



TN

TAMIL NADU

US

URBAN SANITATION

SP

SUPPORT PROGRAMME

iihsTM
INDIAN INSTITUTE FOR
HUMAN SETTLEMENTS

In Association With:

Keystone
A GROUP FOR RSDI DEVELOPMENT INITIATIVES



CDD Consortium for
DEWATS
Dissemination
Society

Training programme on Fecal Sludge Management for Engineers in Trichy Corporation

Faecal Sludge Treatment
Technologies

Treatment

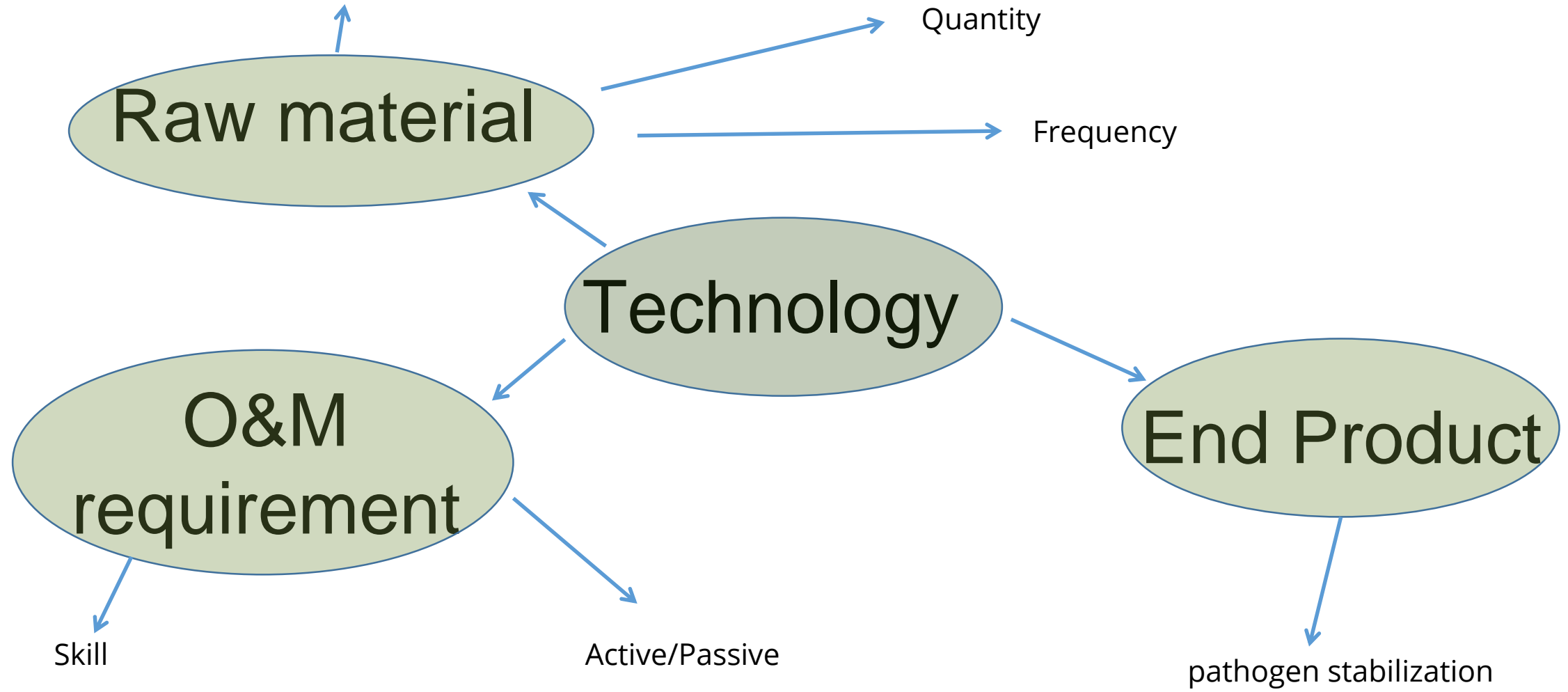
- **What can treatment do....?**



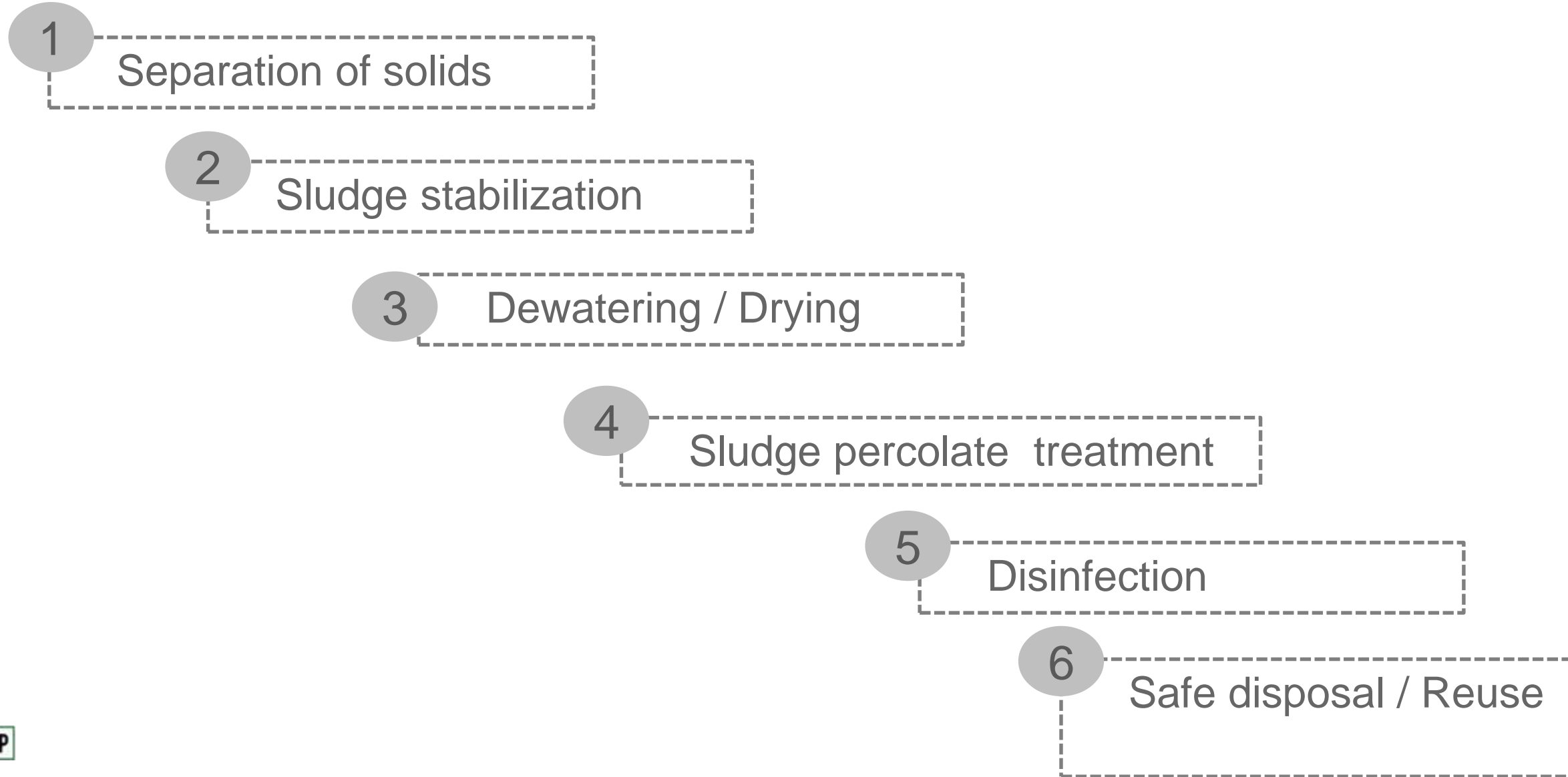
- Reduce Smell and visually displeasing outputs
- Stabilising the sludge to reduce health and environmental risks
- Dedicated place for disposal – easy to regulate
- Revenue generating end products

