

GOVERNMENT OF INDIA
MINISTRY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH
RAJYA SABHA
STARRED QUESTION No. 225
(ANSWERED ON. 20.03.2025)

**TECHNOLOGY FOR WASTE MANAGEMENT AND CONVERSION OF WASTE-
TO-ENERGY**

* 225 SHRI SADANAND MHALU SHET TANAVADE :

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

- (a) whether CSIR has developed any technologies for waste management, including the clearance of old garbage dumps and the conversion of waste into energy. If so, details thereof;
- (b) whether any such technologies have been implemented in any States/UTs, if so, details thereof;
- (c) whether the Ministry has conducted any pilot projects or research studies on using waste-to-energy technologies to address urban and rural waste challenges, if so, details thereof; and
- (d) whether the Ministry has any plans to scale up these technologies nationwide to address the issue of old garbage dumps and improve waste-to-energy conversion rates, if so, details thereof?

ANSWER

MINISTER OF STATE (INDEPENDENT CHARGE) FOR THE
MINISTRY OF SCIENCE AND TECHNOLOGY AND EARTH SCIENCES

(DR. JITENDRA SINGH)

(a) to (d): A statement is laid on the Table of the House.

STATEMENT REFERRED TO IN REPLY TO PART (A) TO (D) IN RESPECT OF RAJYA SABHA STARRED QUESTION NO.*225 FOR REPLY ON 20.03.2025 REGARDING TECHNOLOGY FOR WASTE MANAGEMENT AND CONVERSION OF WASTE-TO-ENERGY ASKED BY SHRI SADANAND MHALU SHET TANAVADE.

(a) Yes, Sir. Constituent laboratories of Council of Scientific and Industrial Research (CSIR), namely CSIR-Central Mechanical Engineering Research Institute (CSIR-CMERI), Durgapur and CSIR-Indian Institute of Petroleum (CSIR-IIP), Dehradun, CSIR-Indian Institute of Chemical Technology (CSIR-IICT), Hyderabad and CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram have developed technologies for waste management and the conversion of waste into energy. The brief details are as under:

- **Waste plastic into fuels and chemicals:** CSIR-IIP together with GAIL has developed a technology for converting polyethylene and polypropylene type waste plastics into fuels and chemicals like gasoline, diesel, toluene and xylene.
- **Upgrading Raw Biogas to Biomethane:** CSIR-IIP has developed a technology for Upgrading Raw Biogas to Biomethane, meeting the BIS 16087 (2016) specifications for piped fuel gas and for vehicular fuel applications. The upgraded biogas can supplant the fossil derived Natural Gas i.e. as a Piped Natural Gas (PNG) equivalent fuel and as Compressed Biogas (CBG) which is equivalent to Compressed Natural Gas (CNG).
- **Conversion of Used Cooking Oil (UCO) to biodiesel and bio-jet:** A technology has been developed by CSIR-IIP for conversion of Used Cooking Oil (UCO) to biodiesel and bio-jet.
- **Decentralised Solid Waste Management Technology (DSWMT):** CSIR-CMERI has developed Decentralised Solid Waste Management Technology (DSWMT) for the management of Solid Wastes. The significant features of the technology are: Integrated & mechanized segregation system for biodegradable & non-biodegradable waste; Eco-friendly disposal of plastic waste through agglomeration process; Generated Bio-gas from organic waste can be used as cooking gas and the conversion of agro waste into briquette by mixing with the slurry of the biogas digester and utilization as fuel. The technology has been transferred to five industries for commercialization/deployment.
- **Anaerobic Gas Lift Reactor (AGR) Technology:** CSIR-IICT has developed a novel high rate bio methanation technology called “AGR” for the generation of biogas and bio-manure from organic solid waste. The said technology is superior in terms of biogas and bio-manure production as it incorporates novel pre and post processing technologies required for the bio methanation of organic solid waste as per its characteristics. The salient features of the technology are advanced high-rate digester, three phase (solid/liquid/gas) separation

mechanism, lower food print area, semi-automatic plant operation, higher methane/ biogas yield and nutrient rich fertilizer etc. It can handle food waste, market and vegetable waste, poultry litter, organic fraction of MSW etc.

- **Bio- drying technology for converting MSW to RDF:** CSIR-NIIST has developed a clean biodrying for treatment of MSW with moisture content to make it suitable for waste to energy. The said technology was developed through a R&D project which was supported by Department of Environment and Climate Change (DoECC), Government of Kerala. Process can handle mixed municipal solid waste containing various kind of waste material including large proportion of organic compounds (high moisture content), plastics, waste clothes etc. in a modern and scientific way. Lab scale bio drying reactor has been fabricated for treating 110 kg waste per batch. This technology will help to clean up the urban environment, restoration of ambient air quality and eliminate GHGs.

