

# Urea Finishing Processes

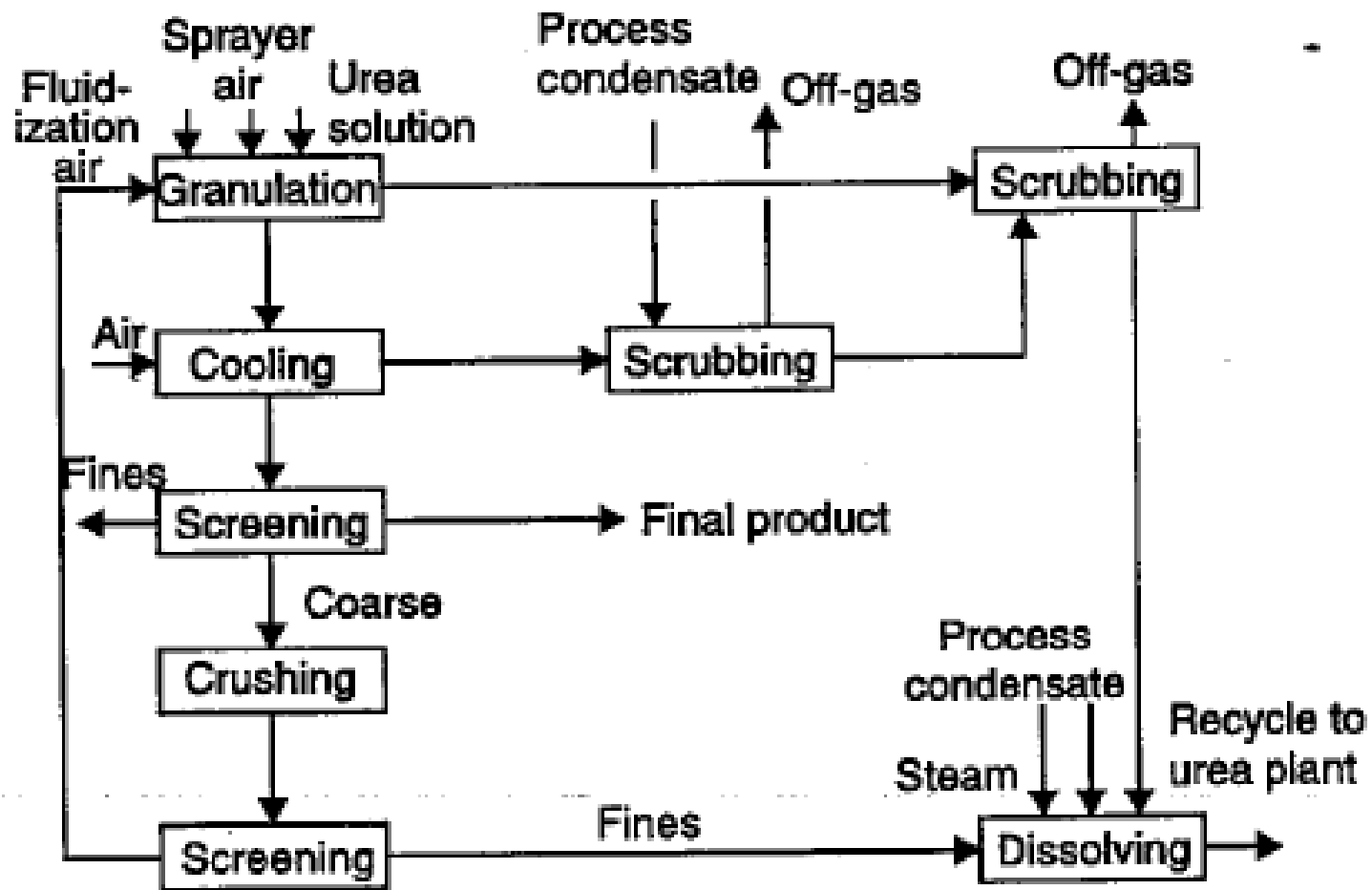
- Urea can be prilled, granulated, flaked and crystallized.

**Prilling:** Spinning bucket, Shower head or Acoustic vibrators

- All prilling tower have dust problem
- Induced draft, forced draft or natural draft.
- Inline cooling or fluidized bed cooling.