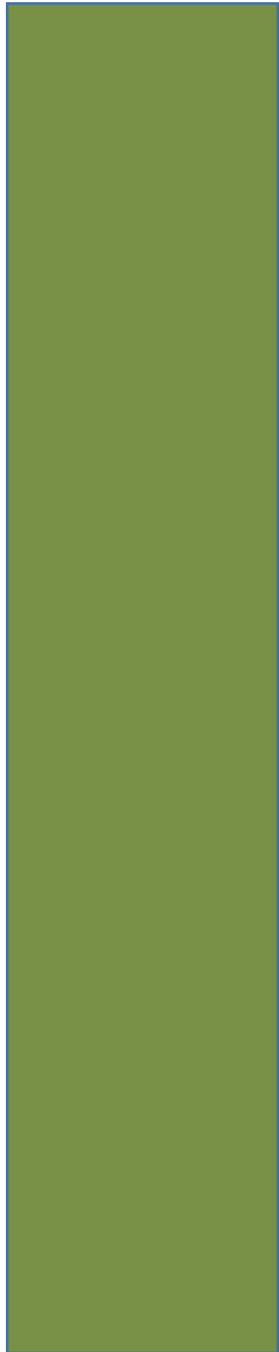
Factors influencing selection of right technology

Quality: Type of containment

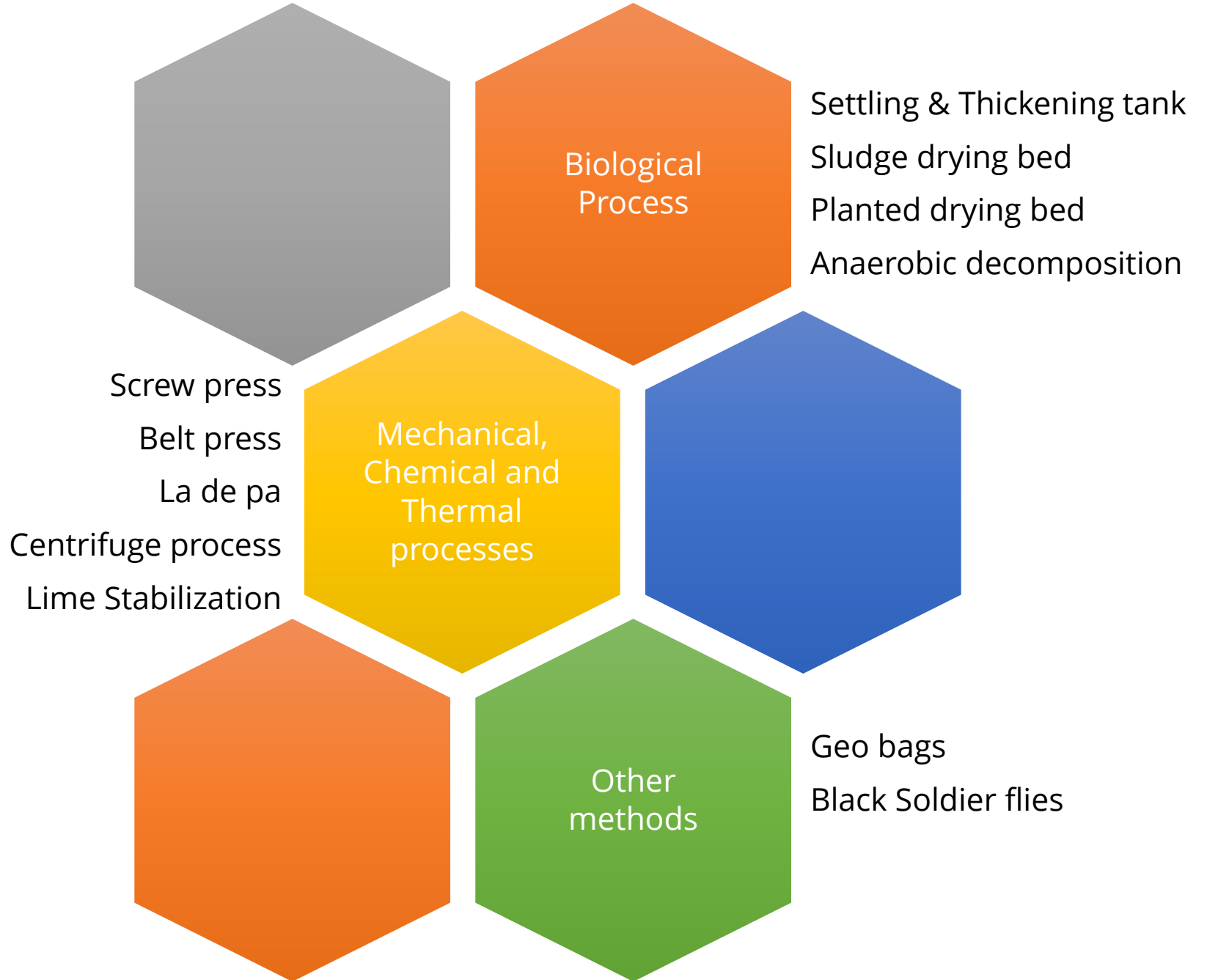


RECAP - Treatment Approach



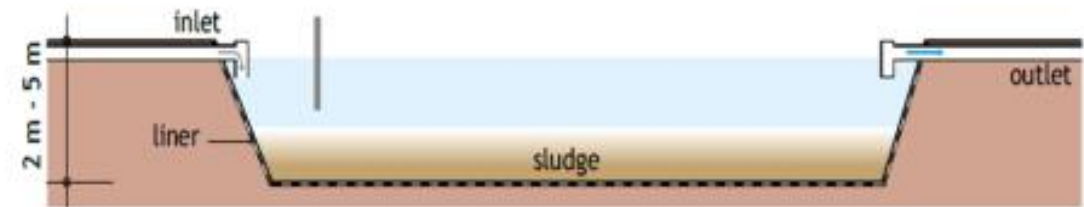
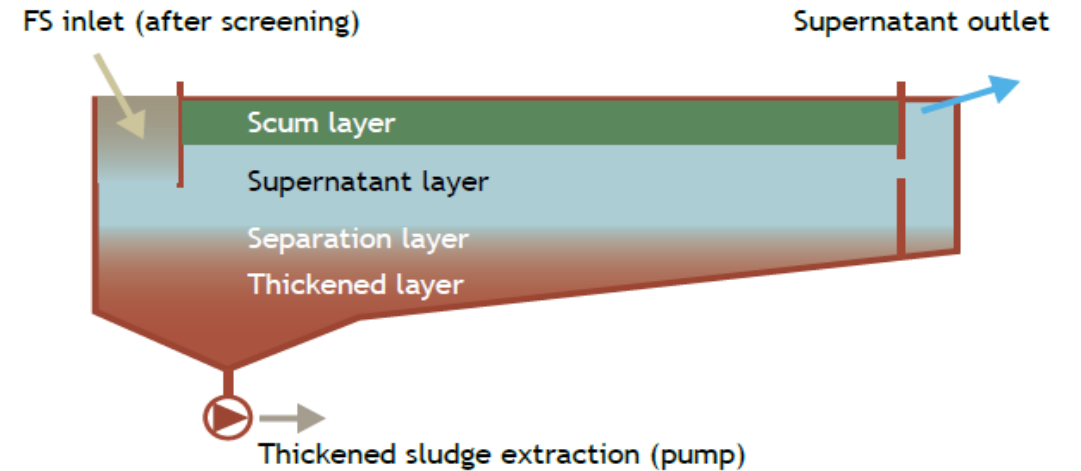


Treatment technologies



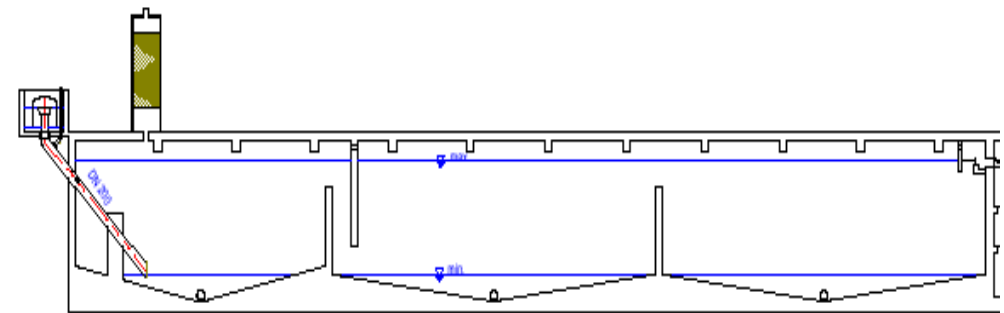
Settling Tanks and Sedimentation Ponds

- Sedimentation of the heavy particles occur without any external forces under gravity
- Settling tanks provide a liquid retention time of a few hours (to ensure settling of Settleable solids)
- Sedimentation ponds provide a liquid retention of few days or several weeks
- designed on
 - Desired depth
 - Quantity of accumulating solids
