

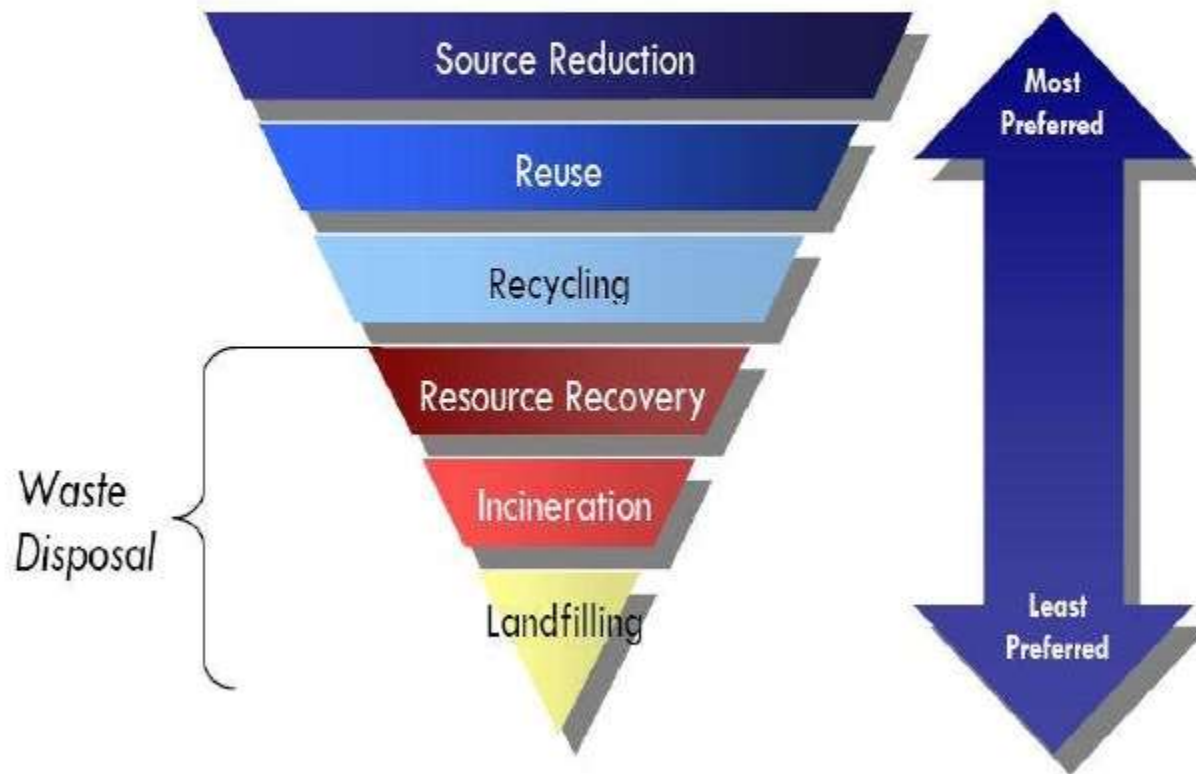
# Solid waste Treatment and Disposal

# Treatment and disposal of solid waste

Several methods are used for treatment and disposal. These are:

1. Composting
2. Incineration
3. Landfilling
4. Pyrolysis
5. Recycling

Figure 3-1. The Solid Waste Management Hierarchy



# Composting

- It is a process in which organic matter of solid waste is decomposed and converted to humus and mineral compounds.
- Compost is the end product of composting, which used as fertilizer.
- Three methods of composting:
  - (a) composting by trenching
  - (b) open windrow composting
  - (c) mechanical composting

## Composting by trenching

- Trenches 3 - 12 m long, 2 - 3 m wide and 1- 2 m deep with spacing 2 m.
- Dry wastes are filled up in 15 cm. On top of each layer 5 cm thick sandwiching layer of animal dung is sprayed in semi liquid form.
- Biological action starts in 2- 3 days and decomposition starts.
- Solid waste stabilize in 4- 6 months and changed into brown colored odorless powdery form known as humus.



