File No BT/PR44635/ NDB/39/792/2022
GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

Block 2, 6-8th Floors
CGO Complex, Lodhi Road,
New Delhi- 110003
Dated: 08.02.2024

ADMINISTRATIVE ORDER

Sanction of the President is hereby accorded, under Rule 18 of the Delegation of Financial Powers Rules, 1978, for the implementation of the project entitled " **Stabilisation and valorisation of seed oils from stone fruits by developing nano pickering emulsions**" for a period of three year at a total cost of Rs. **5399920** (Rupees Fifty Three Lakhs Ninety Nine Thousand Nine Hundred and Twenty Only) on the terms and conditions detailed here under: -

2. The Project

2.1. Title: Stabilisation and valorisation of seed oils from stone fruits by developing nano pickering emulsions

2.2. Details of the Investigators:

Lead Principal Investigator:

Dr. Adil Gani
Assistant Professor & Coordinator,
Department of Food Science and Technology,
University of Kashmir,
Srinagar, Jammu & Kashmir, India

Principal Investigator:

Dr. Asima Shah
Inspire Faculty,
Department of Food Science and Technology,
University of Kashmir,
Srinagar, Jammu & Kashmir, India

Co-Principal Investigator:

Dr. Idrees Ahmed Wani
Sr. Assistant Professor,
Department of Food Science and Technology,
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2.3. Objectives

Overall Objectives:

Objective 1: Extraction, characterization and nutraceutical potential of stone fruit oils found in J&K Himalayas.

Objective 2: Extraction of biopolymers from weeds, their Nanoreduction and toxicity assessment.

Objective 3: Exploring Pickering emulsion as a technology to increase the stability and shelf-life of extracted oils using Nano-reduced starch and protein particles.

Objective 4: Formation of salad dressing and mayonnaise using seed emulsion.

Objective 5: Nutraceutical potential and quality evaluation of developed functional salad dressings and mayonnaise.

2.4 Time Schedule: Three Years

2.5 Project Cost: The total cost of the project is Rs. 5399920 (Rupees Fifty Three Lakhs Ninety Nine Thousand Nine Hundred and Twenty Only) as per details given below:

(Financial figures are shown in lakhs)

Institutes	Year 1	Year 2	Year 3	Total Cost (Rs.)
University of Kashmir, Srinagar	34.4344	9.4344	10.1304	**53.9992**
Total	**34.4344**	**9.4344**	**10.1304**	**53.9992**

Institute wise budget details are:

(Financial figures are shown in lakhs)

Budget Head	Year 1	Year 2	Year 3	Total (Rs.)
1. Name of the Institute: University of Kashmir, Srinagar				
Grants for Creation of Capital Assets	25.00	0.00	0.00	**25.00**
Grants-in-aid General	9.4344	9.4344	10.1304	**28.9992**
Total	**34.4344**	**9.4344**	**10.1304**	**53.9992**

2.6 Equipment (Capital Assets): The details of the Capital Assets sanctioned for the implementation of the project is detailed at **Annexure-I**

2.7 Year-wise "Overhead" budget is restricted to Rs 20,000/- for University of Kashmir, Srinagar for 1st, 2nd year and 3rd year. The aggregate Overhead budget sanctioned during the project period to University of Kashmir, Srinagar is Rs. Rs. 60,000/-.

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3. Head of Account:

The Non-Recurring (Capital Assets) expenditure involved is debitable to:

Demand No. 90	Department of Biotechnology
3425	Other Scientific Research 2023-2024
3425.60	Others (Sub Major Head)
3425.60.200	Assistance to other Scientific Bodies (Minor Head)
3425.60.200.29	Biotechnology Research and Development
3425.60.200.29.17	Assistance to Research and Development
3425.60.200.29.17.35	Grants for creation of capital assets

The Recurring (GIA General) expenditure involved is debitable to

Demand No. 90	Department of Biotechnology
3425	Other Scientific Research 2023-2024
3425.60	Others (Sub Major Head)
3425.60.200	Assistance to other Scientific Bodies (Minor Head)
3425.60.200.29	Biotechnology Research and Development
3425.60.200.29.17	Assistance to Research and Development
3425.60.200.29.17.31	Grants -in-Aid General

4. Terms & Conditions:

4.1. In case the whole or a part of the amount of the grant-in-aid is being refunded, an interest rate at the rate of ten percent thereon shall be recovered. The equipment sanctioned under the project should be purchased within 18 months from the date of the release of the grant.