- The accumulating solids have to be removed and treated further



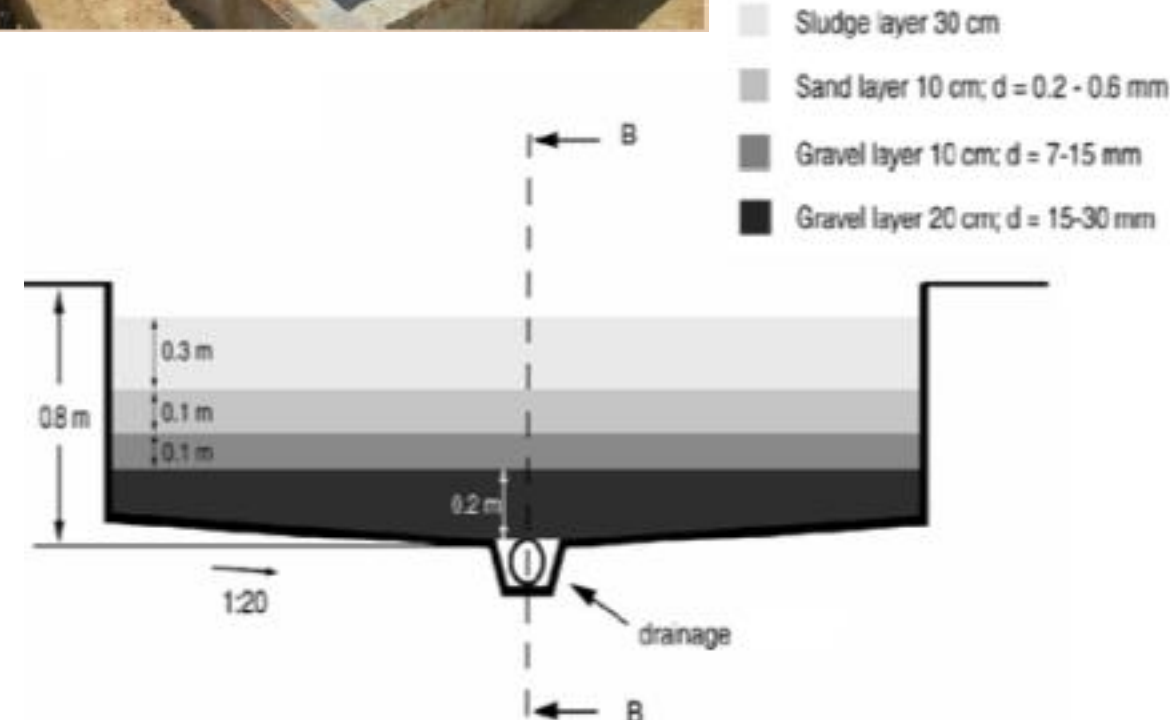
Anaerobic Digestion

- This process ensure effective sludge digestion and stabilization
- During digestion:
 1. Organic matter is converted to biogas
 2. The stabilized sludge (digestate) utilized as soil conditioner
- The SRT is maintained for 10-15 days
- Removal of accumulated solids from the digester remain a challenge



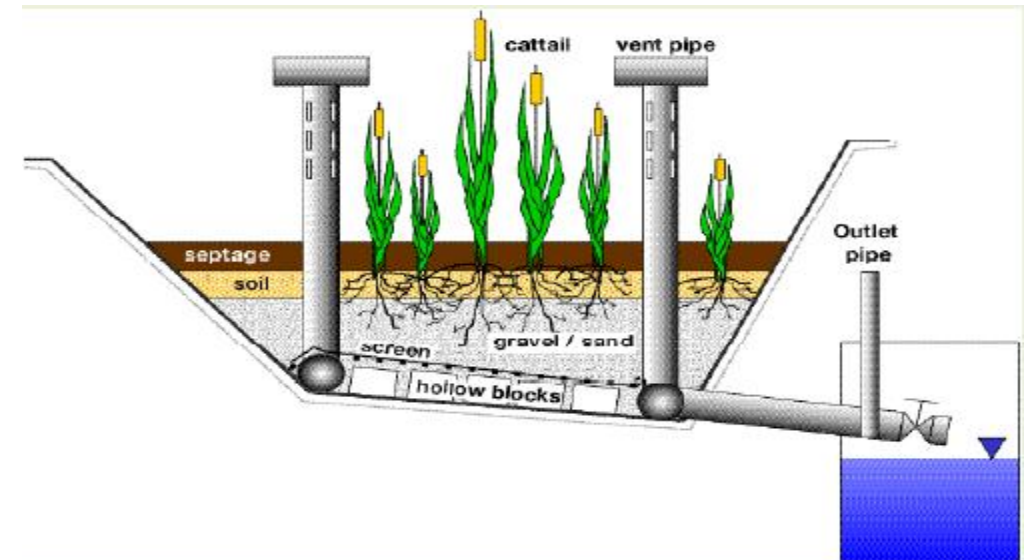
Sludge Drying Beds

- Key process involved – Filtration and evaporation
- Graded filter media of different diameter
- Approximately 50-80% of the liquid drains as filtrate and 20-50% due to evaporation
- Sludge drying period range of 10-20 days depending on the temperature