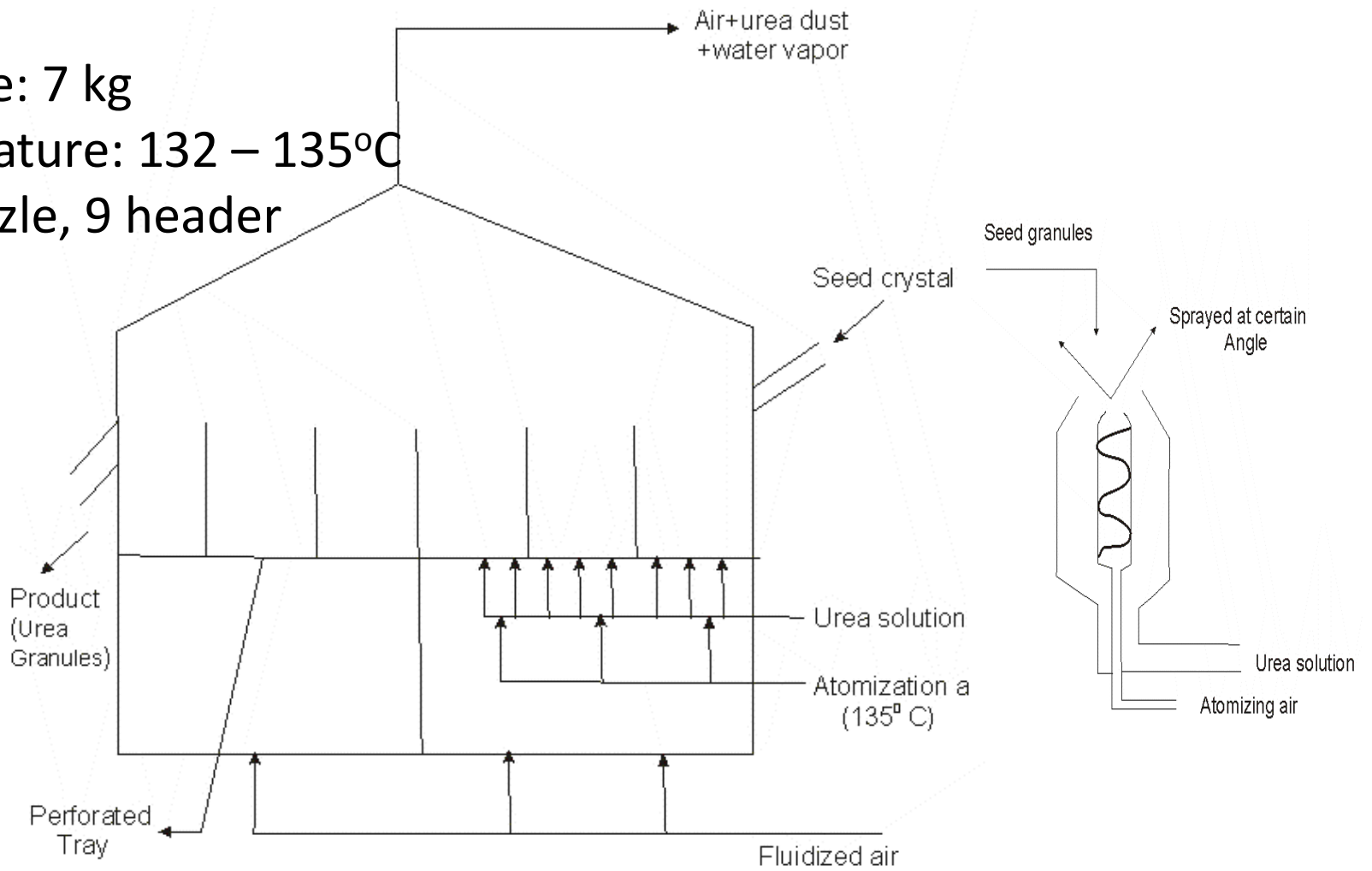
**Granulation:**

- Less dust problem, uniform size, better crushing and impact, transport and handling strength.

