00
	Total	**22,42,000.00**	**22,42,000.00**	**-**	**32,684.00**	**22,09,316.00**
B. Recurring						
2	Staff salaries	8,19,000.00	5,14,746.00	-	4,62,330.00	52,416.00
3	Material cost for experimentation with MRS	5,90,000.00	5,90,000.00	-	-	5,90,000.00
4	Consumables and chemicals	1,18,000.00	15,963.00	-	3,85,733.00	- 3,69,770.00
5	Analytical Charges	2,36,000.00	2,36,000.00	-	-	2,36,000.00
6	Travel	59,000.00	59,000.00	-	-	59,000.00
6	Contingencies/Miscellaneous	59,000.00	6,363.00	-	-	6,363.00
7	Overheads	59,000.00	-	-	-	-
	Total (1 to 7)	**19,40,000.00**	**14,22,072.00**	**-**	**8,48,063.00**	**5,74,009.00**
	Grand Total (A+B)	**41,82,000.00**	**36,64,072.00**		**8,80,747.00**	**27,83,325.00**

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FOR VASANTDADA SUGAR INSTITUTE

CHIEF ACCOUNTANT

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