Planted Sludge Drying Beds

- FS is loaded with layers of sludge
- multiple physical (dewatering) and biological mechanisms (volatilisation)
- The beds consist of gravel/sand/soil filter planted with plants such as reeds, cattails, bulrushes
- Sludge retention time is 2-3 years depending on sludge loading rate TS

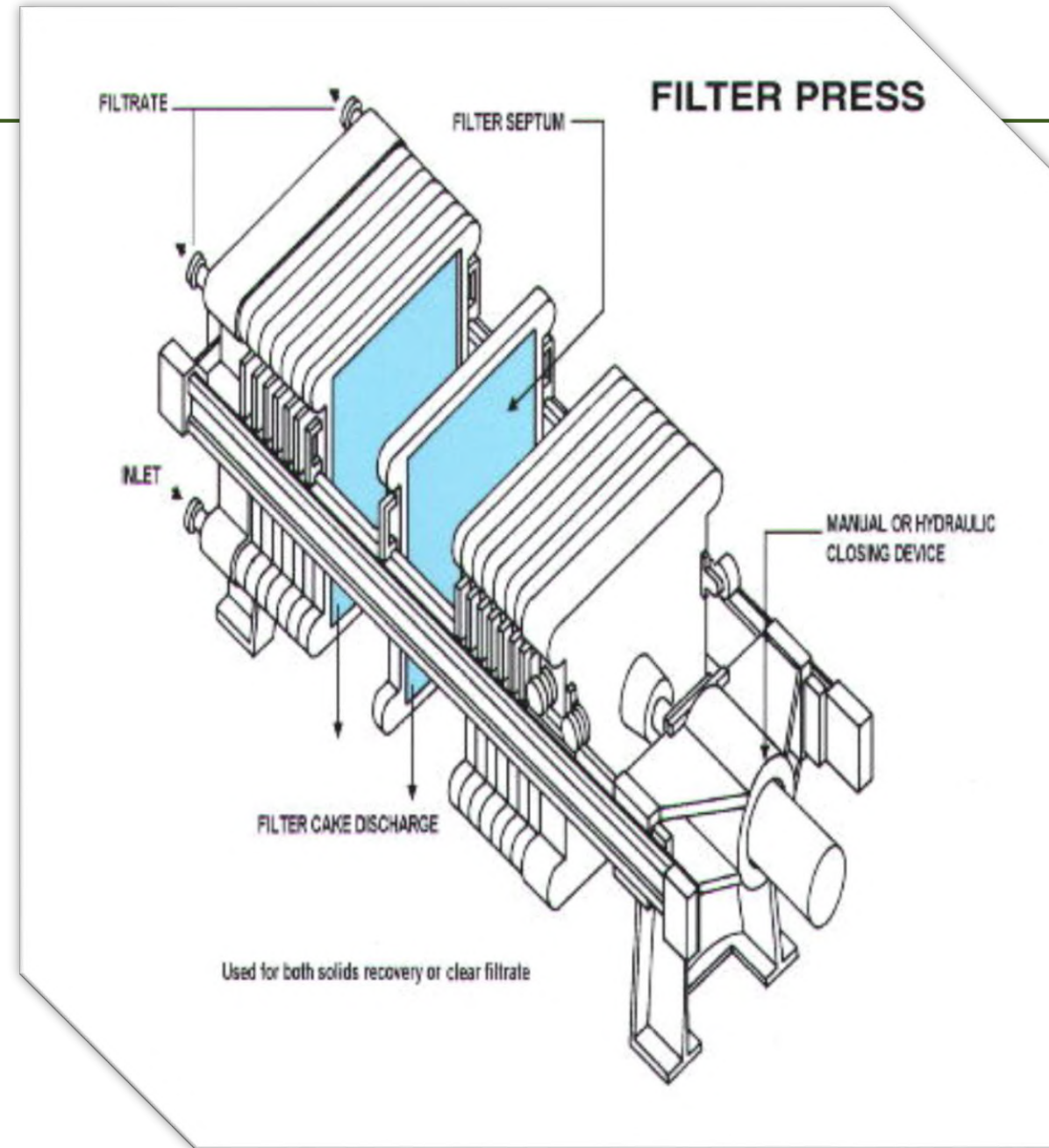


Mechanical Treatment Options

- The technologies used to treat wastewater sludges are also applicable for Faecal Sludge namely:
 1. Belt Filter Press
 2. Frame Filter Press
 3. Screw Press
 4. Centrifuge
- Advantages of mechanical treatment options include compactness and speed of the process
- Limitations of mechanical treatment options include high investment costs, O&M and electricity requirements

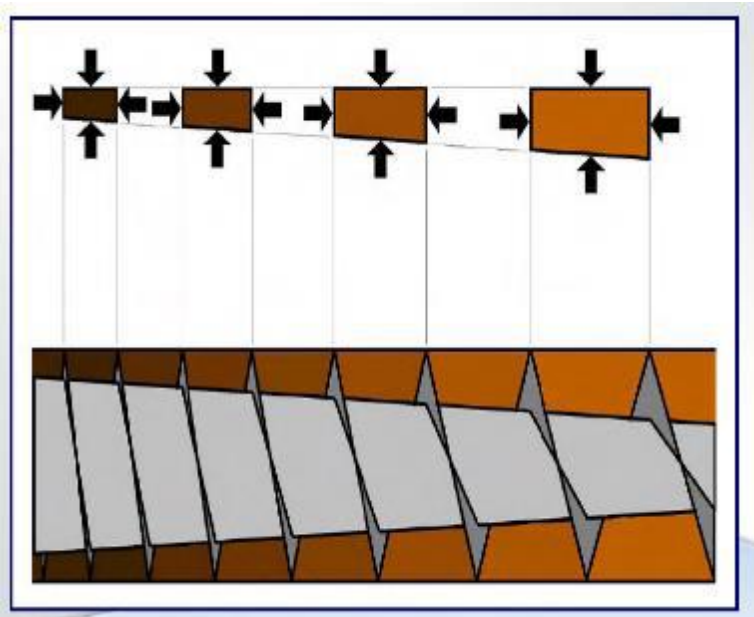
Frame Filter Press

- This is the simplest type of pressure filter.
- It consists of plates and frames arranged alternately and supported on a pair of rails.
- The plate is a solid piece having a ribbed surface.
- The frame is hollow and provides the space for the filter cake.
- By this alternate arrangement of frame and filter the chamber form in which cake will deposited.
- The plate and frame are square or rectangular in shape with Coated materials are used



Screw Press

- It is the simplest machine for separation of solids and liquids.
- It is a cage style press.
- It is used for separation of Water from the faecal sludge
- Screw pressing is a continuous operation, hence these are also known as “expellers”
- It works on the principle of ‘compression and shear’.

