GOVERNMENT OF INDIA
MINISTRY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH
LOK SABHA
UNSTARRED QUESTION NO. 3099
(TO BE ANSWERED ON 19.03.2025)

E-WASTE MANAGEMENT

3099. SMT. HIMADRI SINGH:
MS. KANGNA RANAUT:

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

(a) whether Council of Scientific and Industrial Research (CSIR) has developed any technology solution to manage e-wastes; and

(b) if so, the details thereof and if not, the reasons therefor?

ANSWER

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

(DR. JITENDRA SINGH)

(a)&(b) Yes, Sir. Council of Scientific and Industrial Research (CSIR) has developed a few technology solutions to manage e-wastes. CSIR-National Metallurgical Laboratory (CSIR-NML), Jamshedpur – a constituent laboratory of CSIR has developed the following technologies/processes to manage e-waste:

- **Recovery of Gold from Waste Mobile Phones and Scraps of various Equipment: A process has been developed for the dissolution of metal from the PCBs of waste mobile phone, small parts of various equipment containing gold on the outer layer. Chemical leaching followed by**

adsorption/ cementation with subsequent heat treatment was used to recover 99% gold.

- **Recovery of Cobalt from Discarded Li-ion Batteries of Mobile Phone: A process has been developed for the dissolution of metals from discarded lithium-ion batteries (LIBs) of mobile phones. Diluted sulfuric acid in presence of an oxidant was used to leach out ~70-80% cobalt along with other metals in 60 min at elevated temperature. Leach liquor generated was further processed through solvent extraction, precipitation, crystallization/ electro-winning techniques to recover cobalt as salt/ metal.**
- **Recovery of Neodymium as a Value Added Product from Waste Hard Disk of Personal Computers: A process has been developed for the recovery of neodymium as value added product from magnets of discarded hard disk. Under optimized condition, sulfuric acid leaches 98% Nd, 97% Fe, 60% Ni and 7.5% B. Acid leaching was followed by selective precipitation of Nd and leaching of the precipitate with 5-20% HF solution.**
- **Recycling of spent/used/discarded lithium iron phosphate (LFP) batteries for recovery of Lithium, iron and phosphorus: With acid leaching using 10-20% solids, 98-100% Li, Fe and P could be extracted. The leach liquor was subjected to selective sequential precipitation route to extract 90-95% pure lithium as lithium carbonate/lithium hydroxide and 98% pure iron phosphate. Purified graphite was a derivative in the process. The developed process recovers lithium in most desired marketable form, apart from iron phosphate. The derived values can be used for multiple applications apart from new battery manufacturing.**
- **Recovery of Lithium, Nickel, Cobalt, Manganese and Graphite from Spent/Used/Discarded Lithium-ion Batteries of mixed chemistries: With acid leaching using 20-30% solids, 94-96% Li, Co, Ni and Mn, was extracted. The leach liquor was subjected to selective sequential multistage solvent extraction and precipitation route to extract >96-99.9% multiple variant pure salts of lithium, nickel, cobalt and manganese. High pure graphite is a derivative product of the process. The process enables recovery of acid and reagents. The developed technology can extract critical elements like Lithium, Cobalt and**

Nickel apart from manganese as salts in most desired marketable form, with holistic recycling to result in reusable graphite. For generic value, an estimate of 100kg of spent laptop LIBs gives 25kg electrode material, from which 5.7 kg Cobalt sulfate, 0.69 kg Lithium Hydroxide, 0.51 kg Nickel Carbonate, 5.4 kg Manganese Carbonate, 0.5 kg Alumina Powder and 12 kg graphite powder can be separated. CSIR-NML, Jamshedpur has also developed a pilot scale facility to dismantle and recycle LIBs at 1TPD scale. This facility is capable of processing all LIBs to synthesise metal salts suitable for new battery making.

Further, CSIR-Institute of Minerals and Materials Technology (CSIR-IMMT), Bhubaneswar– a constituent laboratory of CSIR has also developed following process flowsheets for the management of e-waste:

- **Process flowsheet for recovery of valuable metals from the Printed Circuit Boards: A process flowsheet for the recycling of the e-waste was developed following mechanical separation and hydrometallurgical route. The flotation technique (a physico-chemical separation method) was used to separate hydrophilic metallic and hydrophobic non-metallic particles. The fine metallic particles subjected for copper leaching. The residue obtained from the copper leaching circuit was subjected for tin and precious metal recovery circuit.**
- **Process flowsheet for the recovery of Nd and Pr and other Rare Earth Elements (REEs): The process flowsheet was developed for the recovery of Nd and Pr and other REEs from waste NdFeB magnet, scrap, etc. present in the electronics.**

******