Notice Inviting Expression of Interest (EoI) from Industries for Collaboration on Land-Based Cultivation of *Ulva* from Spore-Based Seedlings

CSIR-Central Salt & Marine Chemicals Research Institute (CSIR-CSMCRI), Bhavnagar, Gujarat – one of the premier national research institutes under the aegis of the Council of Scientific and Industrial Research (Government of India), invites Expression of Interest (EoI) from reputed industries, start-ups, or multinational companies in aquaculture, functional foods, nutraceuticals, bio-stimulants, or allied sectors for partnership to commercialize and scale up an innovative land-based cultivation technology for edible green seaweed *Ulva* using spore-based seedlings.

This patent-protected technology addresses the major bottleneck of seasonal and inconsistent Ulva supply by enabling year-round, controlled biomass production, making it suitable for multiple industrial applications.

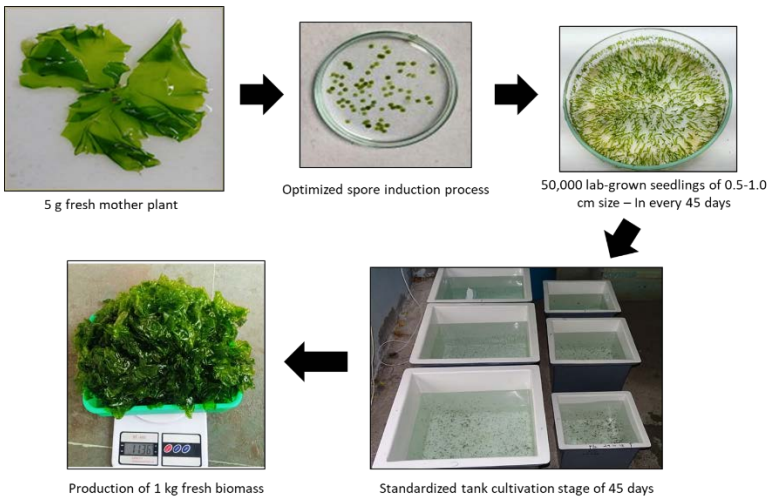
Tenure of partnership	:	Initially for 3 years which may be extended subject to review by CSIR-CSMCRI.
Fee	:	Will be decided by mutual discussions with partner Firm/company.
Scope of services to be rendered by CSIR-CSMCRI to the empanelled firm(s)	:	*Right to market & deploy technology:* The partner industries will get non-exclusive right to market & deploy CSIR-CSMCRI's land-based *Ulva* cultivation technology in India. *Know-how demonstration:* CSIR-CSMCRI will demonstrate the spore-based seedling production and tank cultivation process at laboratory scale (one lakh seedlings and 2 kg fresh biomass per 90 day batch cycle) at CSMCRI. *Business enquiry referral*: CSIR-CSMCRI will advise prospective aquaculture/bioprocessing industries about the partner firms as preferred collaborators for commercial deployment. *Technical support for marketing:* CSIR-CSMCRI will provide process-related technical support documents (data, literature etc.) to the partner firm(s) for the purpose of marketing the technology. *Training:*

		CSIR-CSMCRI will provide training to the team of partner firms on spore-based *Ulva* seedling production and tank-cultivation protocols. *Technology know how documents:* CSIR-CSMCRI will provide technology transfer documents including process flow, equipment details, analysis data, and relevant scientific publications. *Safety data:* CSIR-CSMCRI will provide any available data related to the safety and environmental impact of *Ulva* cultivation under controlled land-based systems, ensuring compliance with regulatory norms. *Bio-efficacy:* CSIR-CSMCRI will share data on *Ulva* biomass quality, nutritional composition, and suitability for functional food or nutraceutical applications based on lab-scale and semi-controlled trials.
Responsibility of the partner firm(s)	:	The partner firm will ensure compliance with all necessary regulatory requirements and obtain the appropriate licenses for commercial-scale land-based cultivation of *Ulva* using CSIR-CSMCRI's technology.