## Open windrow composting

- Large materials like broken glass, stone, plastic articles are removed.
- Remaining solid wastes is dumped on ground in form of piles of 0.6 - 1 m height.
- The width and length of piles are kept 1- 2 m and 6 m respectively.
- Moisture content maintained at 60%.
- Temp. increases in side pile.
- After pile for turned for cooling and aeration to avoid anaerobic decomposition.
- The complete process may take 4- 6 week.







## Mechanical composting

- It requires small area compare to trenching and open windrow composting.
- The stabilization of waste takes 3- 6 days.
- The operation involved are
  - reception of refuse
  - segregation
  - shredding
  - stabilization
  - marketing the humus

1



2



3



85% TO GASIFIER  
- PULP/PAPER  
- PLASTIC  
- ORGANIC MATERIAL



5% METALS



10% TO LANDFILL

## Vermi Composting

Vermi-compost is the natural organic manure produced from the excreta of earthworms fed on scientifically semi-decomposed organic waste.

A few vermi composting plants generally of small size have been set up in some cities and towns in India, the largest plant being in Bangalore of about 100 MT/day capacity.

Normally, vermi-composting is preferred to microbial composting in small towns as it requires less mechanization and it is easy to operate.

It is, however, to be ensured that toxic material does not enter the chain which if present could kill the earthworms.

## Anaerobic Digestion and Biomethanation

Biomethanation is a comparatively well-established technology for disinfections, deodorization and stabilization of sewage sludge, farmyard manures, animal slurries, and industrial sludge.

Its application to the organic fraction of MSW is more recent and less extensive.

It leads to bio-gas/power generation in addition to production of compost (residual sludge).

This method provides a value addition to the aerobic (composting) process and also offers certain other clear advantages over composting in terms of energy production/consumption, compost quality and net environmental gains.

This method is suitable for kitchen wastes and, other putrescible wastes, which may be too wet and lacking in structure for aerobic composting. It is a net energy-producing process (100–150 kWh per tonne of waste input).

A totally enclosed system enables all the gas produced to be collected for use.

A modular construction of plant and closed treatment needs less land area.

This plant is free from bad odour, rodent and fly menace, visible pollution, and social resistance.

It has potential for co-disposal with other organic waste streams from agro-based industry.

The plant can be scaled up depending on the availability of the waste.

However, this method is suitable for only the organic biodegradable fraction of MSW; it does not degrade any complex organics or oils, grease, or ligno-cellulosic materials such as yard waste.

Similar to the aerobic composting process input waste needs to be segregated for improving digestion efficiency (biogas yield) and the quality of residual sludge.

While the liquid sludge can be used as rich organic manure, either directly or after drying, its quality needs to be ensured to meet statutory standards. No grinding of waste material should take place.

Wastewater generated in the plant requires treatment before disposal to meet statutory standards. Biogas leakage poses a small environmental and fire hazard.

This plant is more capital intensive than aerobic composting.

The biogas technology developed at BARC in India and commercialized as Nisarguna Biogas Plant is an improvement on this technology



## **Production of Refuse Derived Fuel (RDF) or Pelletization**

It is basically a processing method for mixed MSW, which can be very effective in preparing an enriched fuel feed for thermal processes like incineration or industrial furnaces.

The RDF pellets can be conveniently stored and transported long distances and can be used as a coal substitute at a lower price.

