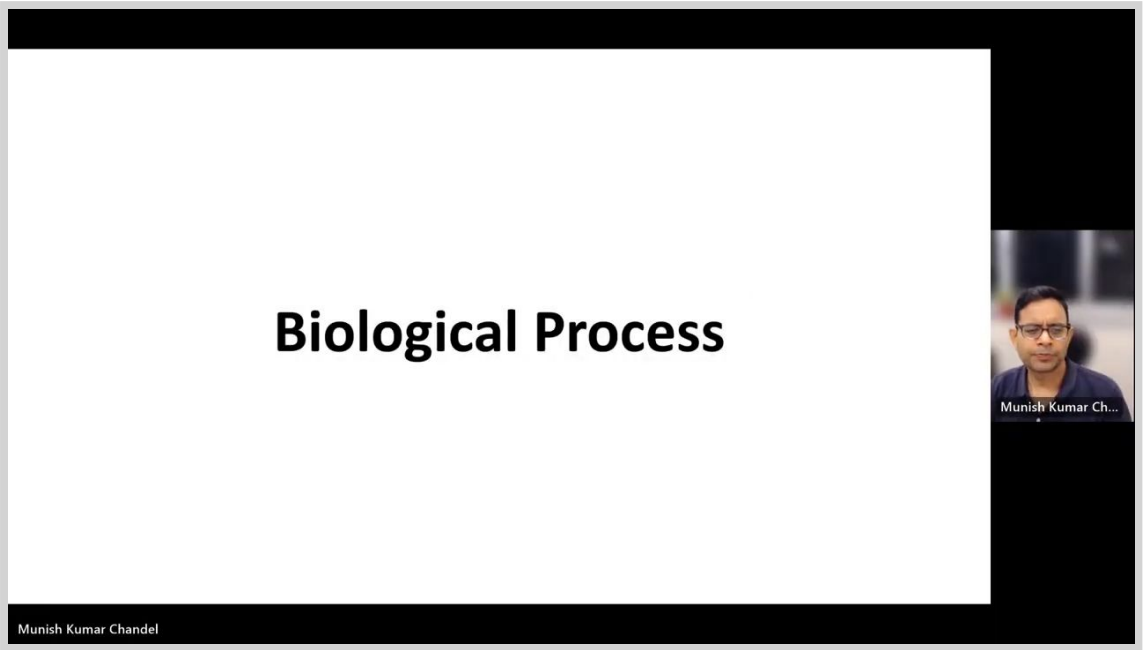
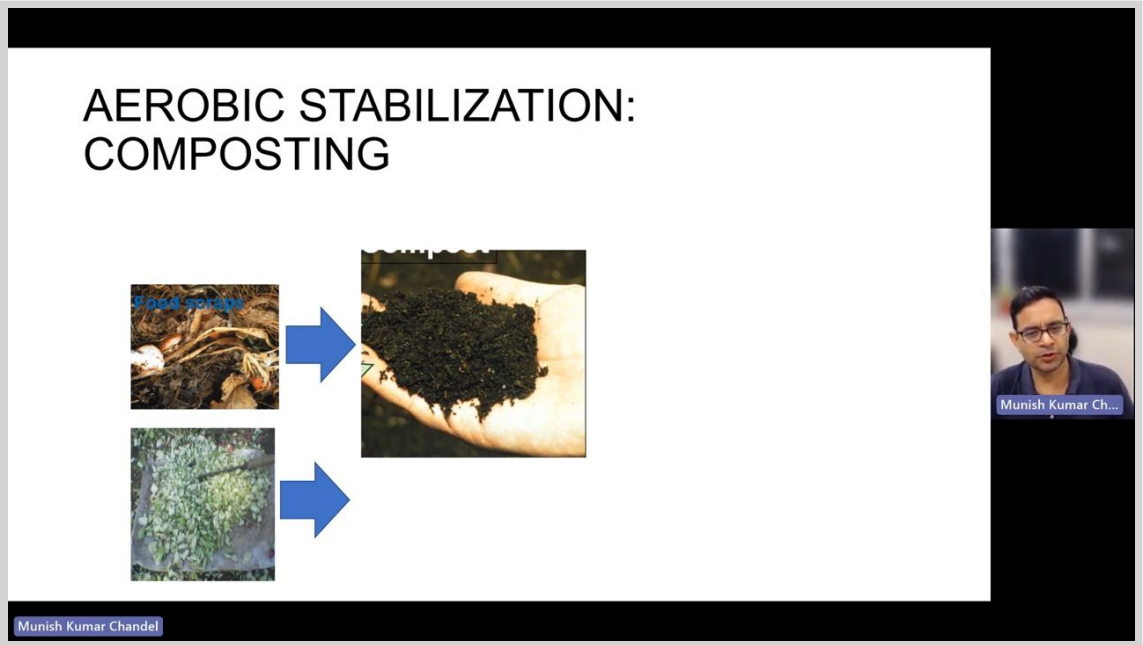
←

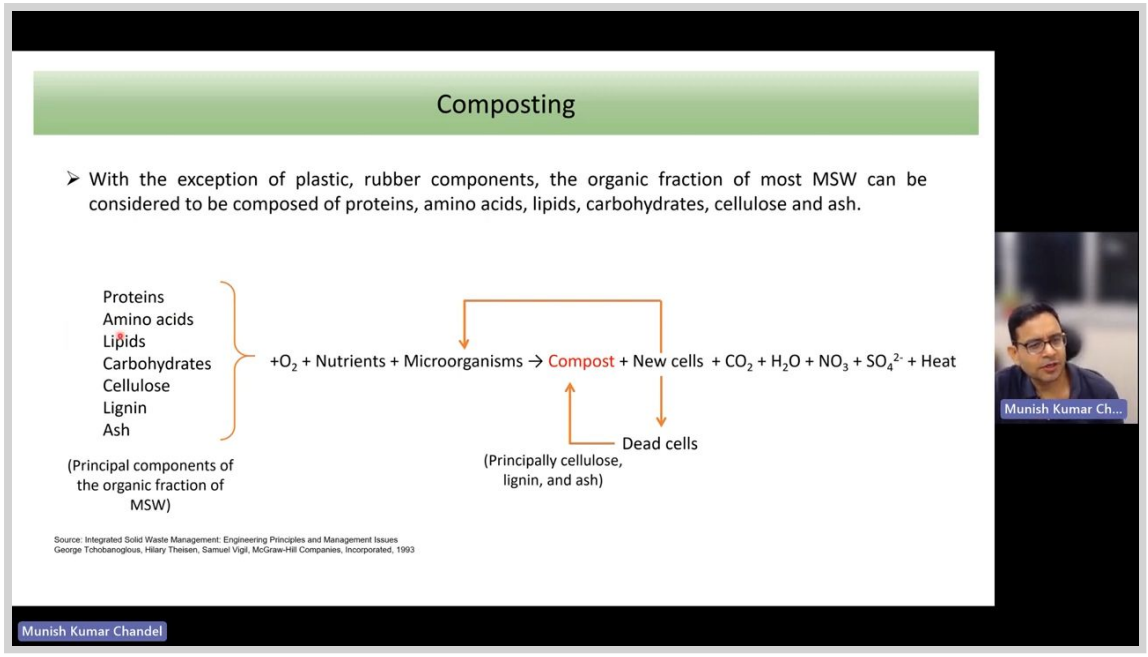
00:02



00:24



01:20


Composting
With the exception of plastic, rubber components, the organic fraction of most MSW can be considered to be composed of proteins, amino acids, lipids, carbohydrates, cellulose and ash.