Interested industries are invited to submit their EoI on or before 25th September 2025 to Dr. Kamalesh Prasad at kamlesh@csmcri.res.in.
Enclosure: Technology Brochure

1.	Title of Process/ Know-how/ Product/Design/Equipment	Land-based cultivation of edible green seaweed *Ulva* from spore-based seedlings
2.	IPR Status & Details	IPR filed (Appl. No. 202411099850)
3.	Application/Uses/Problem being addressed	Among macroalgae, *Ulva* stands out due to its versatility and health benefits (contains up to 26% protein on dw basis), making it valuable for the functional food market and global food needs. However, *Ulva*'s seasonal nature and reproductive behavior pose challenges to its continuous cultivation, hindering sustained production. Establishing a cultivation technique through artificial seed production is crucial for ensuring a consistent supply of high-quality biomass and safeguarding wild seaweed resources. Traditional methods for seedling production have limitations, such as relying on sexually matured plants in the wild and vulnerability to contamination. The technology developed here gives year-round *Ulva* seedling production method followed by cultivation in tanks under semi-controlled laboratory conditions to address these challenges.
4.	Salient Technical Features including Competing Features/ Impact	The technology involves standardization of method for consistent production of *Ulva*'s spore-based seedlings at a scale of 1,00,000 seedlings per batch of 45 days. It has demonstrated the use of various abiotic stresses like fragmentation, salinity, fresh-water treatment, desiccation, temperature and a combined stress to get maximum number of viable seedlings consistently from a minimum use of mother tissue. In addition, a 45-day semi-controlled laboratory tank cultivation protocol has also been established. Media, stocking density, seedling size, light illumination were standardized at each stage of tank-based cultivation with different customized tanks, with specific conditions and nutrient compositions, which promote maximum growth. The invention provides a systematic approach to tank-based *Ulva* cultivation using spore-based seedlings, offering benefits such as increased biomass production, reduced mortality rates, and sustainability.
5.	TRL Level & Scale of Development	TRL – 4; [Small scale prototype] Lab scale production @ 1,00,000 spore-based seedlings of size 0.5-1.0 cm in a batch of 45 days has been achieved. Semi-controlled environment @ 2 kg of fresh biomass production from those spore-based seedlings has been achieved in land-based tanks in additional 45 days.

6.	Business scope & opportunity (in terms of scale, cost, market etc.)	Green seaweed market is likely to reach USD 2.09 billion by 2028 growing with a rate of 6.9%. *Ulva*, a genus of green seaweed, holds immense promise for land-based aquaculture due to its cosmopolitan distribution and high biomass productivity (Jansen et al. 2022), offering rich nutritional content vital for industrial applications. As consumers become increasingly health-conscious and seek out natural and sustainable food options, the demand for *Ulva* and other seaweed-based products in the functional food market is expected to continue growing. In addition, valuable compounds present in *Ulva* can be exploited for use in food, cosmetic, energy, and pharmaceutical applications (Vaghela et al. 2023). Extract derived from *Ulva* also known to provide abiotic stress tolerance to crop plant (Latique et al. 2021), having application in agriculture sector also. This method will give continuous supply of *Ulva* raw material throughout the year which necessary for the survival of any *Ulva* based industry. Scale and cost will vary depending on requirement of seedling material.
7.	Environmental Considerations	The method follows non-polluting practices, does not require any harmful chemicals. As it is land-based cultivation can be deployed to any coastal area of the country without harming natural ecosystem of the sea.
8.	Status of Licensing	This technology is not yet licensed.
9.	Status of commercialization	Not yet done, though ready for deployment
10.	Major Raw Materials Needed	*Ulva* mother plant stock
11.	Major Plant Equipment and Machinery Required	Requires temperature (25-28 °C) and light controlled seaweed culture laboratory kind of set up and tank-cultivation facility under control and semi-controlled condition, customized tanks (PE plastic bags reactor), shade and small farm to maintained adequate stock and acclimatized the newly transported *Ulva* seedling. Adequate seawater and media is also require.
12.	Techno-Economics	Starting with 5 g fresh biomass, 1,00,000 seedlings of size 0.5-1.0 cm can be produces which can be further cultivated in tanks to give 2 kg fresh biomass in total 90 days. This requires only one manpower. Current prize of 1 kg dry biomass in India is around Rs. 250-300 per kg. 1 kg fresh biomass contains 85% moisture.
13.	Technology Package	Know-how for spore-based seedling generation and subsequent demonstration of tank cultivation for one cycle;; License fee and other financial details would be provided on request.

14.	Photograph (Important/Significant; high quality photographs suggesting proof of concept & validation)	 Schematic diagram of tank cultivation of the green seaweed *Ulva* using spore-based seedlings