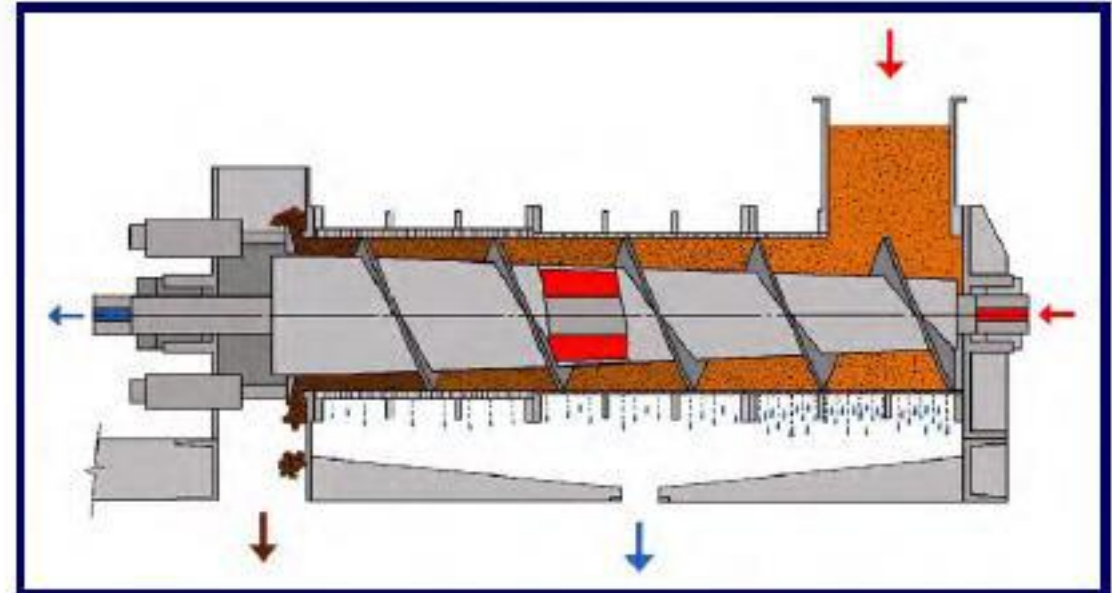


TYPES OF SCREW PRESS

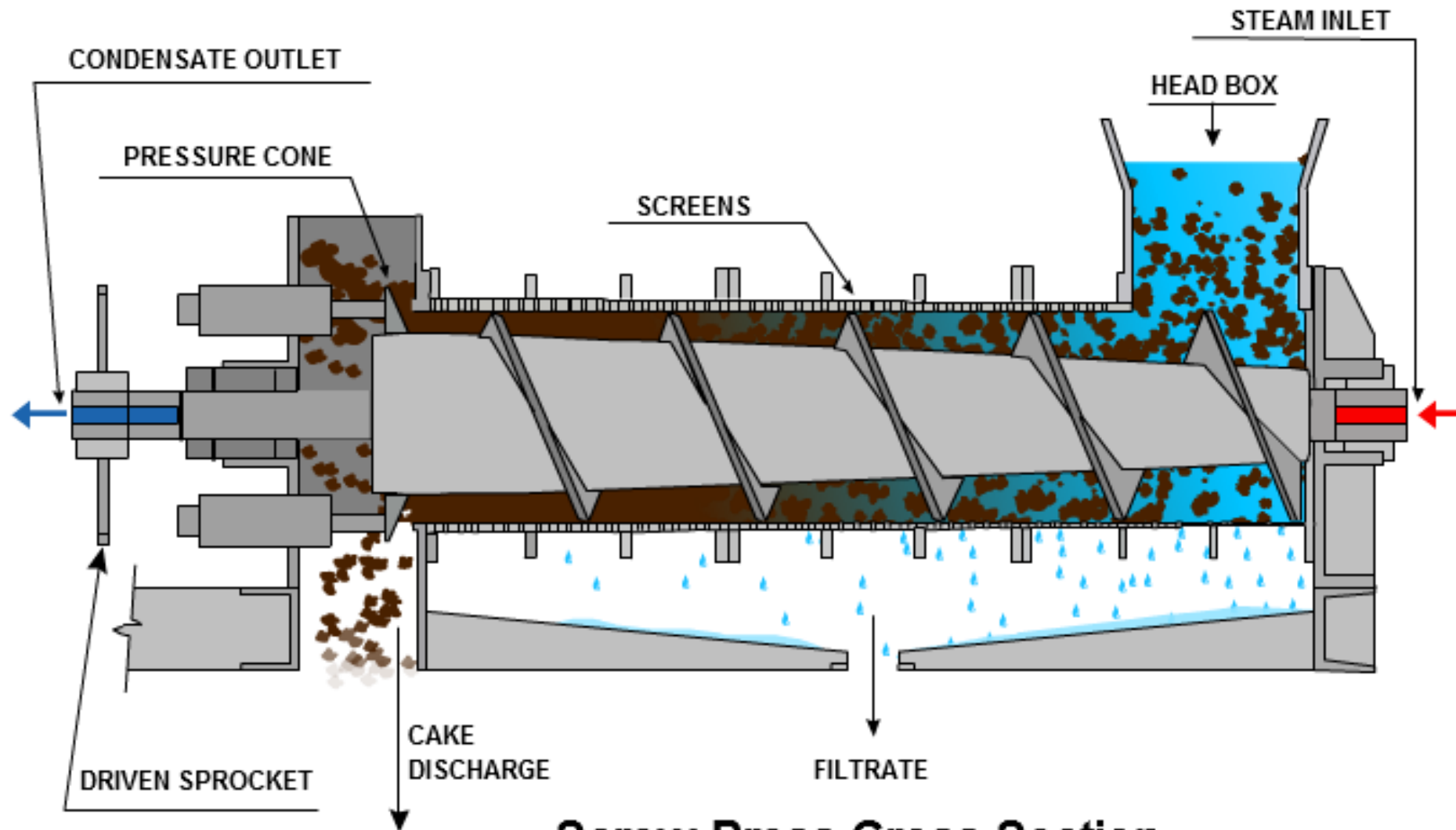
Huber inclined screw press



Horizontal screw press



CONSTRUCTION & WORKING



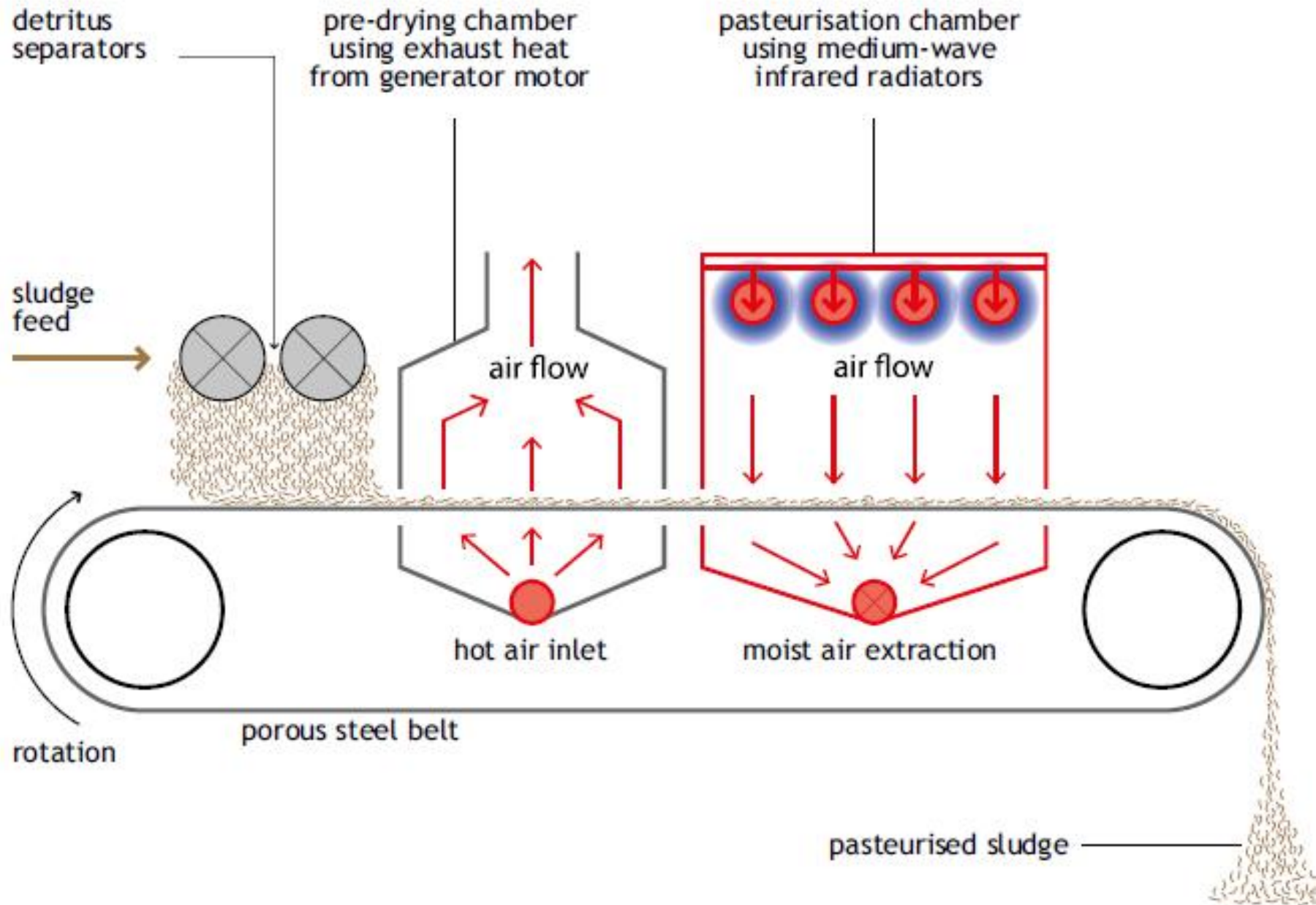
Screw Press Cross Section

LaDePa pelletizer

- Pyrolysis is a process which decomposes matter using heat in the absence of oxygen.
- Modifying a commercially available pyrolysis unit and adding dewatering and water treatment units.



Schematic



Lime Treatment

- Objective of lime addition is to achieve reduction of pathogens, odor and degradable organic matter
- The level of digestion depends on the degree of the initial stabilisation of FS, the temperature, and on the retention time inside the tank
- As per the experience in order to achieve the desired results, it is proposed to 5 kg of lime per cum of sludge



Geo-tube bags

- Geo bags are porous tubular containers fabricated with high strength woven geotextiles (polyethylene material) mainly used for dewatering sludge .
- Bags will help to achieve the capture of 98% of solids from the sludge
- Polymer will added to increase the solid settling
- Filtrates from the container should be collected and treated properly before discharge



Black soldier flies - BSF



Stages of life: *Hermetia illucens* (Black soldier fly)