4.2. A Memorandum of Agreement (MoA) will be signed between the Department of Biotechnology and the grantee institution on Non-Judicial stamp paper Rs. 100/- in the enclosed format and the second release/instalment will be made only after signing of MoA between the grantee institutions and DBT. In case of NGO's and Private Institution's, execution of MOA is mandatory before first release. A format of the MoA is enclosed in **Annexure-II.**

4.3. In accordance with Rule 238(5) & 238(6) of GFR, 2017, the private institutes/ voluntary organizations which are receiving Grant-in-aid of Rs.50.00 lakh and above have to submit their Annual Reports and Annual Audited Accounts to the Department within 09 months of the close of the succeeding financial year.

4.4. No international travel will be undertaken from the sanctioned project grant unless specified otherwise.

4.5. The Dean Research, University of Kashmir, Srinagar would be responsible for submission of Utilization Certificates (UC), Statements of Expenditure (SoE), Capital Assets Acquired Certificates, in prescribed DBT formats to DBT in respect of grants released in this project from time to time. The institute shall also furnish an undertaking that monthly emoluments of engaged human resource in this project have been disbursed in accordance with the duly notified norms/guidelines of the Government Department/Ministry/Autonomous Bodies.

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4.6. PI's of DBT sponsored projects can consider appointment of JRF from Category-II merit list of DBT-BET exam so that candidates can be paid fellowships at par with NET/GATE/BET qualified candidates as per revised DST OM No.SR/S9/Z-08/2018 dated 26.06.2023. However, there is no compulsion on PI's to select candidates for JRF in their projects from Category-II of DBT-BET.

4.7 As per Rule 236 (1) of GFR 2017, the accounts of all Grantee Institutions or Organizations shall be open to inspection by the sanctioning authority and audit, both by the Comptroller and Auditor General of India under the provision of CAG (DPC) Act 1971 and internal audit by the Principal Accounts Office of the Ministry or Department, whenever the Institution or Organizations is called upon to do so.

4.8. If the Research Project involves biological resources, the obligations under the Biological Diversity Act 2002 as applicable shall be complied with by the Project Investigator, the details of such obligations can be accessed at www.nbaindia.org

4.9. "The PIs/Implementing Agencies shall strictly adhere to the GoI instructions issued vide OM No.F.4.1.2021-PPD dated 30.6.2021 in the matter of issue of Global Tender Enquiry with special reference to instructions contained under para 4 of the said OM for procurement of equipments, spares and consumables for research purposes and shall not issue Global Tenders Enquiries before seeking the approval of the competent authority".

4.10. After incurring the expenditure on import of such items and at the time of submission of UCs to the department next year, the PIs will also furnish the copy of the approval sought from the competent authority for issue of the GTE for such items of import. The releases of next instalment of grant will the subject to the fulfilment of the above condition."

4.11. If any biological data as specified in the guidelines are being generated in the project then PI should submit the data generated in the project to Indian Biological Data Centre – The National Repository being implemented at Regional Centre for Biotechnology, Faridabad in compliance with the Biotech-PRIDE Guidelines 2021.

4.12. The quarterly deliverables in the project, in quantifiable terms have to be provided for each quarter of the project, based on which, inter-alia, monitoring/review of the project will be done and proposal for release of subsequent instalment will be considered. Please see **Annexure-III.**

4.13. While asking for 2nd instalment onwards, the Institute has to certify that the Institute has not utilized more than the amount sanctioned under the 'Overhead' component.

4.14 Subject to compliance of ministry of OM dated 08.03.2022 regarding Competitive Research Grant System (CGRS) para 2 (xi) which reads that project Extension will be considered only under exceptional circumstances by TEC/DBT Apex Board for a minimum of six months only. Extension requests will not be considered if received after completion of the project. Further, PI is required to provide undertaking to Department that any valuable data that may arise during research will be shared with IBDC of RCB, Faridabad.