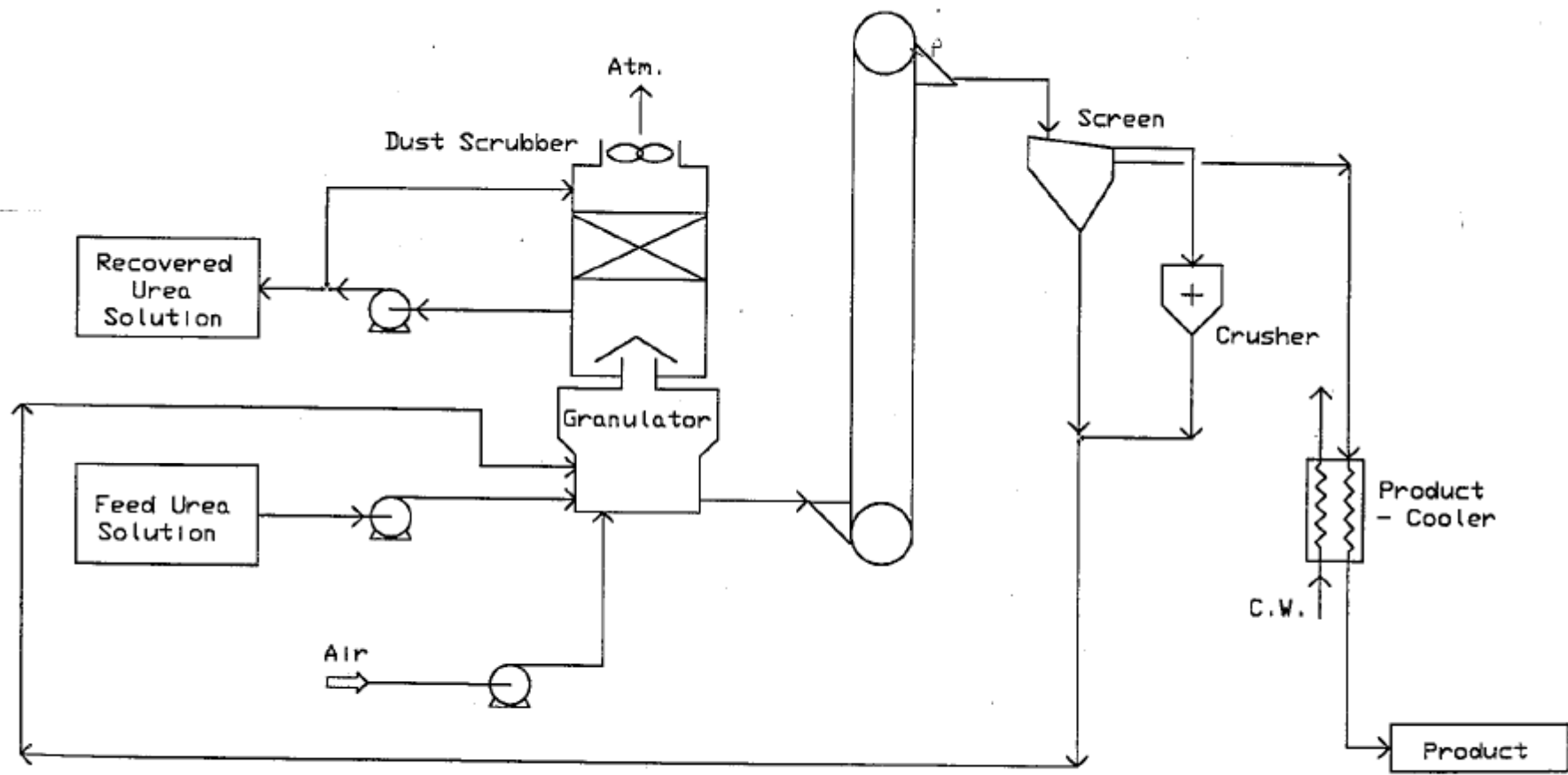


**Figure 9.10. Stamicarbon Fluid-Bed Granulation.**

Pressure: 7 kg  
Temperature: 132 – 135°C  
