GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
LOKSABHA
UNSTARRED QUESTION NO-3051
ANSWERED ON 19/03/2025

R&D IN COLD CHAIN, WATER & WASTE MANAGEMENT BY DAE

3051. SHRI SURESH KUMAR KASHYAP
SHRI BHARTRUHARI MAHTAB
SMT. ROOPKUMARI CHOUDHARY
SHRI ANURAG SHARMA
MS. KANGNA RANAUT

Will the PRIME MINISTER be pleased to state:-

(a) whether Department of Atomic Energy (DAE) has done any Research and Development (R&D) activities on technologies addressing issues related to post-harvest cold chain;
(b) if so, the details thereof along with the efforts made for commercialisation of the same; and
(c) whether any DAE technologies are being utilised in Water treatment & Urban Waste Management and if so, the details thereof?

ANSWER

THE MINISTER OF STATE FOR PERSONNEL, PUBLIC GRIEVANCES & PENSIONS AND PRIME MINISTER'S OFFICE (DR. JITENDRA SINGH)

(a) Yes, the Department of Atomic Energy (DAE) has conducted comprehensive R&D activities on technologies specifically aimed at mitigating post-harvest spoilage in agri-produce through integrated approaches involving irradiation and cold chain. Some of the important agri-produce preserved through this approach include onion, potato, mango and litchi.

(b) Successful long term preservation of onion with minimal weight loss and retention of overall quality characteristics has been demonstrated by Bhabha Atomic Research Centre (BARC) a constituent unit of DAE through various commercial trials involving different Government and private agencies. Recently in 2023, a commercial trial was conducted jointly with National Cooperative Consumer Federation (NCCF) and

Department of Consumer Affairs through which the radiation processed onions produced in Rabi crop were effectively stored for 7.5 months under specified cold storage conditions.

Potatoes can be stored after radiation processing in cold storage for extended period of 8 months without dependence on chemical sprout inhibitors. This approach helps in overcoming cold induced sweetening which otherwise results in quality deterioration for potato processing industry. Irradiated potatoes can be stored at 14°C at Relative Humidity greater than 90% compared to traditionally used condition for storage of potato in cold storage at 2-4 °C resulting in power saving.

Irradiation has enabled the export of mangoes to USA since 2007 through the air-route. In an effort to further provide a major boost to the export of mangoes, shipment through sea-route offers a promising cost-effective alternative. The R&D efforts at BARC have also led to the development of a USDA-APHIS approved protocol that maintains the quality of radiation processed mangoes for a month's time in cold storage thus meeting the voyage period from India to USA. The large-scale sea-route shipment of 'Kesar' mangoes was successfully accomplished in the year 2022 in joint venture with a private firm.

BARC has developed a technology by which processed litchi can be preserved up to 60 days at low temperature (4±2 °C), and relative humidity (55-60%) while retaining its nutritional, sensory (taste), functional and colour qualities. This treatment is essentially based on mild rinsing of plucked litchi fruits using three solutions containing GRAS (Generally Recognized As Safe) chemicals, which help in retaining these quality attributes.

(c) Multiple DAE technologies are being used for water, wastewater and urban waste management as described below :

1. DAE has developed desalination technologies viz. Multistage Flash (MSF), Multi Effect Distillation (MED), Sea Water Reverse Osmosis (SWRO). Details of installations are as follows :
    a) 6.3 MLD hybrid MSF-SWRO Nuclear desalination plant coupled to Madras Atomic Power Station at Kalpakkam, Tamil Nadu.

b) 5.0 MLD SWRO- MED plant at Odisha Sands Complex, District Ganjam, Odisha.

2. DAE has developed membranes such as ultrafiltration (UF), nanofiltration (NF) and reverse osmosis (RO) for desalination and water purifications and transferred these technologies to Indian manufacturer for 'Atma Nirbhar Bharat'. BARC-developed water purification technologies (PoU & community-scale plants based on indigenous UF & RO membranes) are commercially available and deployed in domestic households as well as on community scale through BARC licensees across India. BARC developed water purification technologies are deployed in 200 village equivalents, catering to a population of about 2 lakh people.

3. Hybrid granular sequencing batch reactor (hgSBR) is a patented technology aimed at providing compact biological treatment in the sewage treatment plants/effluent treatment plants. It relies on microbial bio-beads and sequencing batch reactor (SBR) for providing effective and sustainable wastewater treatment. Due to the advantages on treatment and environmental sustainability, several private companies approached BARC for technology transfer for large scale deployment. Notably, 3 numbers of hgSBR-based treatment plants each of 500 KLD capacity were deployed for treating the sewage from the temporary toilets provided to the pilgrims in the recently concluded Maha Kumbh 2025 at Prayagraj.

4. DAE has developed is a cotton cloth-based radiation grafted matrix for treatment of effluents from dye industry. The matrix developed is able to adsorb ionic dyes from effluents efficiently. Salient features of the technology include green fabrication process, easily available low-cost ingredients, no by-products left in the treated water and ease of upscaling. Demonstration plant of 75 KLD capacity based on this technology has been operating in Jodhpur, Rajasthan since last one year.

5. For urban waste management DAE has developed technology for hygienisation of sewage sludge generated in sewage treatment plants. This technology utilizes high energy gamma radiation from Co-60 for hygienizing dry sewage sludge. The hygienised sludge is a rich source of organic carbon and can be used as organic

manure for horticulture and agricultural applications. Two plants based on this technology have been commissioned under MoU with municipal corporations. The first plant was set up at Ahmedabad and second plant was set up at Indore.

6. BARC has developed Nisargruna technology for solid biodegradable waste management. The technology converts solid biodegradable waste into two useful by-products i.e. biogas and manure. Biogas is rich in methane contents and can be used for a community kitchen, hotel kitchen or electricity generation. Further, Shesha, based on same technology, in compact form with smaller foot print, has also been developed for small housing society.

7. A completely indigenous technology for treatment of oil and salt contaminated waste water to obtain clean water suitable for agricultural / industrial use has been developed by BARC, and demonstrated at Oil and Natural Gas Corporation (ONGC) Mehsana under actual site conditions. The technology has been transferred to industry.

* * * * *