UTTARAKHAND STATE COUNCIL FOR SCIENCE & TECHNOLOGY
(GOVT. OF UTTARAKHAND)
DEHRADUN- 248007

PROFORMA FOR SUBMISSION OF R&D AND DEMONSTRATION PROJECTS IN THE IDENTIFIED AREAS

PART I: GENERAL INFORMATION

1. **Project Title**: Development of Eco-Friendly Menstrual Pads Using Nettle-Based Natural Fibers and Polymers for Sustainable and Inclusive Menstrual Hygiene Management

2. **Name of the Institute/University/Organization:** School of Pharmaceutical Science (SPS) Swami Rama Himalayan University (SRHU), Dehradun and Rural Development Institute (RDI), Himalayan Institute Hospital Trust (HIHT),

3. **Status of the Institute**: Private University established under Act No. 12 of 2013 by the Government of Uttarakhand; recognized by University Grants Commission (UGC), New Delhi.

4. **Name and designation of the Executive Authority of the Institute / University forwarding the application**: Registrar of the University

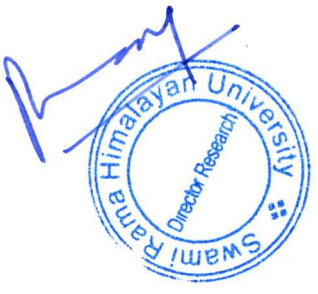
5. **Category of the Project**: R&D

6. **Specific Area:** Women's Health, Natural Product Technology, Waste Management, Disability Inclusion

7. **Duration**: 2 Years
8. **Total Cost**: Rs.15 Lac
9. **Is the project Single Institutional or Multiple-Institutional**: Single
10. **If the project is multi-institutional, please furnish the following**: NA

11. **Project Summary**

This project proposes to design, test, and pilot biodegradable, polymer-blended menstrual pads utilizing locally available nettle fibers. Special emphasis will be on addressing menstrual hygiene needs of women with disabilities (WWDs). The inclusion of biodegradable polymers (Carrageenan) with nettle fiber will enhance adsorption, shape retention, and wash durability, creating a user-friendly, reusable menstrual solution. The project will integrate Universal Design principles, undergo scientific testing, and engage target beneficiaries in Uttarakhand for field-level validation. It aligns with the goals of environmental protection, women's health, and livelihood generation.



PART II: PARTICULARS OF INVESTIGATORS

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PART III: TECHNICAL DETAILS OF PROJECT

14. Introduction

14.1 Origin of the proposal

Menstrual hygiene remains an underserved area, particularly for women with disabilities in rural Uttarakhand. Commercial products are unsustainable and chemically intensive. The abundance of **nettle (Urtica dioica)** and other natural fibers, combined with advances in **biodegradable polymers**, offers a unique opportunity to innovate a **reusable, inclusive, and eco-friendly menstrual pad**.

14.2 Definition of the problem

There is a lack of menstrual hygiene solutions that are:

a) Biodegradable
b) Reusable and affordable
c) Designed for use by women with physical or sensory disabilities
d) Locally manufacturable and environmentally safe

14.3. Objectives

1. Develop a biodegradable menstrual pad using **nettle fiber and polymers**
2. Optimize for **absorption, reusability, comfort**, and **inclusivity**
3. Test dermatological safety, environmental degradation, and functionality
4. Engage WWDs for feedback and field validation
5. Promote **sustainable livelihoods** through localized production

15. Review of Current Status of research and development in the subject

15.1 International Status

Global initiatives such as Days for Girls, Eco Femme, and polymer-scaffold menstrual solutions exist, but few are disability inclusive. Here's an overview of the international landscape surrounding sustainable menstrual hygiene innovations, especially those using natural fibers and eco-SAP approaches. Globally, dozens of community-driven programs and social enterprises have emerged, producing biodegradable or reusable pads using natural fibers like bamboo, banana, hemp, papyrus, and water hyacinth. Examples include Afripads in humanitarian settings and Days for Girls, which offers reusable pads via kits distributed in over 100 countries and supports local manufacturing hubs. Academic and industrial research has validated that bamboo and plant-based fibers offer excellent absorbency and antibacterial benefits, although production costs especially for biodegradable SAP replacements—remain a key barrier. On the commercial front, innovators are releasing new eco-centric products with global reach: Fluus (formerly Planera) introduced the world's first flushable, 100% biodegradable sanitary pad in Europe GB, Natracare, a UK-based brand since 1989, offers certified organic, plastic-free pads and tampons and Kodu Technology in Ghana produces banana- and plantain-stem pads, aiming to both combat period poverty and support farmers.

In Uganda, the Makapad papyrus pad is handmade locally for refugee and rural girls, offering 8–10 hours' protection at far lower cost than plastics. At the policy level, forward-thinking regions like Catalonia, Spain, have begun distributing free reusable menstrual kits—including cups, period underwear, and cloth pads to some 2.5 million individuals via pharmacies, marking a first-of-its-kind public program Research on natural fiber-polymer composites (e.g., PLA-nettle) for hygiene use is in early stages.