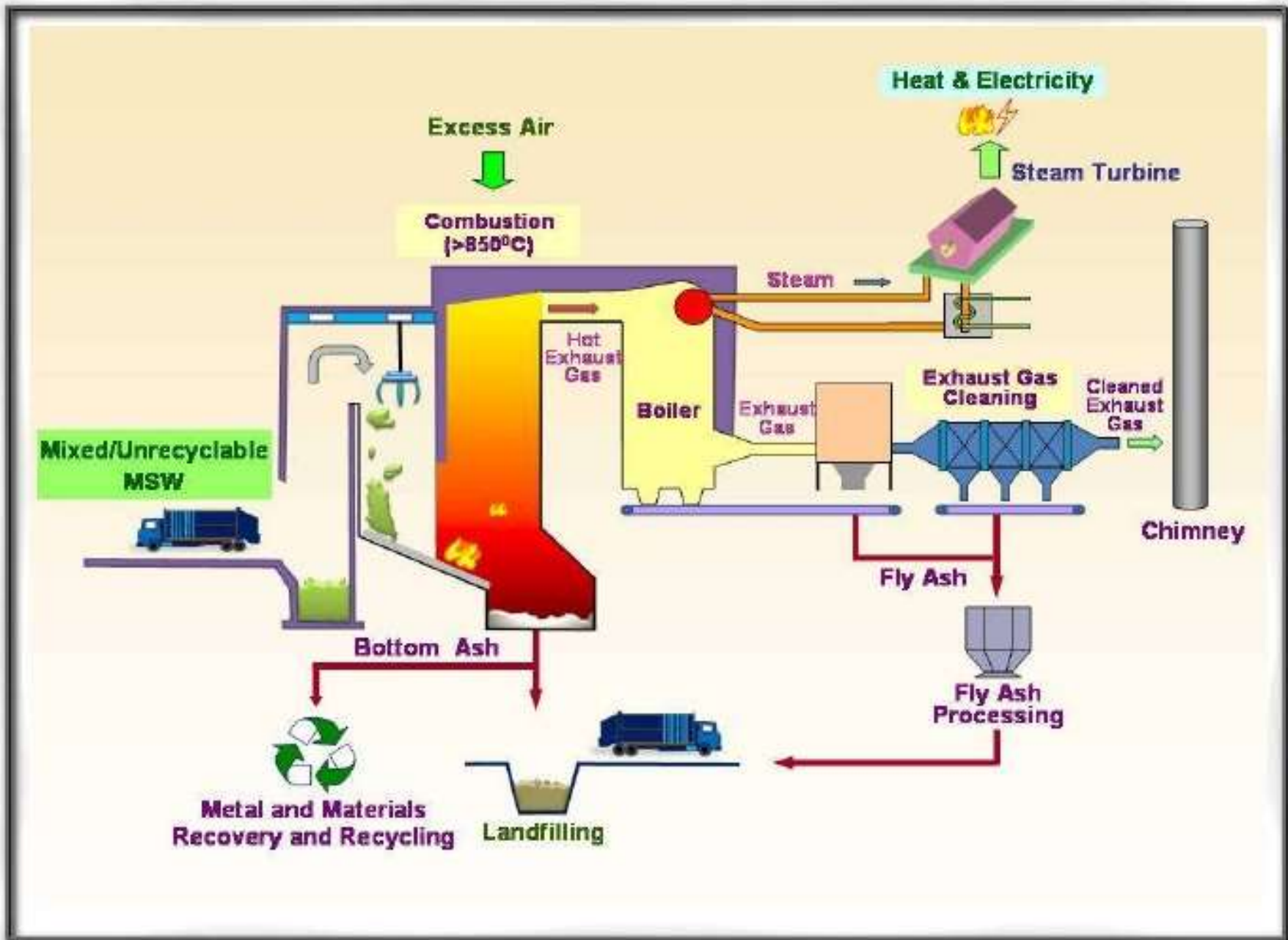
As pelletization involves significant MSW sorting operations, it provides a greater opportunity to remove environmentally harmful materials from the incoming waste prior to combustion.

The process, however, is energy intensive and not suitable for wet MSW during rainy season.

If RDF fluff/pellets are contaminated by toxic/hazardous material, the pellets are not safe for burning in the open or for domestic use.

# Incineration

- Incineration is a waste treatment process that involves the combustion of organic substances contained in waste materials.
- Incineration and other high temperature waste treatment systems are described as "thermal treatment".
- Incineration of waste materials converts the waste into ash, flue gas, and heat.
- Incinerators are used for this process.