BSF larvae feeds on

1. Municipal organic solid waste
2. Food waste
3. Animal waste
4. Faecal sludge

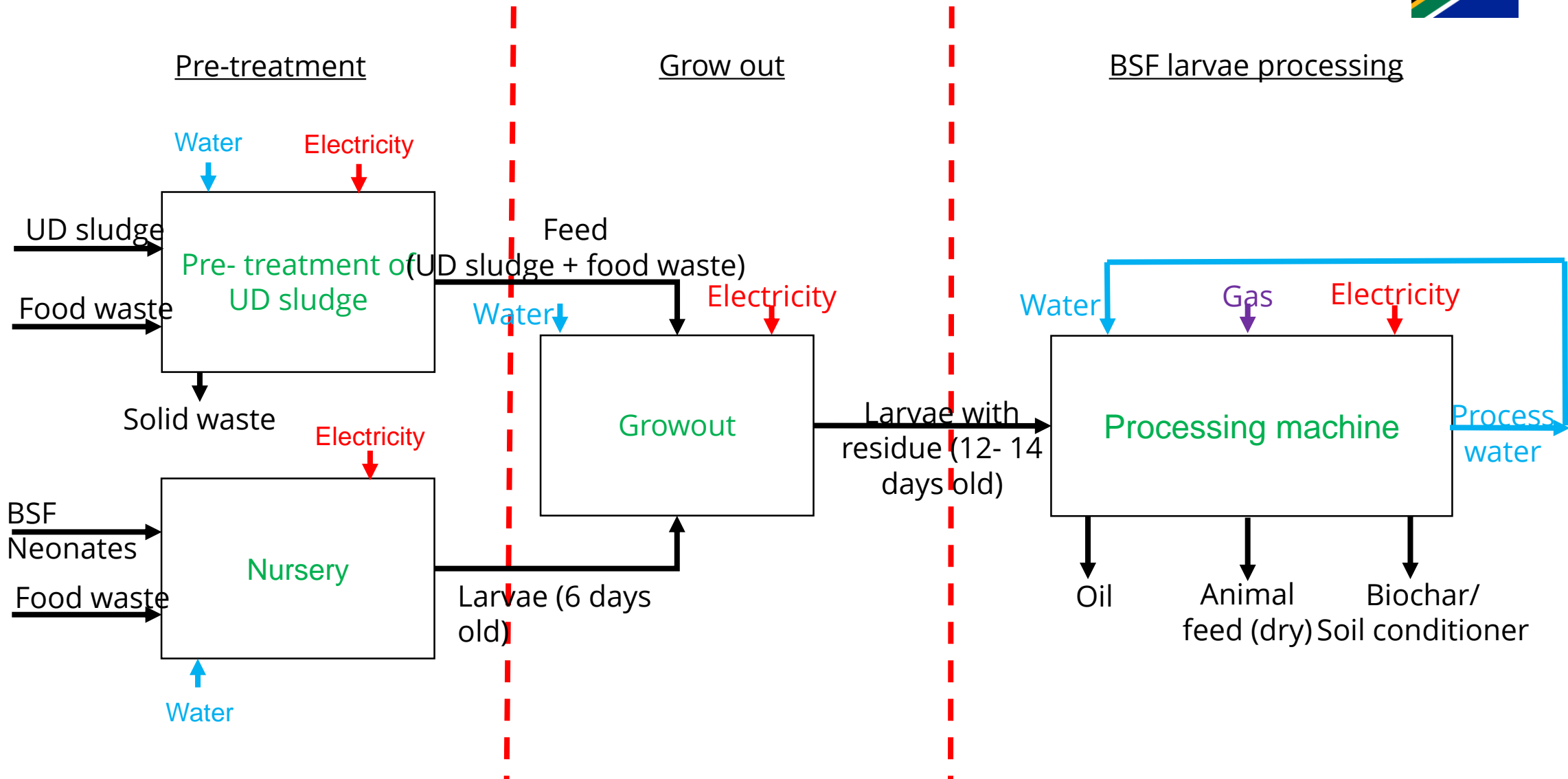
BSF larvae contains

1. 42% crude protein
2. 35% fat, amino and fatty acids

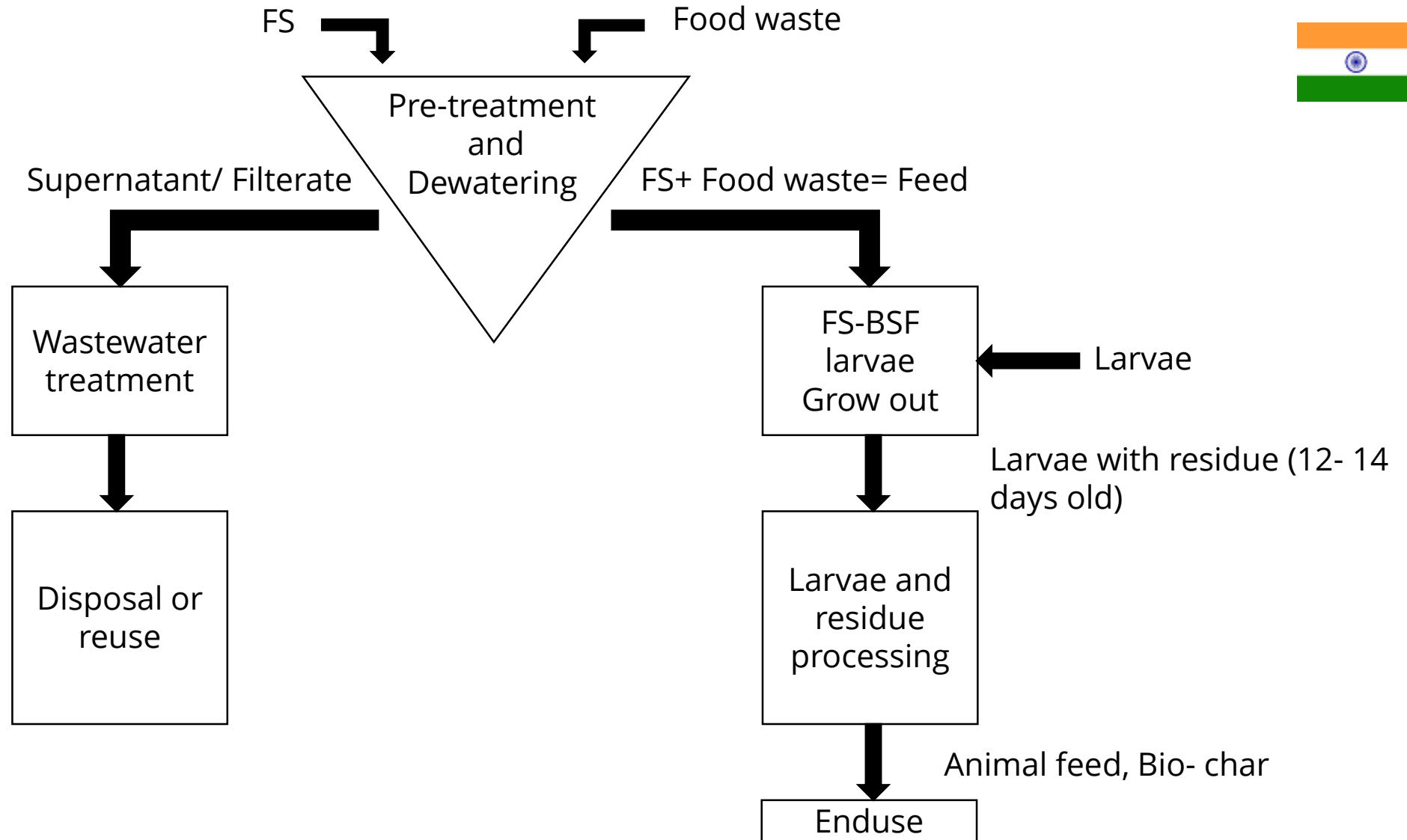
BSF-FS treatment end-products

1. Animal feed
2. Soil conditioner
3. Biochar

Treatment Methodology - UD sludge using BSF larvae in South Africa



Treatment Methodology - FS using BSF larvae in India



Reuse potential after BSF



Animal feed



Soil conditioner



Oil

(<http://agriprotein.com/>)

Intermediary solution: Trenching Technique



Composting

- Controlled process by which biological decomposition of organic matter occurs
- The resulting end product is a dark, rich, humus-like matter that can be used as a soil amendment.



