

GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

LOK SABHA

UNSTARRED QUESTION NO. 3089

ANSWERED ON 11.03.2026

"Marine and Space Biotechnology"

3089. Shri K C Venugopal:

Will the Minister of SCIENCE AND TECHNOLOGY be pleased to state:

- a) whether the Government has identified futuristic marine and space biotechnology as priority sectors under country's biotechnology and bio manufacturing strategy and if so, the details thereof;
- b) the details of the country's current capabilities in marine bio manufacturing and space biotechnology, including research infrastructure, funding and human resource development;
- c) the details of the steps taken by the Government to reduce country's dependence on imported seaweed-derived and marine bio-based products used in food, pharmaceuticals and medical applications;
- d) whether a dedicated national roadmap with timelines and outcomes is being formulated for marine and space biotechnology in coordination with Indian Space Research Organisation (ISRO) and other scientific institutions and if so, the details thereof; and
- e) the measures proposed to encourage private-sector participation and scale-up of research, innovation and manufacturing in these emerging biotechnology domains?

ANSWER

**MINISTER OF STATE (INDEPENDENT CHARGE) FOR THE MINISTRY OF
SCIENCE AND TECHNOLOGY & EARTH SCIENCES
(DR. JITENDRA SINGH)**

- a) Yes, the Government has identified futuristic marine and space biotechnology as priority sectors under the BioE3 (**B**iototechnology for **E**conomy, **E**nvironment and **E**mployment) Policy of the Department of Biotechnology (DBT). The key priority areas in space

biotechnology include microgravity research, space bio manufacturing, bioastronautics and space biology. On the other hand, DBT envisions developing a biomanufacturing ecosystem based on futuristic marine research to tap the oceanic resources and oceanic space for meeting the growing needs of food, energy, chemicals, and materials.

- b) Several national institutes and universities have been involved in screening and identifying bioproducts of utility in health and other commercial applications from marine resources. The DBT's Public Sector Unit, Biotechnology Industry Research Assistance Council (BIRAC) has supported India's first marine biofoundry under the BioE3 Policy at KIIT-Technology Business Incubator, Bhubaneswar for production of cattle feed additives, pharma-grade collagen, seaweed-based biostimulants. Ministry of Earth Sciences (MoES), through the Deep Ocean Mission is spearheading the inventorisation of deep-sea fauna and flora, capacity building and bioprospecting using deep-sea genetic material from microbes. National Institute of Ocean Technology (NIOT) under MoES is engaged in activities related to technology development and demonstration in the areas of micro-algal culture, open-sea fish culture in cages, and seaweed cultivation. ICAR- Central Marine Fisheries Research Institute (CMFRI) has also been contributing significantly to the advancement of marine biotechnology. Pradhan Mantri Matsya Sampada Yojana (PMMSY) of the Department of Fisheries (DoF) has given momentum to the seaweed industry.

In the area of space bio manufacturing, the current focus is to characterize the behavior of various microorganisms for their potential space bio manufacturing applications. Towards this, three experiments from DBT institutions were shortlisted in the recent ISRO-NASA mission to International Space Station. In parallel, collaborative efforts are underway to undertake demonstration of space bio manufacturing processes in future. DBT has provision for funding for futuristic marine and space biotechnology sectors via the Cabinet approved 'Biotechnology Research Innovation and Entrepreneurship Development (Bio- RIDE)' scheme.

- c) The Futuristic Marine Research vertical of the BioE3 policy is focused on R&D in Seaweed Cultivation: breeding for traits such as high yield; disease resistance and climate tolerance; strain improvement through genome assisted approaches for indigenous species of seaweed; developing scalable farming techniques for large scale production of seaweeds/algae in offshore waters and onshore and sensors for in-situ measurement of seaweed crop health and real time monitoring of farm integrity; development of value added products such as biofuels; animal feed supplements for animal health and methane reduction; agri inputs &

fertilizers; pharmaceuticals such as drugs/immunomodulators; nutraceutical products; biodegradable plastics etc. from micro & macro algae. These strategic initiatives will give a fillip to indigenous production and help reduce import dependency. The cultivation of seaweeds and processing them into value-added products is also being pursued by the Council of Scientific and Industrial Research (CSIR) through its constituent laboratory, namely, CSIR-Central Salt and Marine Chemicals Research Institute (CSIR-CSMCRI), Bhavnagar. DoF designated ICAR-CMFRI as a Centre of Excellence for Seaweed Cultivation to strengthen indigenous production, quality seed supply, farming protocols, and value-chain development.

- d) The DBT has signed a MoU with Indian Space Research Organisation (ISRO) for cooperation in Space Biotechnology. The short-term goals consist of implementation of proposals under the ISRO-NASA collaboration. On the other hand, mid-term and long term goals include DBT-ISRO joint space biomanufacturing as well as establishment of ground based infrastructure for space biotechnology experiments. Further, a Biomanufacturing implementation plan, for effective implementation of the BioE3 policy (including futuristic marine and space research) has been prepared.
- e) Public-private co-creation model is an inherent part of the BioE3 policy where implementation of the biomanufacturing initiative will combine the available expertise in academia, startups, and industry. BIRAC has supported India's first marine biofoundry under the BioE3 Policy at KIIT-TBI, Bhubaneswar. CSIR-CSMCRI, Bhavnagar, has transferred several seaweed-based technologies to the industries for commercialization. Further, CSIR-National Institute of Oceanography (CSIR-NIO), Goa is collaborating with industries for scale-up and product development through the sustainable utilization of marine living resources. MoES has also taken steps to encourage private-sector participation in marine bio-based products, and transfer of technology for specific products has been carried out for interested industries. ICAR-CMFRI supports industry engagement through licensing of technologies, collaborative research projects, and incubation support for start-ups.