## Important points regarding incineration

- Supplying of solid waste should be continuous.
- Waste should be proper mixed with fuel for complete combustion.
- Temp. should not less than 670 °C.

## Advantages

- Most hygienic method.
- Complete destruction of pathogens.
- No odor trouble.
- Heat generated may be used for steam power.
- Clinkers produced may be used for road construction.
- Less space required.
- Adverse weather condition has no effect.

## Disadvantages

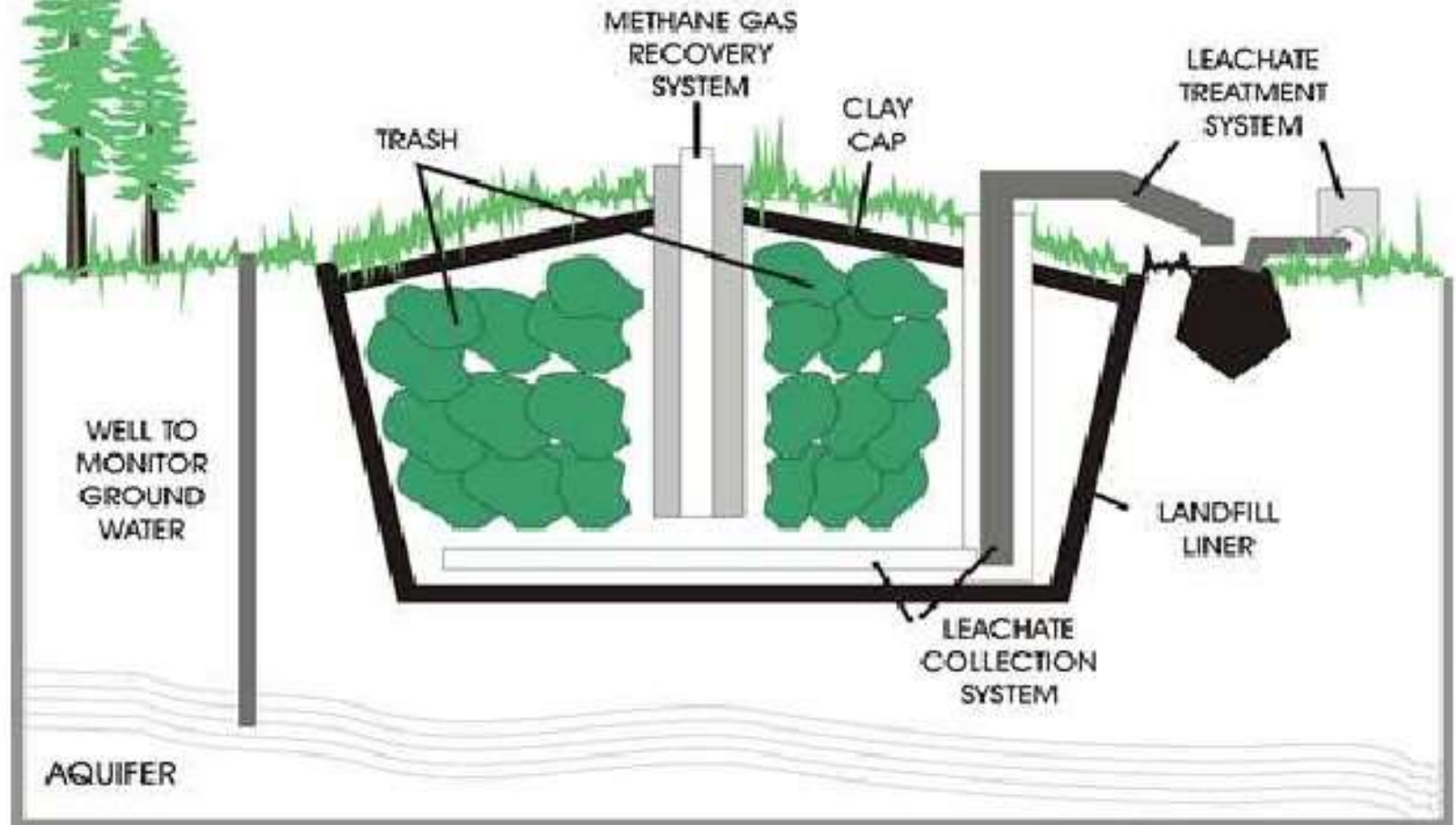
- Large initial expense.
- Care and attention required otherwise incomplete combustion will increase air pollution.
- Residues required to be disposed which require money.
- Large no of vehicles required for transportation.