Proteins
Amino acids
Lipids
Carbohydrates
Cellulose
Lignin
Ash
(Principal components of the organic fraction of MSW)
+O2 + Nutrients + Microorganisms → Compost + New cells + CO2 + H2O + NO3 + SO4 2- + Heat
Dead cells
(Principally cellulose, lignin, and ash)
Source: Integrated Solid Waste Management: Engineering Principles and Management Issues
George Tchobanoglous, Hilary Theisen, Samuel Vigil, McGraw-Hill Companies, Incorporated, 1993
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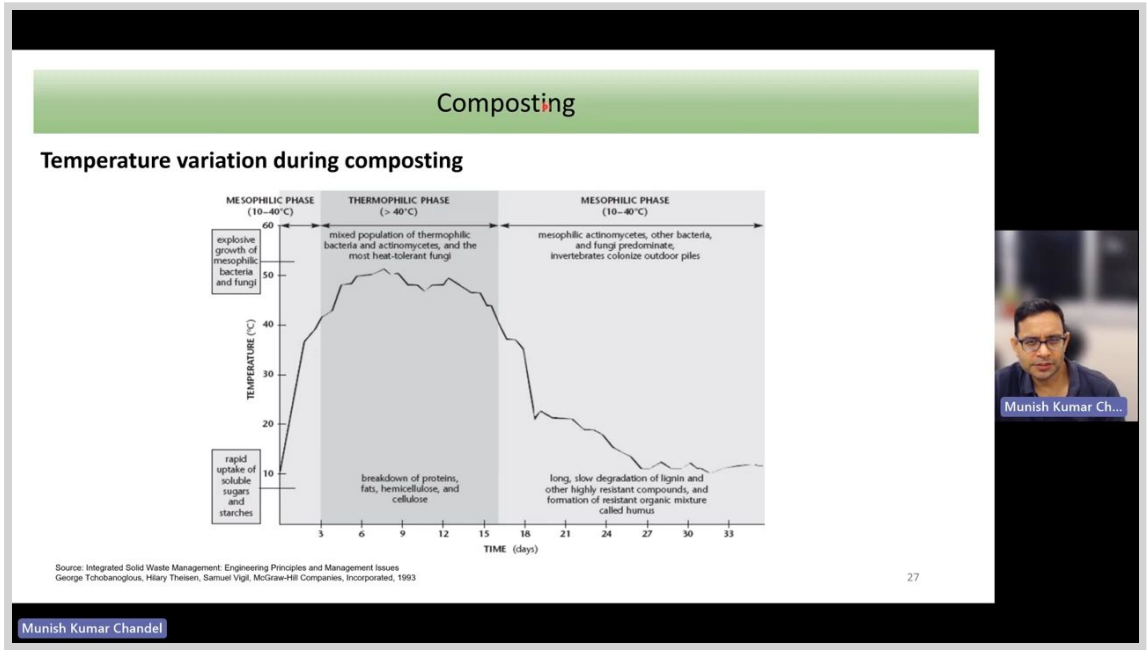
Composting
Temperature variation during composting
MESOPHILIC PHASE (10–40°C)
THERMOPHILIC PHASE (> 40°C)
MESOPHILIC PHASE (10–40°C)
explosive growth of mesophilic bacteria and fungi
mixed population of thermophilic bacteria and actinomycetes, and the most heat-tolerant fungi