Criteria: Selection of Technology

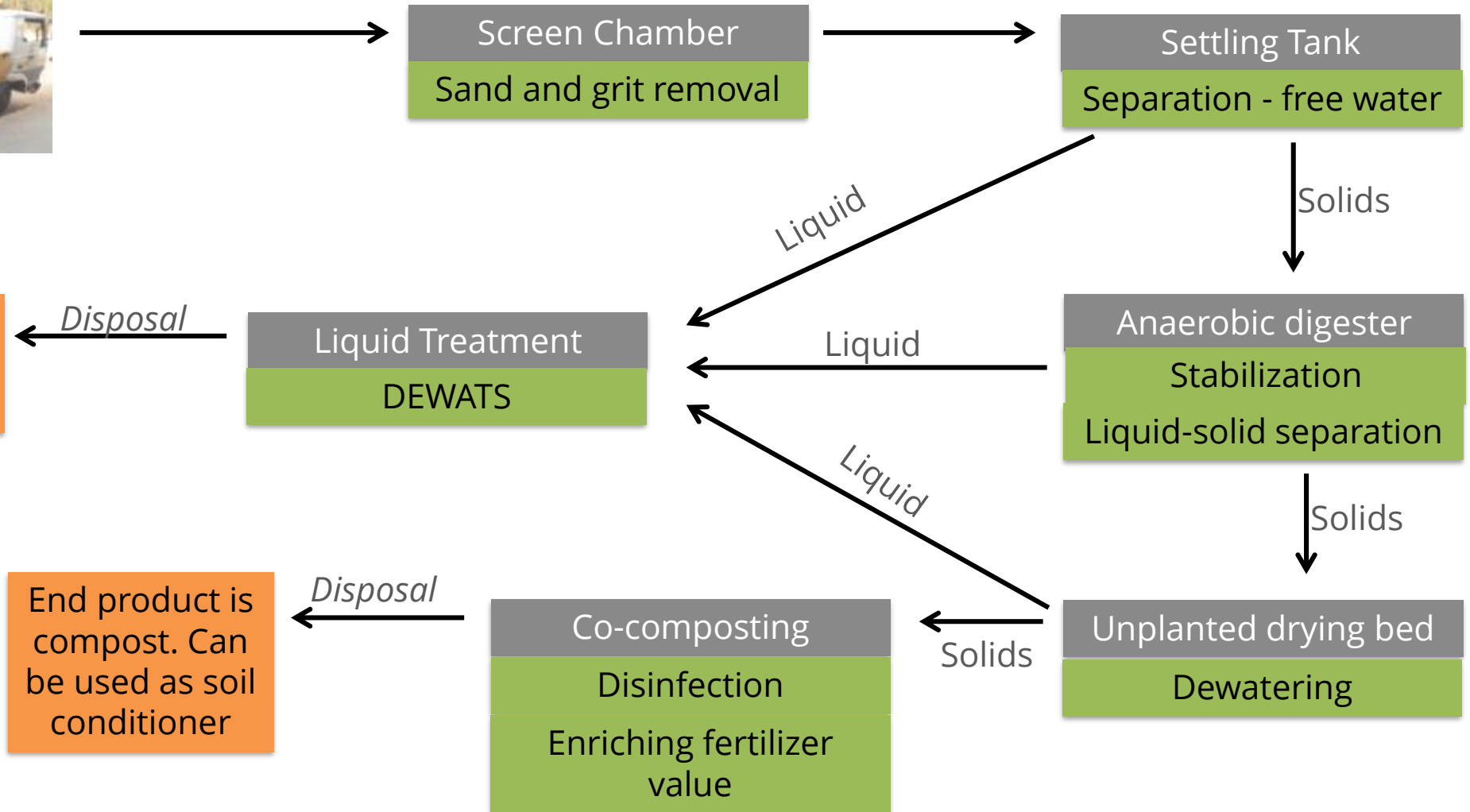
- Design a system based on **final end-use or disposal** option of treatment products
- Designing a system for the **actual quantity and characteristics** of faecal sludge.
- Design system based on the **collection and transport approaches**
- Develop a system by **understanding treatment mechanisms**
- Develop system based on the **resource required** – land, cost, skills
- Develop system based on **Operation and maintenance requirements**

Source: 1. Fecal sludge management systems approach for implementation and Operation, IWA Publications, 2014
2. Sandec Training Tool- Fecal sludge management

Anaerobic based approach for Faecal sludge treatment



Faecal Sludge/Septage



Anaerobic based approach for Faecal sludge treatment

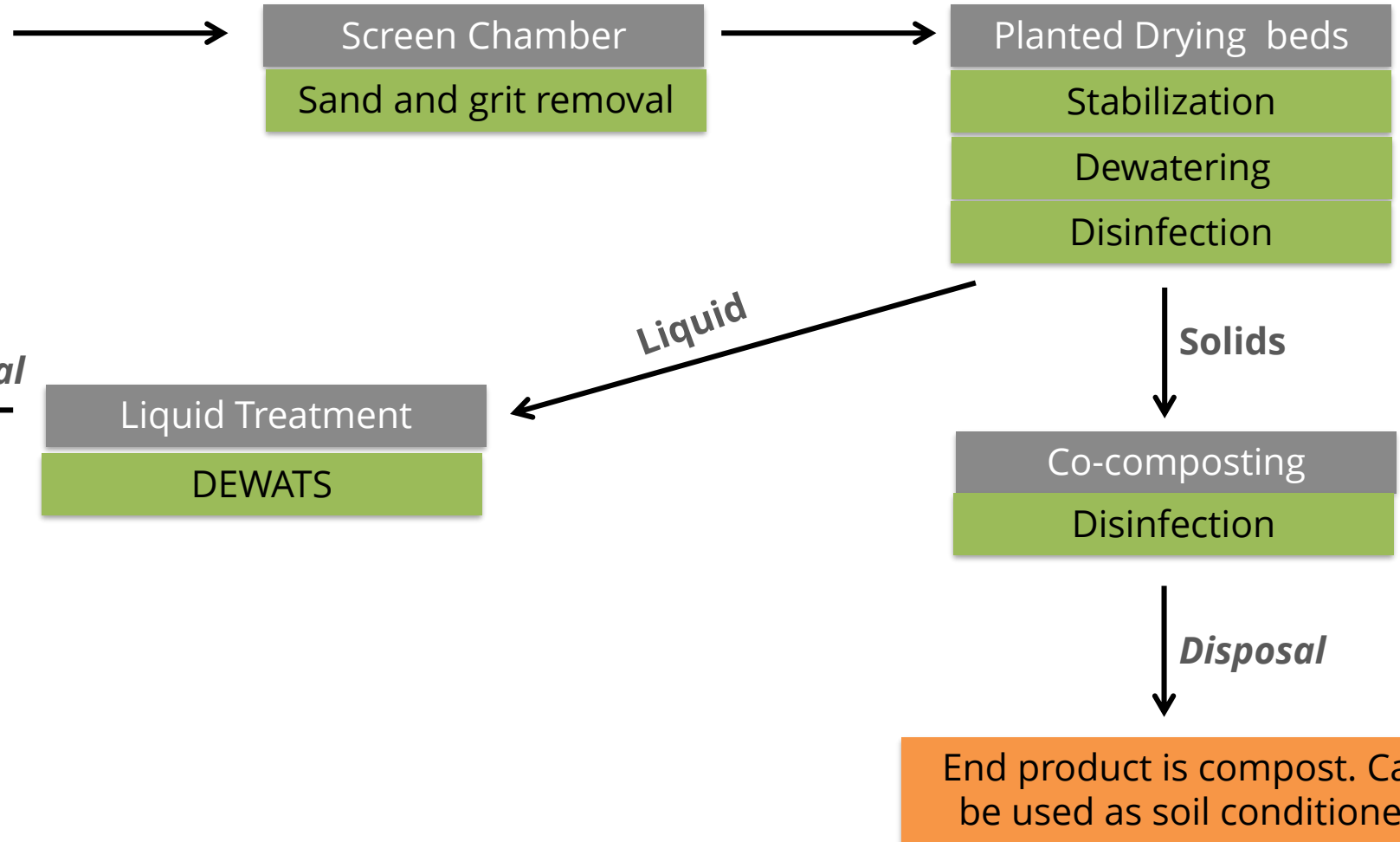
- Regular operator is required. O&M is simple
- Capital cost is high and recurrent cost is minimal
- Large area requirement (UG+OG)
- Suitable for large quantity (20cum)
- Good treatment efficiency
- Regular feeding is not a issue

PDB approach for Faecal sludge treatment



Faecal Sludge/Septage

Effluent is discharged into agricultural fields, drain or water body



Cost- INR: 40,000-60,000/cum

Aerobic based approach for Faecal sludge treatment

- Commonly practiced technique due to simplicity
- Moderate capital cost, Low recurring cost
- Large area requirement
- Good treatment efficiency
- Location of the treatment system may be an issue – odor, flies
- Operation and maintenance may be an issue – acceptance
- Regular feeding may be an issue

Thank You