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5. This issues, under the power delegated to this Department and with the concurrence of IFD vide their **SAN No.102/IFD/SAN/2605/2023-2024/ dated 08.02.2024**

6. This sanction order has been noted at serial no **....38....** in the Register of Grants.

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Scientist 'F'

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To,
The Pay & Accounts Officer,
Department of Biotechnology,
New Delhi – 110003

Copy to:

1 The Principal Director of Audit (Scientific Departments), DACR Building, New Delhi- 110002.
2 Cash Section, DBT (2 copies).
3 Sanction Folder.
4 File Copy.
5 The Dean Research, University of Kashmir, Srinagar, , Jammu & Kashmir, India
6 **Dr. Adil Gani,** Assistant Professor & Coordinator, Department of Food Science and Technology, University of Kashmir, Srinagar, Jammu & Kashmir, India
7 **Dr. Asima Shah,** Inspire Faculty, Department of Food Science and Technology, University of Kashmir, Srinagar, Jammu & Kashmir, India
8 **Dr. Idrees Ahmed Wani,** Sr. Assistant Professor, Department of Food Science and Technology, University of Kashmir, Srinagar, Jammu & Kashmir, India
9 **CNA**, NII, New Delhi

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Annexure –I

Details of the Equipment (Capital Assets) for the implementation of the project entitled "Stabilisation and valorisation of seed oils from stone fruits by developing nano pickering emulsions ":

(Financial figures are shown in lakhs)

Name of the Institute: University of Kashmir, Srinagar			
S.No.	**Name of Equipments**	**No.**	**Cost (Rs.)**
1.	Dynamic Rheometer	1	25.00
	Total		25.00

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Computer No. 19152 || Dr. Adil Gani || BT/PR44635/NDB/39/792/2022

Objectives vis-à-vis Proposed Milestones & Deliverables (Year-1)

Defined Objectives	Abbreviated Name of Institutions	Milestones and Deliverables for the 1st Year							
		Quarter 1/12 (Milestones)	**Quarter 1/12 (Deliverables)**	**Quarter 2/12 (Milestones)**	**Quarter 2/12 (Deliverables)**	**Quarter 3/12 (Milestones)**	**Quarter 3/12 (Deliverables)**	**Quarter 4/12 (Milestones)**	**Quarter 4/12 (Deliverables)**
		List out Tasks-to-be Completed → i) Different sites of J&K will be identified for collection of stone fruits. ii) Stone fruits like cherry, apricot and peach will be collected from different regions of J &K Himalayas. iii) Washing and cleaning of raw material will be carried out. Crushing of stones for seed collection will be done. Milling of seeds for oil collection will be done. Extraction of oil using solvent extraction method. iv) Chemical , composition analysis of extracted seed oil of stone fruits using GC-MS. v) Physicochemical quality parameters like free acidity, peroxide value, and ultraviolet [UV] absorption characteristic and oxidative stability will be carried out following the analytical methods described by Regulation EEC/2568/91 of the Commission of the European Union. vi) Antioxidant activity of extracted seed oil will be evaluated for its antioxidant properties using different assays which include: DPPH, metal chelating, reducing power DNA scission inhibition using submarine electrophoresis. vii) Antidiabetic activity of the extracted seed oil will be done using DPP-IV, a- amylase and a- glucosidase inhibitory assay. viii) Antihypertensive activity will be determined by Angiotensin Converting Enzyme (ACE) inhibitory activity. ix) *In vitro* anticancer activity will be performed against different human cancer cell lines like HEK (Human embryonic kidney cells), COLO (Colon cancer cell) etc. by MTT assay.							
Objective 1: Extraction, characterization and nutraceutical potential of stone fruit oils found in J&K Himalayas.	UOK, Srinagar	i) The sites of Himalayan region rich in production of stone fruits will be identified ii) Collection of stone fruits like cherry, peach and apricots at selected sites of Himalayan J&K. iii) Process optimization	i) Identification and selection of sites ii) Stone fruits collection iii) Extracted seed oil from stone fruits will be collected for further characterization.	i) Identification and quantification of various constituents in extracted seed oil of stone fruits using GC-MS. ii) Physico-chemical characterization of extracted oil for analyzing its quality and	i) Chemical composition analysis of extracted stone oil. ii) Characterization of extracted seed oil	i) Extracted seed oil will be evaluated for its nutraceutical potential in terms of, antioxidant activity, Antidiabetic, antihypertensive and anti-cancerous activity will be evaluated using	i) Nutraceutical potential of extracted oil		