mesophilic actinomycetes, other bacteria, and fungi predominate, invertebrates colonize outdoor piles
TEMPERATURE (°C)
60
50
40
30
20
10
rapid uptake of soluble sugars and starches
breakdown of proteins, fats, hemicellulose, and cellulose
long, slow degradation of lignin and other highly resistant compounds, and formation of resistant organic mixture called humus
3 6 9 12 15 18 21 24 27 30 33
TIME (days)
Source: Integrated Solid Waste Management: Engineering Principles and Management Issues
George Tchobanoglous, Hilary Theisen, Samuel Vigil, McGraw-Hill Companies, Incorporated, 1993
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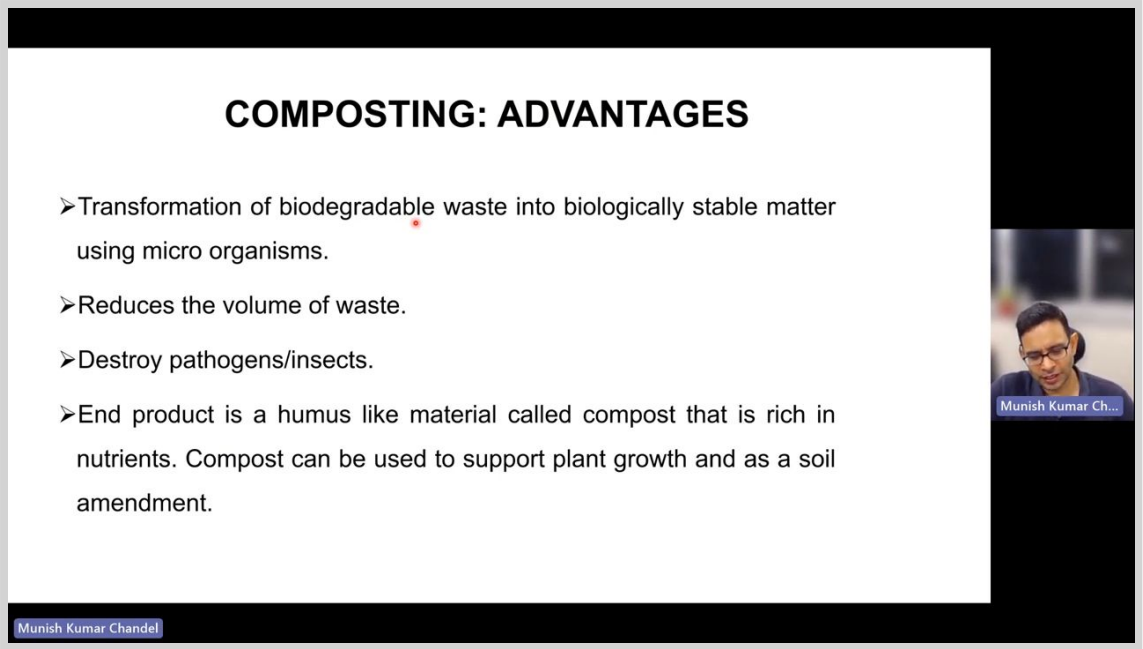
[04:55](#)


COMPOSTING: ADVANTAGES
➢Transformation of biodegradable waste into biologically stable matter using micro organisms.