# Landfilling

- A landfill site is a site for the disposal of waste materials by burial and is the oldest form of waste treatment.
- Historically, landfills have been the most common methods of organized waste disposal and remain so in many places around the world.
- The dumping is done with layers of 1- 2 m.
- The layer is covered with soil of 20 cm thickness.

# MODERN LANDFILL



## Advantages

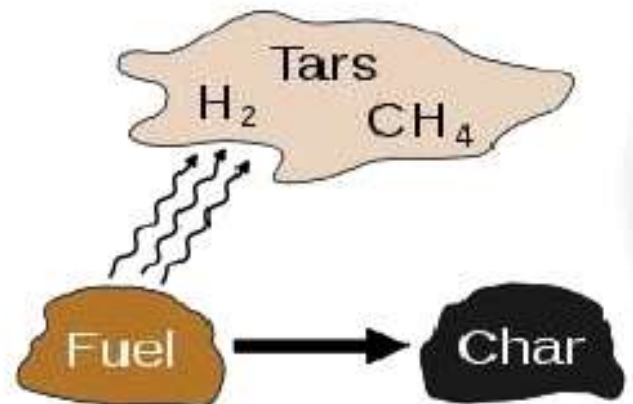
- Simple method.
- No costly plant required.
- No residues or by products need to be disposed.
- Separation not required.
- Unused land can be used.
- Methane gas can be used as fuel.

## Disadvantages

- Large land required.
- Proper dumping site may not be available.
- Odor problem.
- Use of insecticides required.
- Leachate should be collected regularly.
- Methane gas should be collected properly.
- Green house gas problem.

# Pyrolysis

- Heating of the solid waste at very high temp. in absence of air.
- Carried out at temp. between 500 °C - 1000 °C.
- Gas, liquid and chars are the by products.



Pyrolysis gasification processes are established for homogenous organic matter like wood, pulp, etc., while plasma pyrolysis vitrification is a relatively new technology for disposal of particularly hazardous wastes, radioactive wastes, etc. Toxic materials get encapsulated in vitreous mass, which is relatively much safer to handle than incinerator/gasifier ash.

These are now being offered as an attractive option for disposal of MSW also.

In all these processes, besides net energy recovery, proper destruction of the waste is also ensured. These processes, therefore, have an edge over incineration.