		for seed oil extraction of stone fruits Himalayan region.		functional properties.		suitable protocols.			
Objective 2: Extraction of biopolymers from weeds, their nano reduction and toxicity assessment.		**List out Tasks-to-be Completed →** i) Lakes of Kashmir *viz;* Dal and wular will be visited for identification of macrophytes found in them. ii) Collection of identified macrophytes like *Typho angustata*, *Phragmites australis, Myriophyllum*, *Sparganium evectum, Myriophyllum verticillatum* and *Nelumbo nucifera* will be done iii) The collected macrophytes will be washed and cleaned. The macrophytes will then be grinded for extracting macromolecules like starch and protein. iv) Strach will be extracted following the method of Jhan et al., (2022). v) Protein will be extracted using iso electric precipitation method. vi) Extracted macromolecules i.e., starch and protein will be nano sized by using a suitable technique like emulsion polymerization/ ball milling/ ultrasonication. The other techniques like Nano spray, or electrospinning may also be used. v) The evaluation of nano particles will be carried out by using particle size analyzer, surface charge measured by zeta sizer. vi) Surface morphology using scanning electron microscopy (SEM) and structural characterization by FTIR and XRD. vii) Toxicological evaluation of extracted and nano reduced biopolymers will also be carried out on different cell lines (hct 116 , Hek, U2o5, HELA) using MTT assay							
							i) Identification of macrophytes for extraction of macromolecules found in lakes of Kashmir. ii) Macrophytes will be collected from lakes of Kashmir and extraction of macromolecules like starch and protein will be done using suitable protocol.	i) Identification and collection of macrophytes ii) Extraction and estimation of proteins and starch from macrophytes.

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Objectives vis-à-vis Proposed Milestones & Deliverables (Year-2)

Defined Objectives	Abbreviated Name of Institutions	Milestones and Deliverables for the 2nd Year							
		Quarter 5/12 (Milestones)	Quarter 5/12 (Deliverables)	Quarter 6/12 (Milestones)	Quarter 6/12 (Deliverables)	Quarter 7/12 (Milestones)	Quarter 7/12 (Deliverables)	Quarter 8/12 (Milestones)	Quarter 8/12 (Deliverables)
Objective 2: Extraction of biopolymers from weeds, their nano reduction and toxicity assessment.	UOK, Srinagar	i) Nano reduction of extracted starch and protein from macrophytes will be carried out ii) Morphological and structural characterization of nano-reduced starch and protein particles will be carried out to evaluate the effect of nano reduction on macromolecules.	i) Starch and protein nanoparticles. ii) Characterization of nonordered starch and protein particles.	The taxological evaluation of the macromolecules extracted from macrophytes will be done in native and nano reduced form.	Toxicity assessment of starch and protein particles				
Objective 3: Exploring Pickering emulsion as a technology to increase the stability and shelf		**List out Tasks-to-be Completed →** i) Pickering emulsion will be developed using extracted seed oils of stone fruits and nano biopolymers extracted from macrophytes following the protocol of Noor et al; (2022). The nano biopolymers will be used as emulsion stabilizers. ii) The developed Pickering emulsion will be evaluated for their morphological and structural characteristics using optical microscope,/confocal, scanning electron microscopy and FTIR iii) Stability test of developed Pickering emulsion in terms of creaming index (CI), Droplet size distribution etc. will be done using suitable protocol iv) Rheological properties of the emulsion to evaluate its flow behaviour will be done using rheometer							