➢Reduces the volume of waste.
➢Destroy pathogens/insects.
➢End product is a humus like material called compost that is rich in nutrients. Compost can be used to support plant growth and as a soil amendment.
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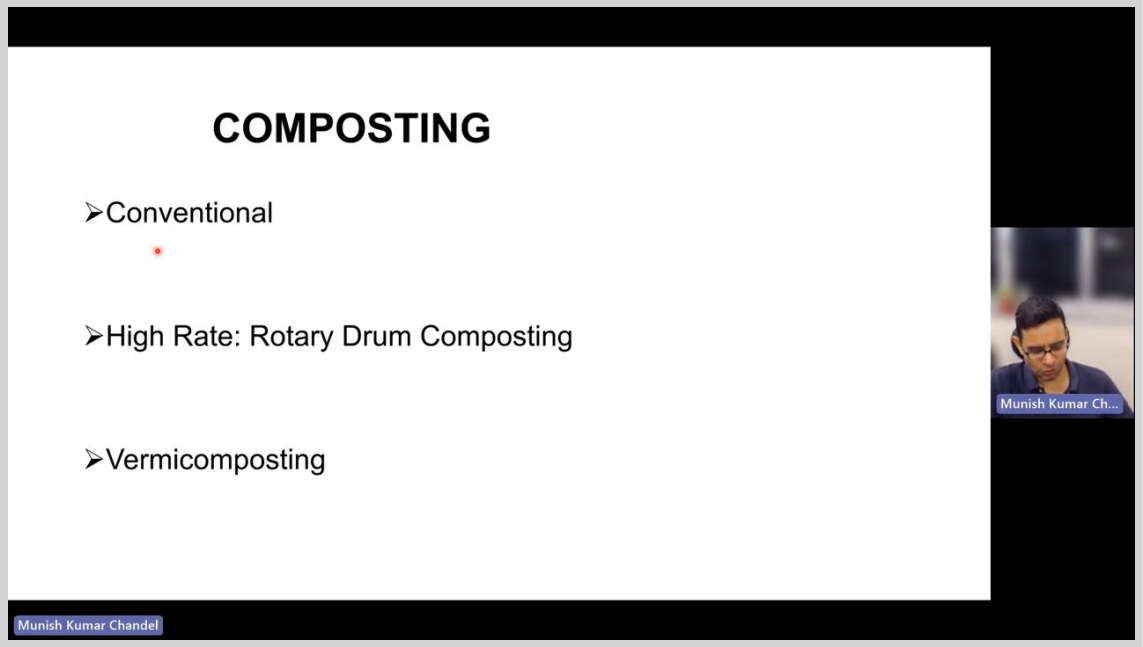
05:47


COMPOSTING
➢Conventional
➢High Rate: Rotary Drum Composting
➢Vermicomposting
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06:14


Composting - Techniques
Windrow Composting
Source http://www.grand-island.com/index.aspx?page=173
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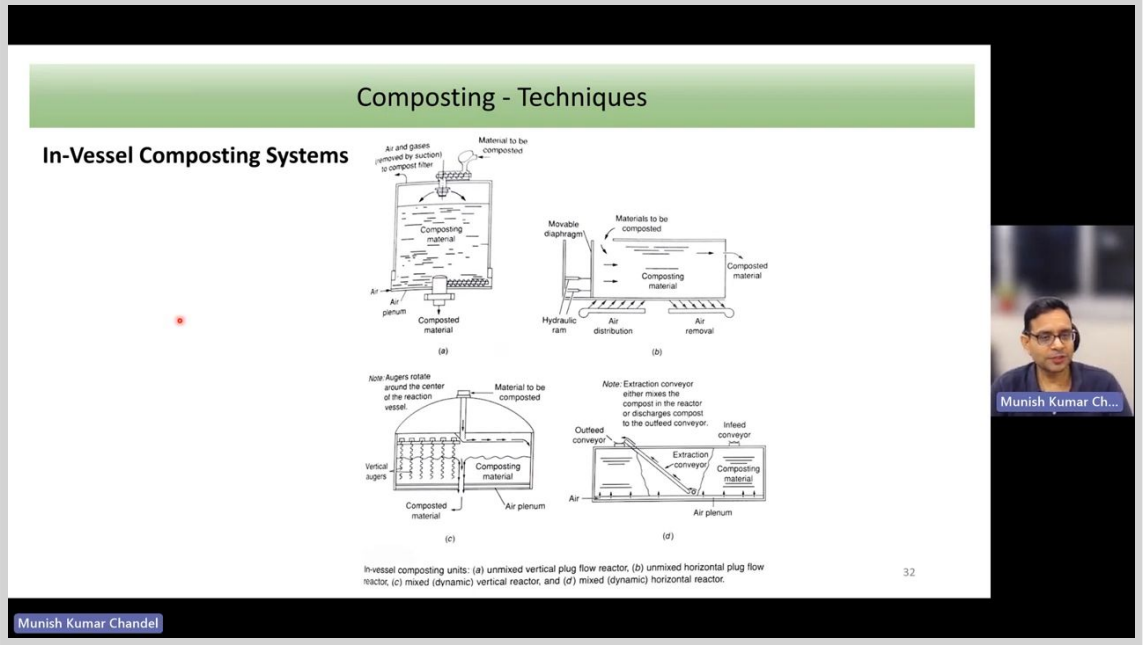
Composting - Techniques
In-Vessel Composting Systems
Air and gases (removed by suction) to compost filter
Material to be composted
Composting material
Air
Air plenum
Composted material
(a)
Movable diaphragm
Materials to be composted
Composting material
Composted material
Hydraulic ram
Air distribution
Air removal
(b)
Note: Augers rotate around the center of the reaction vessel.
Material to be composted
Vertical augers
Composting material
Composted material
Air plenum
(c)
Note: Extraction conveyor either mixes the compost in the reactor or discharges compost to the outfeed conveyor.
Outfeed conveyor
Infeed conveyor
Extraction conveyor
Composting material
Air
Air plenum
(d)
In-vessel composting units: (a) unmixed vertical plug flow reactor, (b) unmixed horizontal plug flow reactor, (c) mixed (dynamic) vertical reactor, and (d) mixed (dynamic) horizontal reactor.