15.2 National Status

Most Indian programs (Swachh Bharat, MHM guidelines) emphasize disposable pads. Few are truly biodegradable or designed for WWDs. This project was born out of our experience

working in rural Uttarakhand, where we saw first-hand how women—especially those with intellectual disabilities—struggled with unaffordable, chemically intensive menstrual products. Inspired by the success of community-led initiatives like Humans for Humanity's WASH Project (launched in Dehradun by Anurag Chauhan in 2014, which trains women to make biodegradable pads and has reached millions) and by innovations from social enterprises like Saathi (launched in 2015 in Gujarat to produce compostable pads using banana and bamboo fibers sourced from farming communities) we envisioned a pad that combines local materials, eco-technology, and inclusive design specifically tailored to be durable, easy to use, and cost-effective for mentally disabled girls in remote villages. The goal was to evolve those proven models by integrating nettle and bamboo fibers with starch-based biodegradable SAPs, enabling community micro-manufacturing and sustainable cross-subsidies so the product is reusable, affordable, eco-friendly, and genuinely accessible for those who need it most. No existing government pads use biodegradable polymer and nettle blend.

15.3 Importance of the proposed project in the context of current status

The importance of your proposed eco-menstrual pad is striking when viewed against the current global and rural landscape. Despite initiatives, rural India still lags behind: only around 43–72 % of rural women and girls exclusively use hygienic menstrual products—significantly lower than urban areas—due to cost, access, and infrastructure barriers. Government-subsidized pads often fail to reach the most remote areas, and even eco products like "Suvidha" pads remain inaccessible in many villages. Commercial sanitary pads are typically 90 % plastic, clogging landfills and persisting for centuries Although biodegradable alternatives exist globally—from bamboo and papyrus to banana-fiber pads, they remain too costly or hard to access for economically vulnerable populations. For girls with intellectual disabilities, the challenge is compounded: they often need longer-lasting, easier-to-use, and highly absorbent products to ensure dignity and safety

In this context, the current project does more than roll out another eco product only but also it bridges a critical gap where cost, accessibility, inclusivity, and sustainability intersect. By integrating local materials, inclusive design, and community-based manufacturing, it offers a scalable, dignified, and environmentally sound menstrual solution for some of the most underserved girls in rural Uttarakhand and beyond.

15.4 Anticipated Products & Processes of Practical/Technological utility /Socio economic relevance expected to be evolved by pursuing the project.

- Patented pad design using nettle and PVA/PLA polymers
- Field-tested model for inclusive MHM
- Livelihood generation via pad production units
- Reduction of menstrual plastic waste

15.5 Expertise available with the proposed investigating group / institution in the subject of the project.

RDI-SRHU has expertise in public health, pharmacy, dermatology, natural product chemistry, and grassroots health delivery. Dr. Priyank Purohit and his polymer chemistry research group have extensively studied carrageenan's physicochemical and biological activities, publishing their findings in highly reputed peer-reviewed journals. Their research contributions include: Eclipsed Conformational Locking: Exploring Iota Carrageenan's Distinct Behavior in Ethanol–Water Systems via Hydrogen Bonding with the Disulfate Group. Chem. Pap. (2024). Modulating Ionic Linkages in the Heterocyclic Sulfated Polysaccharide Carrageenan for Enhanced Selectivity Against Amelanotic Melanoma Cells. Chemistry Select (2024). Conversion of Iota Carrageenan Hydrocolloids to Hydrophobic Hydrocolloids for the Entrapment of Water-Insoluble Drugs. Discov Appl Sci (2024). Benzoylation of Iota Carrageenan: Development of a Stable, Conductive, and Hydrophobic Drug Carrier with Reduced Toxicity and Improved Gel-Forming Ability. Macromol. Chem. Phys. (2024). Iota Carrageenan-Linked Barium Ion Nanoparticle Synthesis for Targeted Imaging and Inhibition of Cancer Cells. J. Polymer Eng. (2024)

15.6 **How this proposal is beneficial to the State.**

The project will empower rural women, including WWDs, and reduce dependence on imported or synthetic MHM products. It will promote **indigenous resources** and create local entrepreneurship. By empowering rural women—including those with disabilities—the project will significantly decrease Uttarakhand's reliance on costly, imported, or synthetic menstrual hygiene products while valorizing indigenous resources and cultivating local entrepreneurship. Drawing on successful models like Muruganantham's low-cost pad machines installed across 23 states—which enabled self-help groups to manufacture and distribute affordable sanitary products locally and Saathi's bamboo/banana-fiber enterprise that sources raw materials from local farmers and creates women-led micro-factories, this initiative embeds production, income generation, and sustainable menstrual care within communities. By training women to produce biodegradable nets/nettle-based pads with starch-based SAPs, the proposal fosters entrepreneurship, retains value locally, reduces plastic waste, and enhances menstrual dignity creating a replicable, scalable model rooted in Uttarakhand's eco-cultural context.

16. **Work Plan**

16.1 **Methodology Sourcing and extraction of nettle and other natural fibers**

- Blending with **biodegradable polymers** (iota Carrageenan)
- Prototyping at the SRHU Tailoring Unit
- Laboratory testing (absorption, skin safety, washability, eco-degradation)
- Piloting with 100 users (30–40 WWDs)
- Iterative feedback loop
- Documentation and IP application

16.2 **Proprietary/patented items, if any, expected to be used for this project.**

None yet, but expected IP outcome

16.3 **Organization of work elements**

1. Materials Science Team led by Dr. Priyank Purohit: Fiber-polymer blend optimization
2. Testing: Microbial and other testing (Dr. Ganesh and JRF)
3. Public Health Team: CO-PI from RDI Survey & piloting
4. Scale Up Unit: RDI team

16.4 **Suggested plan of action for utilization of research outcome expected from the project.**

- Collaboration with SHGs for manufacturing
- Partnership with government MHM schemes