198 nozzle, 9 header



@KAFCO



**Figure 9.9. TEC Urea Granulation Process Flow Diagram.**

## TEC Multi-Stage Spout-Fluid Bed Granulator

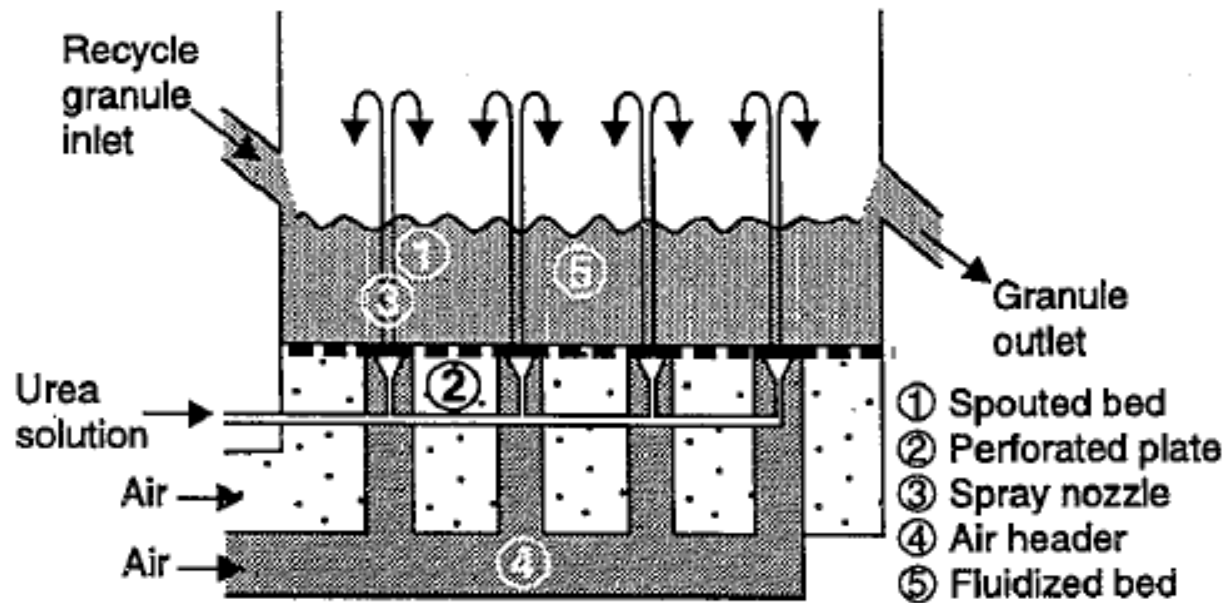
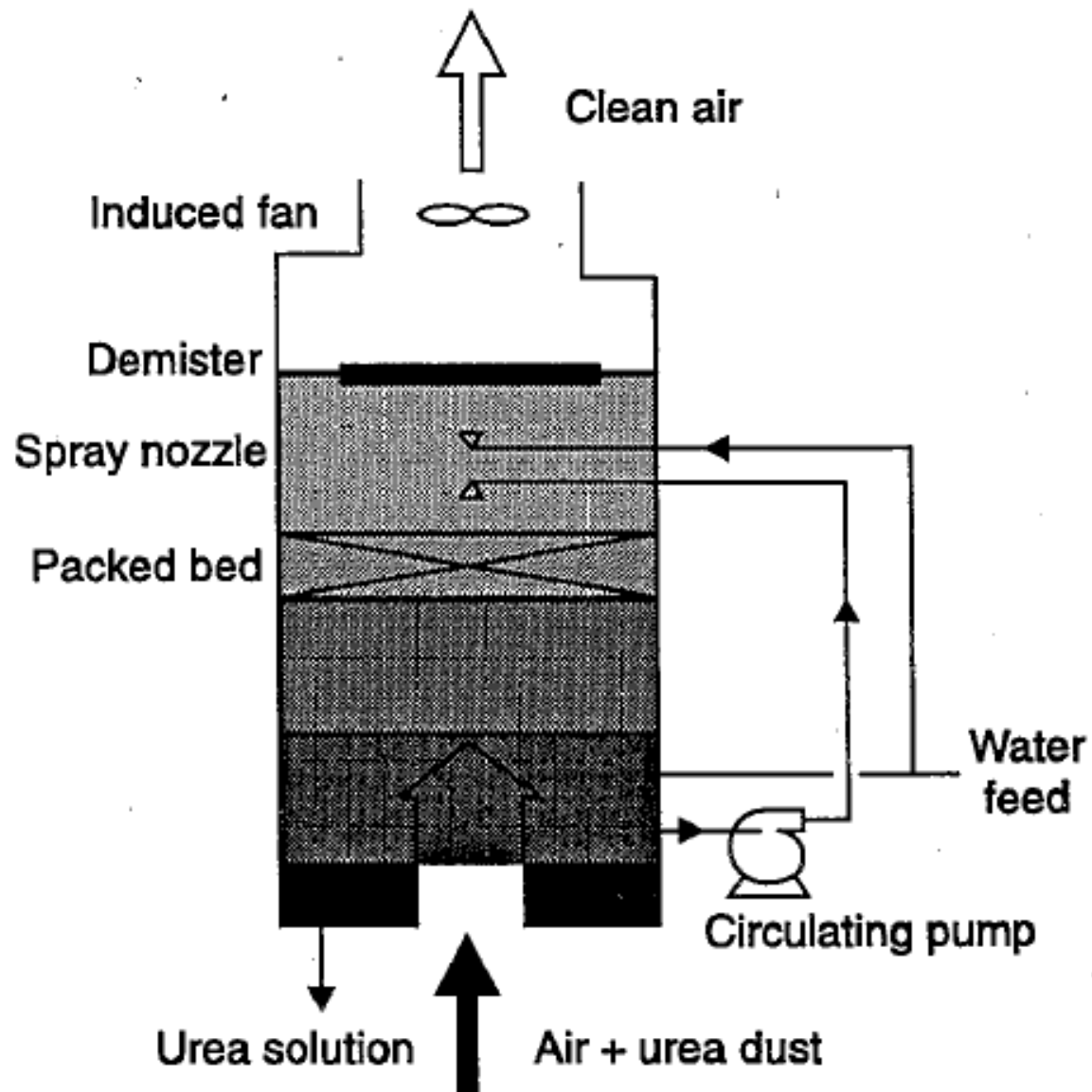
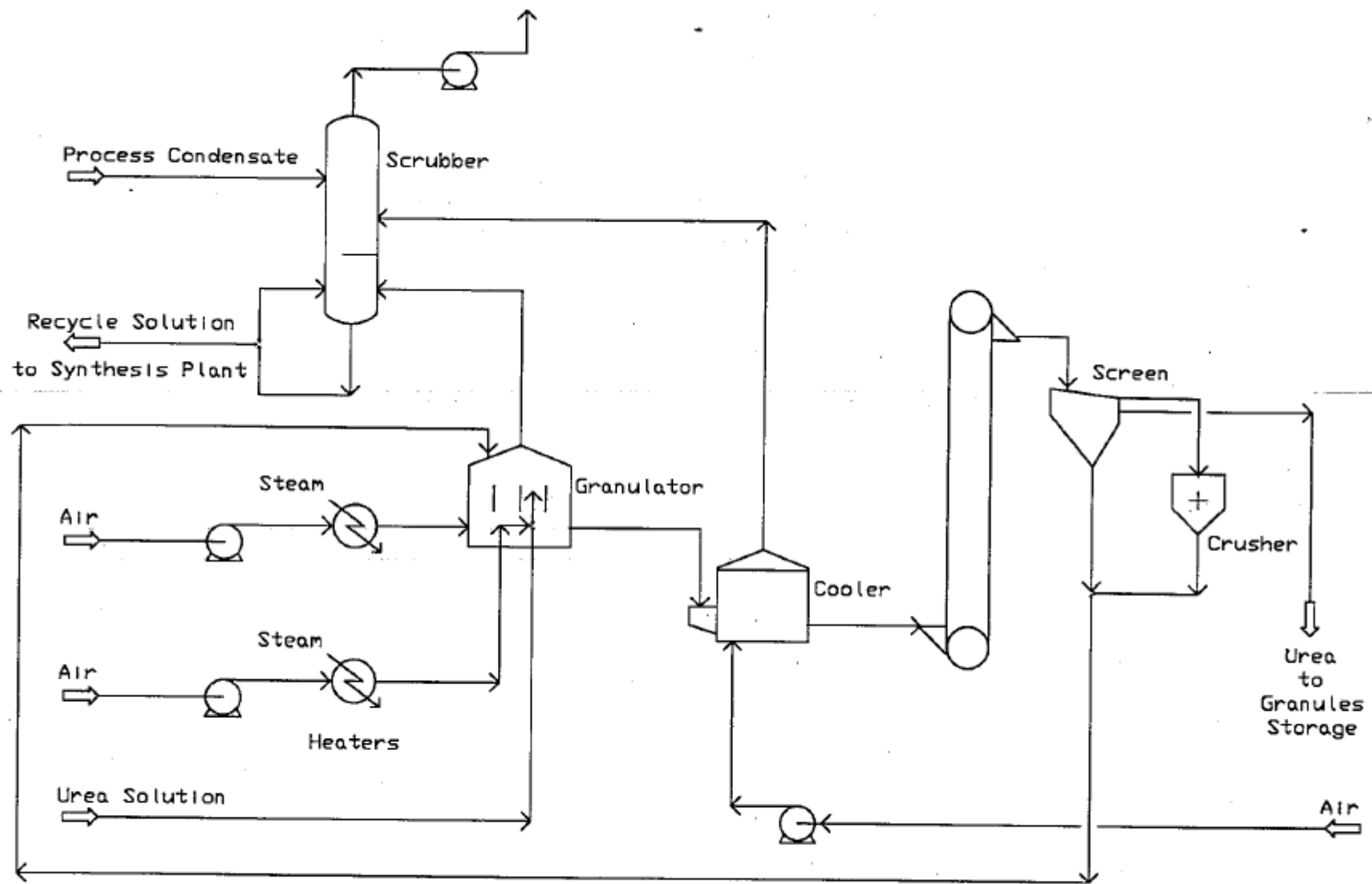


