CSIR-CMERI's Municipal Solid Waste Processing Facility

Why in News

Recently, the **Council of Scientific and Industrial Research's Central Mechanical Engineering Research Institute** (CSIR-CMERI) has developed a **Municipal Solid Waste** (MSW) **Processing Facility (Decentralised Solid Waste Management Plant)** to solve the problem of waste management in India.

Key Points

- **Challenges in Waste Management:**
  - With an **ever-increasing population** and **rapid pace of urbanisation,** India faces a huge challenge of waste management.
  - The volume of waste is projected to **rise from the present 62 million tonnes to about 150 million tonnes** by **2030.**
  - **Indiscriminate dumping** of garbage at the current rate without appropriate scientific treatment would impose a huge **requirement of landfill area** per year.
  - Studies suggest that the MSW generated in India mostly consists of a large fraction of **organic wastes** and their unscientific disposal produces **greenhouse gas** (GHG) emissions and other **air pollutants like methane** (CH_4).
  - The **ineffective processing** of MSW also is the root **cause of many diseases** as the dumped landfills transform into **contamination hubs for pathogens, bacteria and viruses.**
  - The most commonly used process **"composting"** also **does not yield impactful economic returns** for the entrepreneurs.
    - It requires more land space and labour, pasteurisation for effective disinfection and has restricted utilisation due to presence of heavy metals.
    - During the rainy season, managing it becomes difficult due to the presence of excessive moisture.

- **MSW Processing Facility:**
  - It is developed following the **Solid Waste Management (SWM) Rules 2016** prescribed by the Ministry of Environment, Forests and Climate Change.
  - It has been developed with the **potential to scientifically manage the solid waste** including the **Covid-19 wastes.**
    The facility is equipped with special disinfection capabilities to help break the Covid-19 chain through **UV-C lights** and hot-air convection methods.
  - The plant is **self-sufficient** in terms of energy requirement through the installation of roof-mounted solar panels, which can also feed the surplus energy supply onto a mini-grid.
  - **Objectives:**
    - To unburden the common households from the segregation responsibilities through advanced segregation techniques.
    - To achieve decentralised decimation of solid wastes.
    - To help create value-added end-products from abundantly available redundant stuff such as dry leaves, dry grass, etc.
  - **Mechanism:**
    The **mechanised segregation system segregates solid waste** into metallic waste (metal body, metal container, etc.), biodegradable waste (foods, vegetables, fruits, grass, etc.), non-biodegradable waste (plastics, packaging material, pouches, bottles etc.) and inert wastes (glass, stones etc.).
  - **Significance:**
    - It opens up the opportunities to realise the dream of generating **100 GW Solar Power by 2022** and a city with a "Zero-Waste and Zero-Landfill Ecology".
    - It may become a source of job creation through both process-engagement and manufacturing, which can help support the **Micro Small Enterprises** (MSEs) and various start-ups across the nation.

Various Waste Disposal Methods

- **Bio-degradable Waste Disposal:**
  - The bio-degradable component of the waste is **decomposed in an anaerobic environment** popularly known as **bio-gasification.**
  - In this process, biogas is liberated through the conversion of organic matter and the biogas can be **used as fuel for cooking** or can also be utilised in a **gas engine for the generation of electricity.**
  - The **residual slurry** from the biogas plant is converted to **compost** in a natural process known as **vermicomposting** by introducing earthworms. The vermicompost is **utilised in organic farming.**

- **Biomass Waste Disposal:**
    - Biomass waste such as **dry leaves, dead branches, dry grass** etc. are disposed of by **first shredding** it to suitable size followed by **mixing with the slurry of the biogas digester.**
    - This mixture is the feedstock for **briquette** (compressed block of coal dust or other combustible material), which is utilised as fuel for cooking and in gasifier for production o**f syngas** (or **synthesis gas**), utilised in a gas engine for electricity generation.
        - Syngas is a **fuel gas mixture** consisting primarily of hydrogen, carbon monoxide, and very often some carbon dioxide.
- **Polymer Waste Disposal:**
    - The polymer waste **consisting of plastics** is being disposed of through **pyrolysis,** in which the polymer waste is **heated to a temperature of 400-600°C in an anaerobic environment in presence of a suitable catalyst.**
    - The volatile matter from the polymer waste comes out as a result of heating which on condensation gives **pyrolysis oil.**
    - The non-condensed syngas and crude pyrolysis oil after purification are **reused for heating purposes** and it helps in obtaining self-sustainability.
    - The **solid residue known as char** is mixed with the biogas slurry for production of briquette.
- **Sanitary Waste Disposal:**
    - The sanitary items including masks, sanitary napkins, diapers etc. are **disposed-off utilising high-temperature plasma gasification.**
    - The plasma gasification process uses **electricity to generate high-temperature plasma arc** (above 3000°C) inside the plasma reactor which **converts the waste into syngas and the residual ash** can be mixed with cement for preparation of recycled bricks.
        - However, this technology is **not economically viable** as energy requirements for waste treatment using this technology is very high.

Source: PIB