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Rotary Drum Composting
Source: https://www.americanbiogascouncil.org/images/genericDigestionProcess.gif
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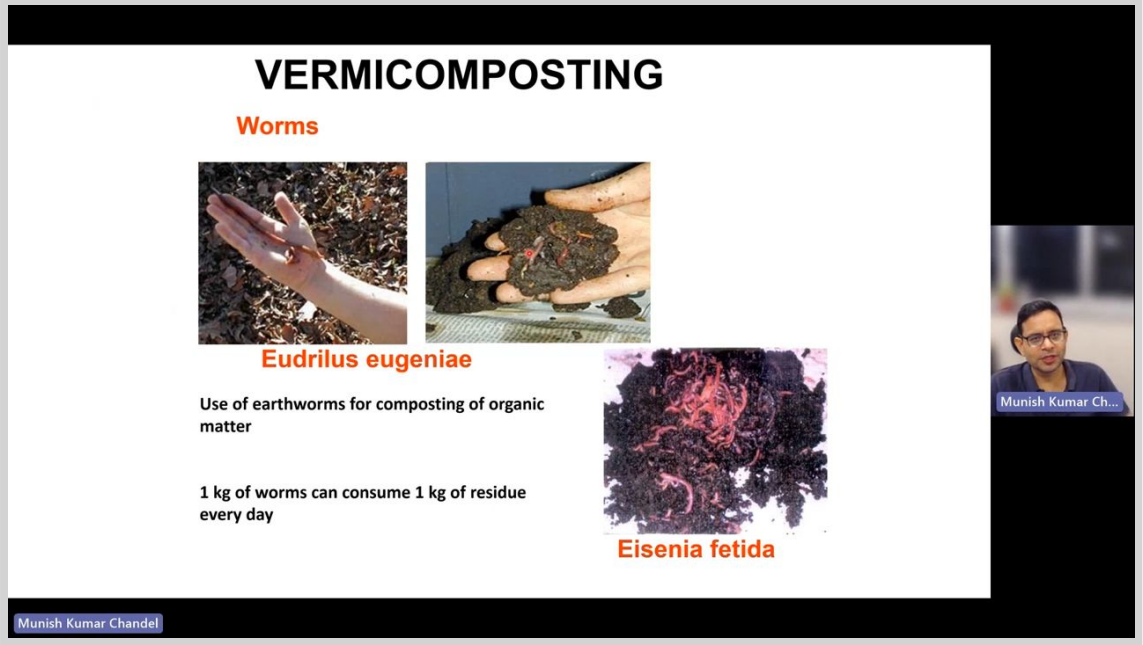
VERMICOMPOSTING
Worms
Eudrilus eugeniae
Use of earthworms for composting of organic matter
1 kg of worms can consume 1 kg of residue every day
Eisenia fetida
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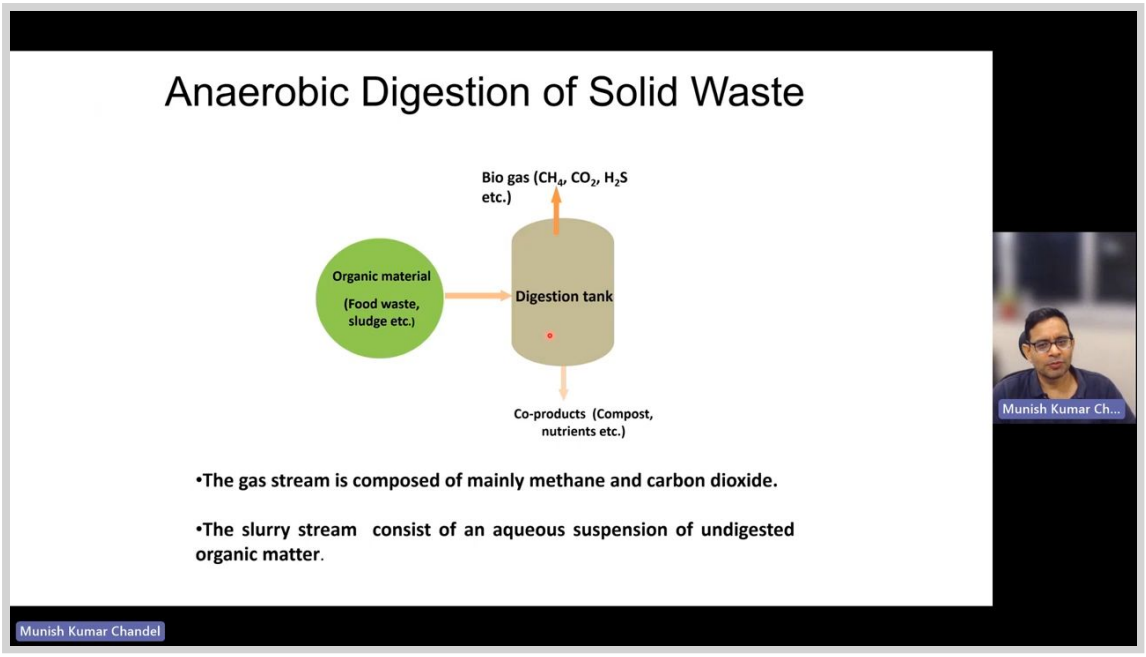
[11:10](#)


Anaerobic Digestion of Solid Waste
Bio gas (CH_4, CO_2, H_2S etc.)
Organic material (Food waste, sludge etc.)
Digestion tank
Co-products (Compost, nutrients etc.)
•The gas stream is composed of mainly methane and carbon dioxide.
•The slurry stream consist of an aqueous suspension of undigested organic matter.