(b) Yes, Sir. These developed technologies have been implemented as follows:

- **Upgrading Raw Biogas to Biomethane:** An old Biogas upgradation plant inside the Haibowal Dairy Complex at Ludhiana, Punjab has been revamped for improving bio-methane recovery based on CSIR-IIP's process knowhow. A new CBG plant based on CSIR-IIP technology is currently under construction at Rudrapur, Uttarakhand by M/s Mailhem Environment Pvt. Ltd., Pune who is a technology licensee of CSIR-IIP on CBG technology.
- **Conversion of Used Cooking Oil (UCO) to biodiesel and bio-jet:** The UCO and non-edible seed oil conversion to biodiesel is implemented at Chhattisgarh Biofuel Development Authority (CBDA), Raipur, Chhattisgarh. The demo plant already working successfully at CSIR-IIP, Dehradun and One more demo plant is ready to be installed at Kashipur, Uttarakhand.
- **Decentralised Solid Waste Management Technology (DSWMT):** The different modules of integrated municipal solid waste disposal system (i-MSWDS) has been implemented at Central Reserve Police Force Group Centre, Durgapur sponsored by Ministry of Home Affairs, Govt. of India; CSIR-NESIT, Jorhat; CSIR-CMERI-CoEFM Ludhiana; Imphal East, Imphal West, Bishnupur, Senapati Districts of Manipur sponsored by PHED, Govt of Manipur; Karunya Institute of Technology & Sciences Coimbatore. CSIR-CMERI and CSIR-IHBT is collaboratively executing project Integrated Scientific Solutions for Improving Legacy Municipal Solid Waste Management in the Indian Himalayan Region at Darjeeling Municipality under National Mission on Himalayan Studies. CSIR-CMERI has been awarded consultancy services for solid waste management by Panchayat & Rural Development, Govt. of West Bengal; Urban & Housing Development Department, Govt. of Jharkhand; Jalandhar Smart City; Damodar Valley Corporation and Maithon Power Ltd.

- **Anaerobic Gas Lift Reactor (AGR) Technology:** The technology can be implemented in gated communities as a minimum and can be implemented in bigger places like the market yards, restaurants, bulk waste generators. The technology has been commercialized on non-exclusive to 4 Indian companies. As of now, a total of 32 plants under operation with different capacities covering 10 states which includes Telangana, Gujarat, Karnataka, Uttar Pradesh, Odisha, Andhra Pradesh, Pondicherry, Sikkim, Himachal Pradesh and Tamil Nadu.
 - **Bio-drying Technology for converting MSW to RTF:** Presently, CSIR-NIIST is implementing a project aimed to demonstrate, at pilot level (10 Tonnes per Batch (TPB)), for treatment of MSW. The cost of project is co-supported by DST (INR 302.06 Lakhs) and CSIR (INR 190.10 lakhs). The project partners include Nedumangad Municipality and Centre for Environmental Development (CED), Thiruvananthapuram.
- (c) Yes, Sir. The details of pilot projects or research studies on using waste-to-energy technologies by CSIR is as under:
- **Waste plastic into fuels and chemicals:** CSIR has approved a Mission mode project on “Depolymerization and Upcycling of Waste Plastics” for the period 2022-2025. As part of this project pilot scale studies have been taken up for converting MSW derived plastics to diesel.
 - **Upgrading Raw Biogas to Biomethane:** CSIR-IIP had conducted pilot study of their biogas upgradation technology during 2018-2020, under a CSIR sponsored Fast Track Translation project, at a municipal waste sorting and management complex under the Pune Municipal Corporation at Katraj, Pune
 - **Conversion of Used Cooking Oil (UCO) to biodiesel and bio-jet:** An FTT/FTC project sanctioned during the FY 2023-24, for the Demonstration of Mobile Unit 50 lit/batch (1 barrel/day) for biodiesel production from non-edible oil and used cooking oil.
 - **Bio- drying Technology for converting MSW to RTF:** A detailed pilot scale study for treatment of mixed municipal solid waste (initial moisture content >60%) was performed utilizing this technology. The volume reduction of 56.5%, bulk density enhancement of 52%, moisture reduction of 20% and complete odour removal were achieved by using this technology which makes the process versatile. At present, the pilot scale unit is capable of treating 110 kg of mixed MSW in a single batch to convert MSW to RDF.
- (d) Yes, Sir. CSIR’s plans to scale up aforesaid technologies are as under:
- **Waste plastic into fuels and chemicals:** After successful completion of pilot scale studies and removing bottlenecks identified during the pilot scale studies, scale-up activities may be taken up considering stake holder interest.

- **Upgrading Raw biogas to biomethane:** Currently CSIR-IIP is offering their biogas upgradation technology to the interested CBG producers across India on site specific and nonexclusive license basis.
- **Conversion of Used Cooking Oil (UCO) to biodiesel and bio-jet:** Tata Projects Limited has shown keen interest in implementing CSIR-IIP room-temperature biodiesel process.
- **AGR Technology of CSIR-IICT and MSW Technology of CSIR-CMERI:** CSIR Hqrs has planned to demonstrate a few of CSIR technologies including AGR technology of CSIR-IICT and MSW sorter technology of CSIR-CMERI as technology demonstration model to relevant stakeholders. The current model is planned to be installed at CSIR-CRRI, New Delhi. It is aimed for integrated approach for keeping relevant stakeholders on same path such as CPCB and Delhi Municipal Corporation (MCD).