life of extracted oils using nano reduced starch and protein particles.								
			Preparation of Pickering emulsion using extracted seed oil and nano-reduced starch and protein particles as stabilizers will be carried out following a suitable protocol.	Development of Pickering emulsion	i) Microstructural evaluation of developed Pickering emulsion will be carried out to identify its suitability to be used in different food formulations. ii) The stability of developed Pickering emulsion will be evaluated. Using suitable protocol. iii) Rheological properties of emulsion will be analyzed for evaluating its flow behaviour	i) Characterization of nano Pickering emulsion ii) Pickering emulsion stability iii) Pickering emulsion rheology		
Objective 4: Formulation of salad dressing and		**List out Tasks-to-be Completed →** i) The formulated nano Pickering emulsion will be utilized for developing food products like salad dressings and mayonnaise using a suitable protocol. ii) The developed food formulations viz; Salad dressings and mayonnaise will be characterized for their physico-chemical properties like acidity, adhesivity, droplet size, colour, density, rancidity, moisture, pH, zeta potential,						

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mayonnaise using seed oil emulsion		creaming index and water activity using a suitable protocol. iii) Rheological properties (i.e. firmness, thixotropy, yield stress), heat and oxidative stability will also be evaluated using rheometer						Process optimization for development of food products *viz.,* Salad dressings and mayonnaise using developed nano Pickering emulsion	Salad dressings and mayonnaise developed

Objectives vis-à-vis Proposed Milestones & Deliverables (Year-3)

Defined Objectives	Abbreviated Name of Institutions	Milestones and Deliverables for the 3rd Year							
		Quarter 9/12 (Milestones)	Quarter 9/12 (Deliverables)	Quarter 10/12 (Milestones)	Quarter 10/12 (Deliverables)	Quarter 11/12 (Milestones)	Quarter 11/12 (Deliverables)	Quarter 12/12 (Milestones)	Quarter 12/12 (Deliverables)
Objective 4: Formulation of salad dressing and mayonnaise using seed oil emulsion	UOK, Srinagar	i) Salad dressings and mayonnaise will be characterized for their physico-chemical characteristics.	i) Characterization of developed food products ii) Rheology of food products						

		ii) Rheological properties of mayonnaise and salad dressings will be evaluated							
Objective 5: Nutraceutical potential and quality evaluation of developed functional salad dressings and mayonnaise.		**List out Tasks-to-be Completed →** i) Nutraceutical potential of developed mayonnaise and salad dressings will be determined in terms of antioxidant activity antioxidant assays like DPPH, metal chelating, reducing power, DNA scission inhibition using submarine electrophoresis ii) In vitro anticancer activity of developed mayonnaise and salad dressings against different human cancer cell lines like HEK (Human embryonic kidney cells), COLO (Colon cancer cell) will be evaluated by MTT assay iii) The Anti-microbial activity of developed mayonnaise and salad dressings will be determined against *E.coli, S. aureus* etc. using disc diffusion method. iv) Antihypertensive activity will be determined by Angiotensin Converting Enzyme (ACE) inhibitory activity v) Anti-obesity activity by Pancreatic lipase (PL) inhibition assay and Cholesterol esterase (CE) inhibition assay. Antidiabetic activity using DPP-IV, a- amylase and a- glucosidase inhibitory assay vi) Sensorial properties of food product using 9 point hedonic scale will be evaluated in order to evaluate the overall consumer acceptability of the products developed.							
				i) Anticancer activity of mayonnaise and salad dressings will be evaluated ii) Antioxidant activity of mayonnaise and salad dressings will be evaluated.	i) Nutraceutical potential of developed mayonnaise and salad dressings.	i) Anti-hypertensive activity of food product will be determined. ii) Anti-obesity activity of food product will be determined	Nutraceutical potential of developed mayonnaise and salad dressings.	i) Textural properties of final products will be evaluated ii) Sensorial properties of final products will also be carried out which will give an insight of overall consumer acceptability.	i) Texture of mayonnaise and salad dressings. ii) Sensorial properties of developed products

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