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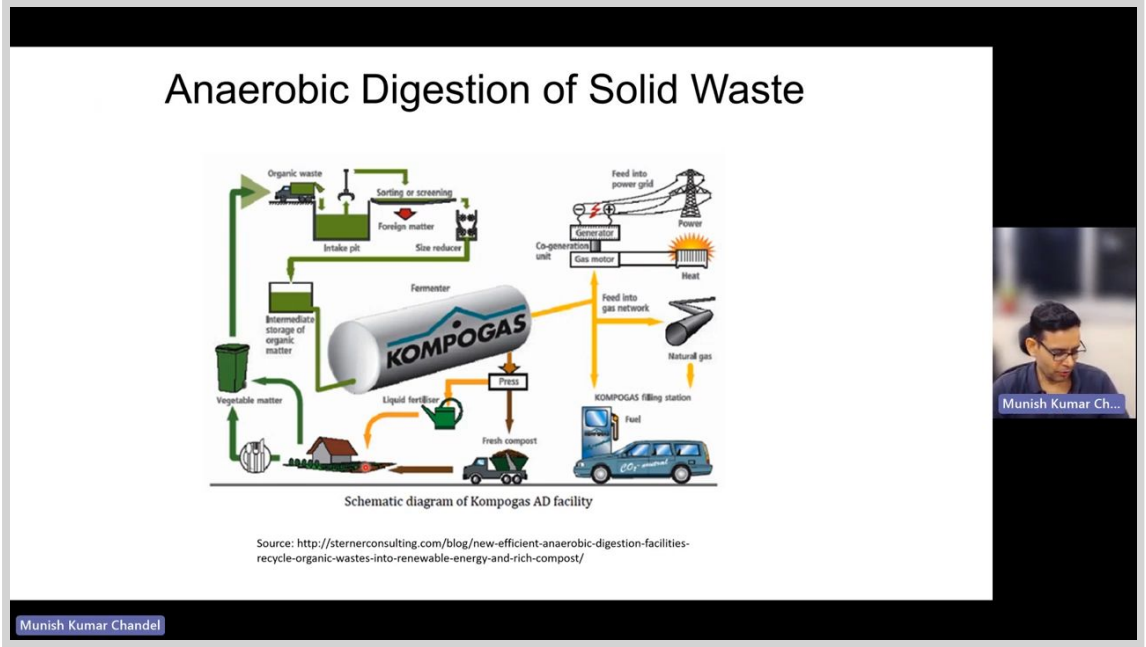
12:35


Anaerobic Digestion of Solid Waste
Organic waste
Sorting or screening
Foreign matter
Intake pit
Size reducer
Fermenter
Intermediate storage of organic matter
KOMPOGAS
Vegetable matter
Liquid fertiliser
Press
Fresh compost
Feed into power grid
Power
Generator
Co-generation unit
Gas motor
Heat
Feed into gas network
Natural gas
KOMPOGAS filling station
Fuel
Schematic diagram of Kompogas AD facility
Source: http://sternerconsulting.com/blog/new-efficient-anaerobic-digestion-facilities-recycle-organic-wastes-into-renewable-energy-and-rich-compost/