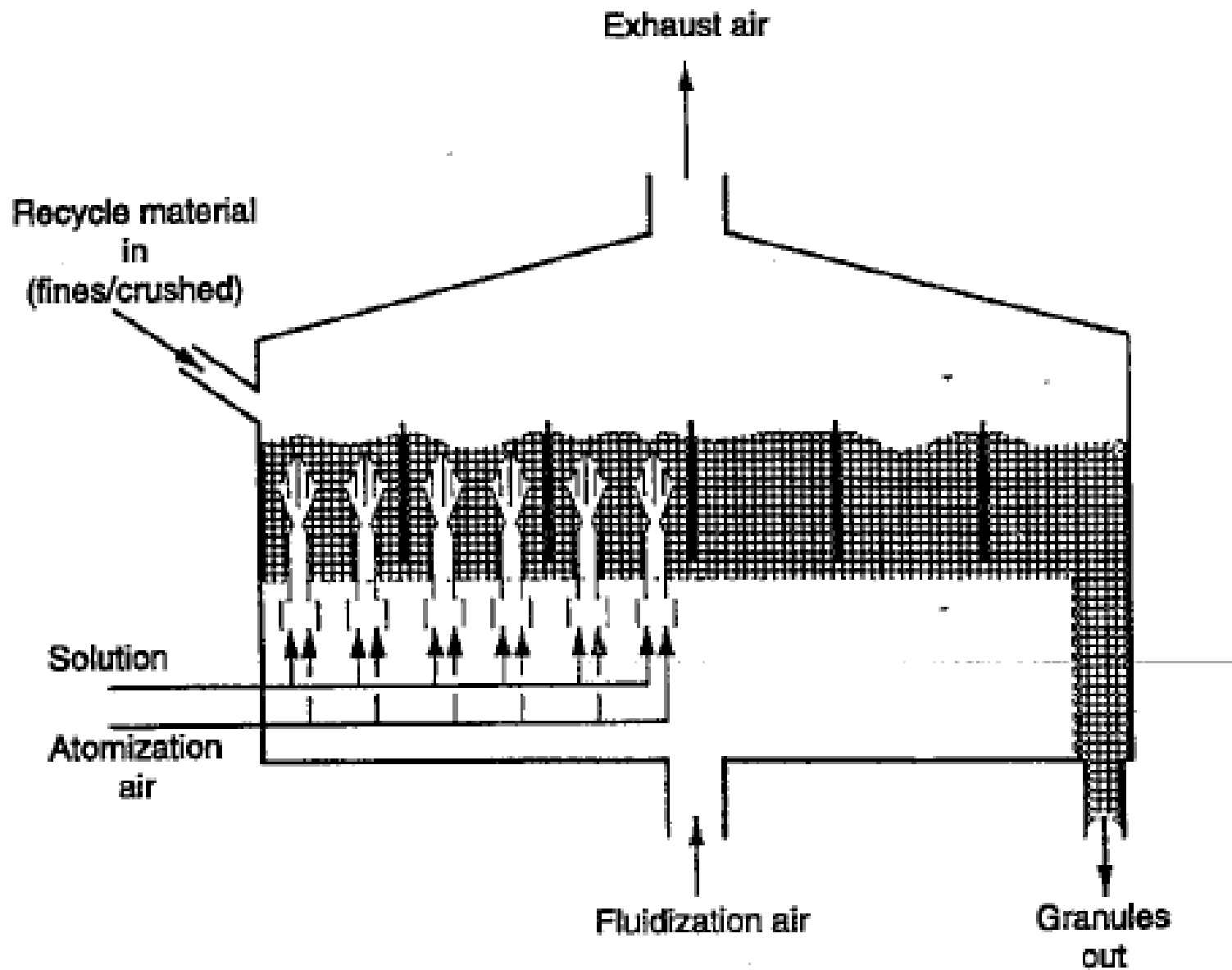
Figure 9.7. TEC Granulator and Scrubber.