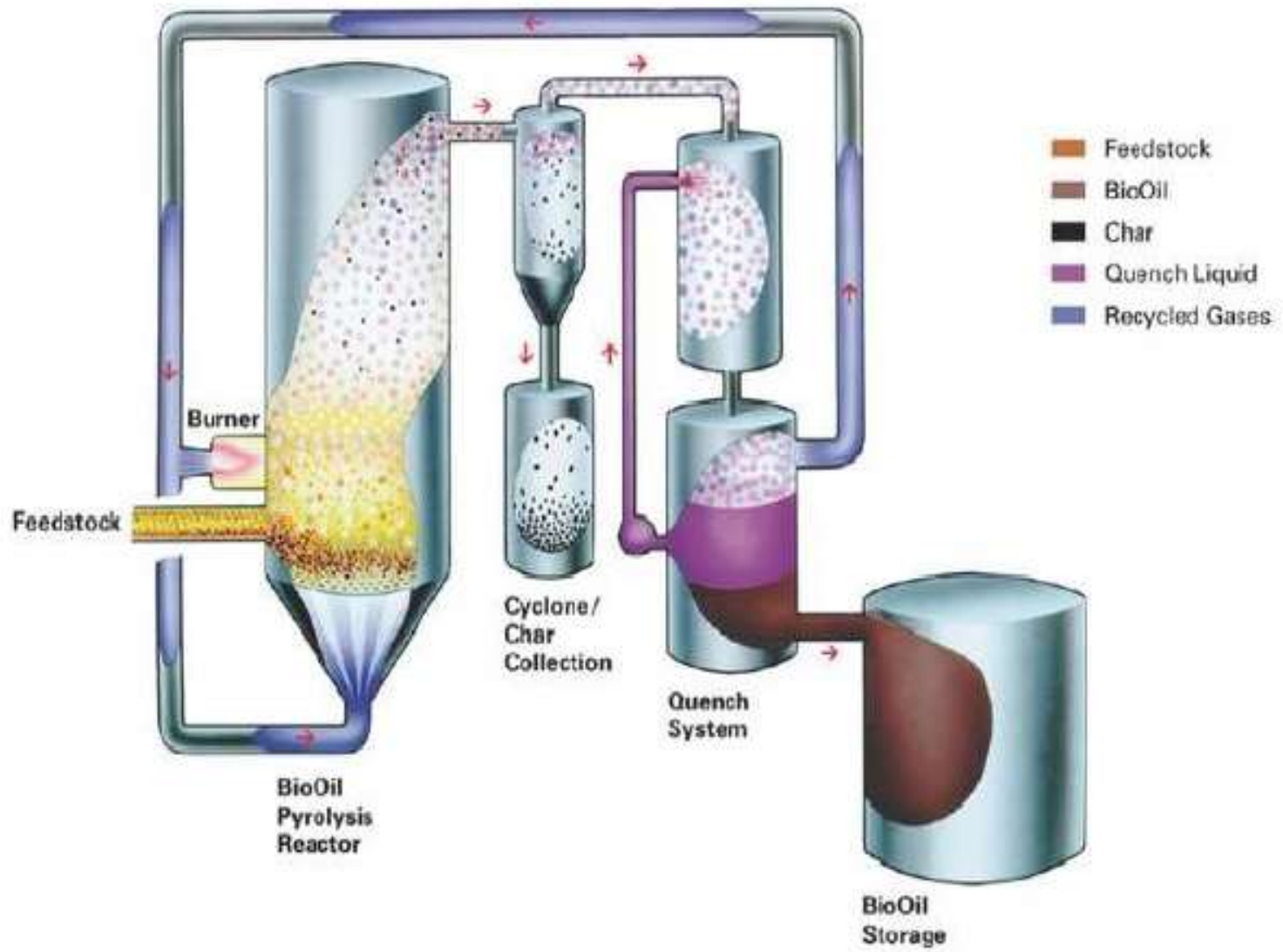


# Advantages

- This process produces fuel gas/fuel oil, which replace fossil fuels and compared to incineration, atmospheric pollution can
- be controlled at the plant level.
- NO and SO gas emissions do not occur in normal operations due to the lack of oxygen in the system.

## Disadvantages

- It is a capital and energy intensive process and net energy
- recovery may suffer in case of wastes with excessive moisture
- and inert content.
- High viscosity of Pyrolysis oil maybe problematic for its transportation and burning.
- Concentration of toxic/hazardous matter in gasifier ash needs care in handling and disposal.



# Recycling

- Recycling is processing used materials into new products .
- It reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution (from incineration) and water pollution (from landfilling).
- Recycling is a key component of modern waste reduction and is the third component of the "Reduce, Reuse, Recycle" waste hierarchy.

- Recyclable materials include many kinds of glass, paper, metal, plastic, textiles, and electronics.
- Although similar in effect, the composting or other reuse of biodegradable waste - such as food or garden waste - is not typically considered recycling.
- Materials to be recycled are either brought to a collection centre or picked up from the curbside, then sorted, cleaned, and reprocessed into new materials.

# WASTE RECYCLING