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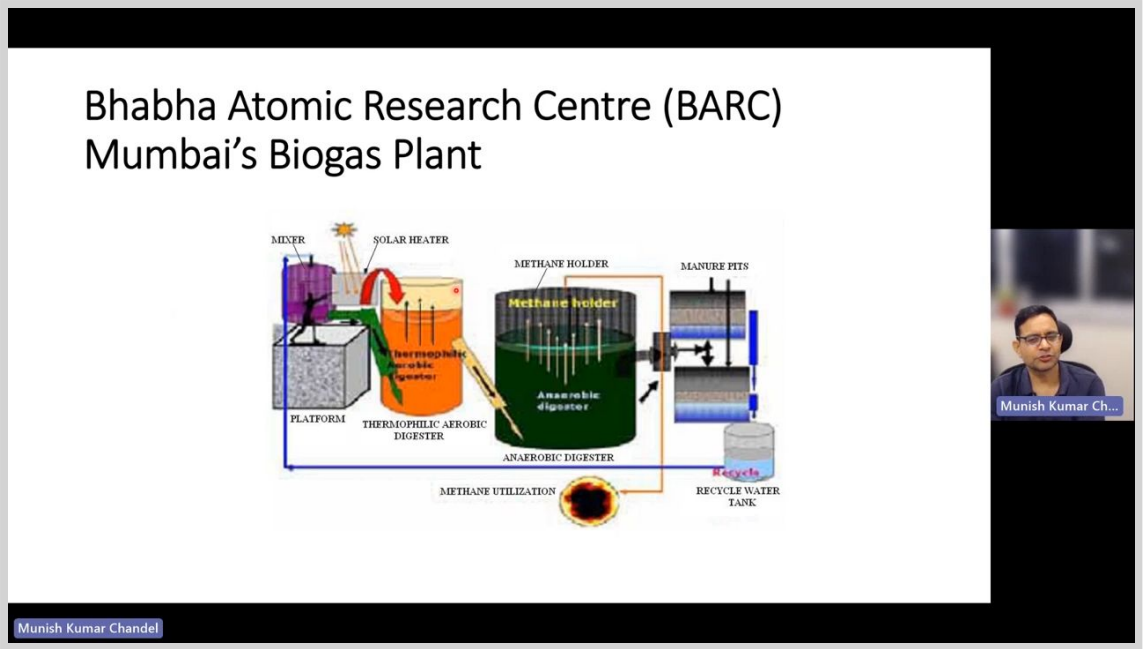
15:26


Bhabha Atomic Research Centre (BARC)
Mumbai's Biogas Plant
MIXER
SOLAR HEATER
METHANE HOLDER
MANURE PITS
Methane holder
Anaerobic digester
PLATFORM
THERMOPHILIC AEROBIC DIGESTER
ANAEROBIC DIGESTER
METHANE UTILIZATION
RECYCLE WATER TANK
Recycle
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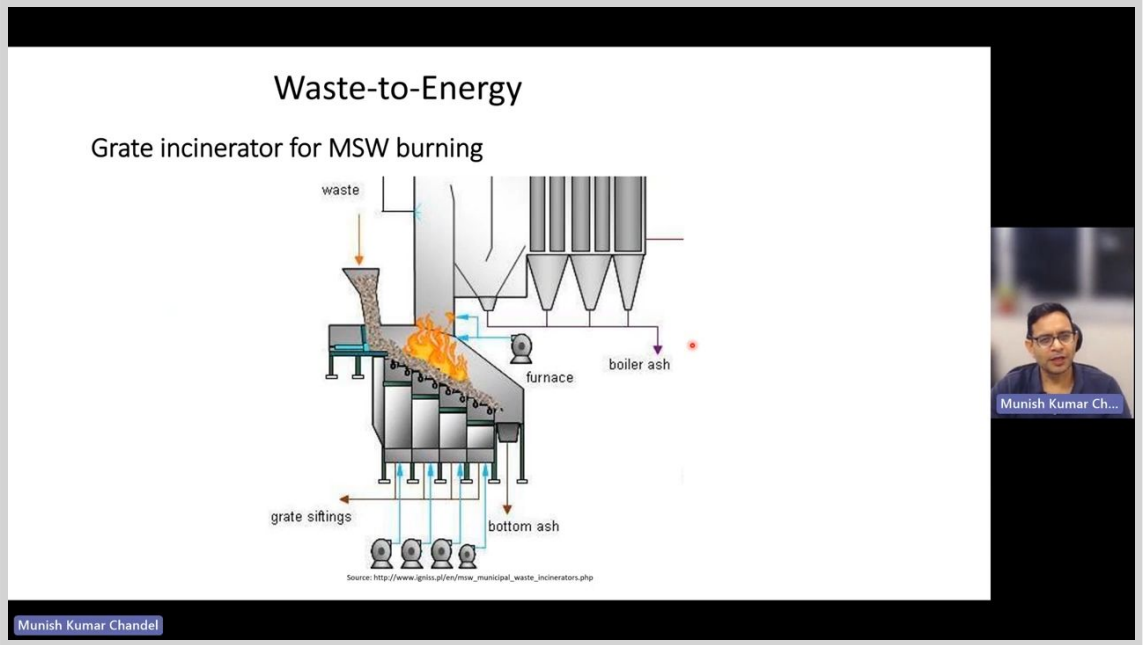
16:39


Waste-to-Energy
Grate incinerator for MSW burning
waste
furnace
boiler ash
grate siftings
bottom ash
Source: http://www.igniss.pl/en/msw_municipal_waste_incinerators.php
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