# TEC Dust Scrubber





**Figure 9.8. Hydro Agri Urea Granulation.**



**Figure 9.11. Hydro Agri Fluid-Bed Granulator.**



# Utility Plant

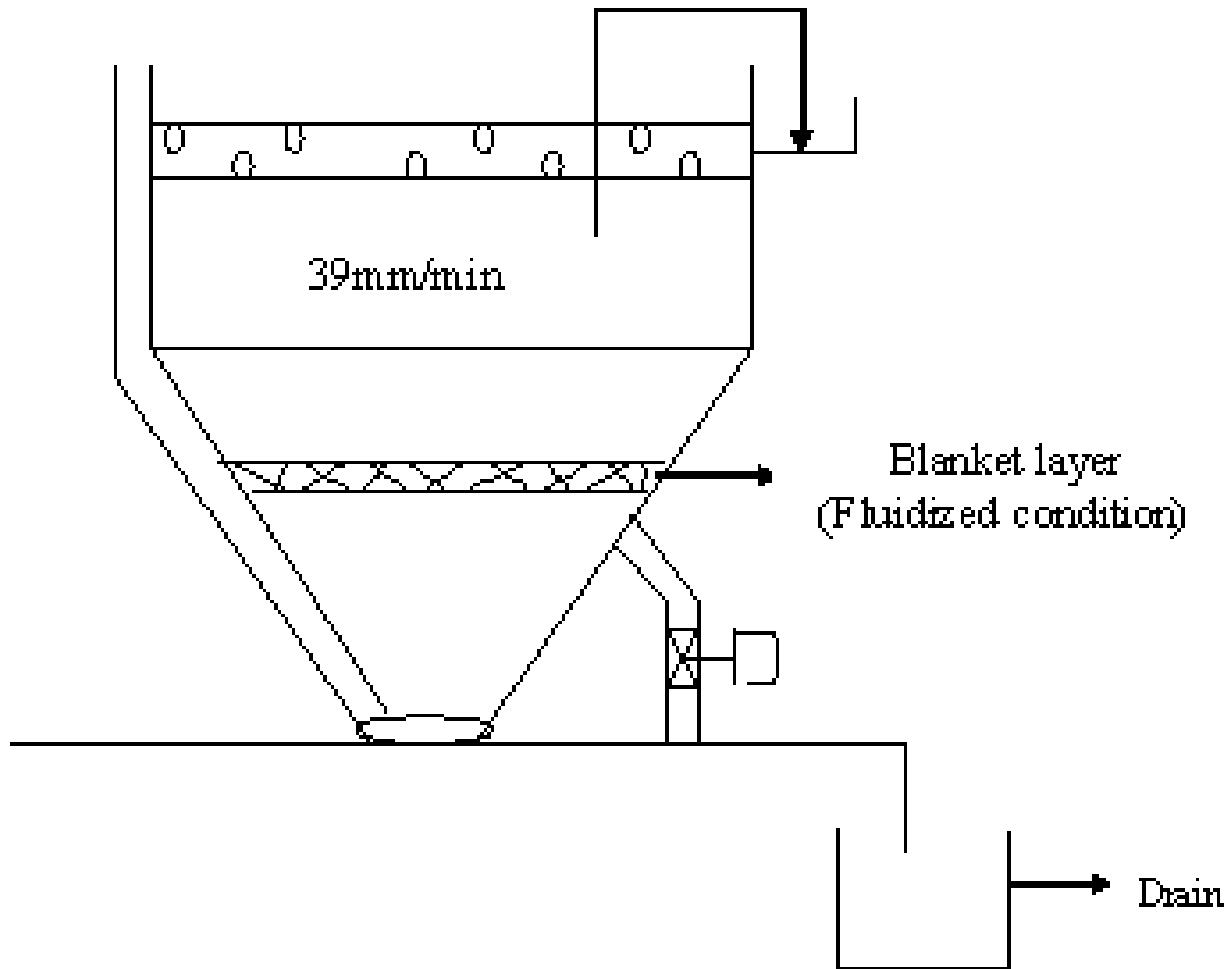
## Major Utilities Requirement

- Steam (HP, MP, LP)
- Power
- Natural Gas (Process, Fuel, Flare Stack, Kitchen)
- Boiler Feed Water
- Cooling Water (Utility, Main)
- Drinking Water
- Service Water
- Plant Air
- Instrument Air
- Nitrogen

# Water Treatment plant

## Major Units

- Clarifier
- Sand filter
- Cooling Tower
- Demineralization Unit
  - Carbon Filter
  - Cation Exchanger
  - Degasifier
  - Anion Exchanger
  - Mixed Bed Polisher
- Boiler Feed Water (BFW)

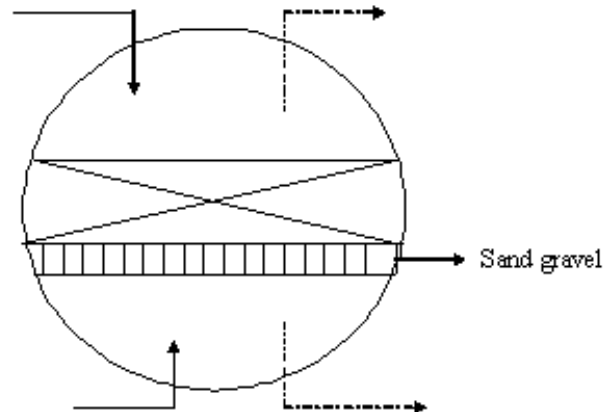


## Chemicals:

- Caustic Soda: To control P<sup>H</sup> at 7.0, because at this P<sup>H</sup> coagulation and flocculation is favorable.
- Alum
  - To grow fine flocs into large size
  - To settle out mud in the clarifier
  - To remove Ca(HCO<sub>3</sub>)<sub>2</sub>
- Chlorine
  - To sterilize Raw Water
  - To oxidize the dissolved iron as ferric hydroxide as precipitate
  - To kill Bacteria
  - To remove Mn<sup>+2</sup>
- Coagulant Aid: one type of polymer, which helps to coagulate quickly e,g,. kurifloc (trade code PA 322).

# Sand Filter

- Remove Mn, fine particles, micro-flocs by sieving, adhesion and settling. Diatomaceous earth is used as sand filter.
- Minimum size of solid can be trap is  $30 \mu\text{m}$ .



**Figure 19:** Schematic diagram of sand filter

# Cooling Tower

- 10 – 15°C, by secondary cooler, i.e., sea water or air.

## Chemicals:

- Sulphuric Acid: To control P<sup>H</sup>
- Chlorine: To kill bacteria and other such types of microorganism
- Dispersant: Zn based Phosphate polymer, which is used to prevent scale formation.
- Corrosion Inhibitor: Zn based Phosphate polymer, which is used to prevent corrosion.

# Demineralization unit

Dissolved ions are removed in the demineralization unit.

Different types of resin are used according to necessity. The major contents of this unit are –

- Carbon Filter:
- Cation Exchanger: To remove  $\text{Ca}^{++}$ ,  $\text{Mg}^{++}$ ,  $\text{Na}^+$ , etc  
$$\text{R-H} + \text{Na}^+ = \text{R-Na} + \text{H}^+$$
- Degasifier: To remove dissolved carbon dioxide in water.  
$$\text{H}_2\text{CO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$$
- Anion Exchanger: To remove  $\text{SO}_4^=$ ,  $\text{CO}_3^=$  etc  
$$\text{R-OH} + \text{SO}_4^= \rightarrow \text{R}_2\text{-SO}_4 + \text{OH}^-$$
- Mixed Bed Polisher: It is used to obtain highest purities in the treatment of feed water and condensate for high-pressure steam boiler. Upper bed is cation exchanger.

# Boiler Feed Water

- Removal of Air (oxygen)
- Keeping P<sup>H</sup> at a certain range

## Removal of Air (oxygen)

- Air is removed from boiler feed water due to its corrosion effects in boiler.
- De-aeration process combined of two steps: First mechanical and then chemical treatment.
- Mechanical: Dissolved air is removed from the water by a countercurrent flow with steam.
- Chemical: Hydrazine is added to remove dissolve Oxygen.

## Keeping P<sup>H</sup> at a certain range

- Ammonia is used to raise pH above 9.0 so as to prevent corrosion.
- Phosphate Solution is added to inlet of the steam line control pH (buffer solution).



# CODES AND STANDARDS

Pressure vessel	ASME, ASTM, JIS, DIN, ANSI, etc
Heat exchanger	ASME, JIS, DIN, ANSI, HEI, etc
Storage tank	API, ASTM, JIS etc
Civil works	ACI, ANSI, ASTM etc
Piping	ANSI, ASME, API, MSS, etc
Boilers	ASME, BS etc
Cooling towers	CTI , JIS etc
Fire fighting	NFPA etc