Biological wastewater treatment

Sinopec Jiujiang

Ammonia Project / China

Wastewater from fertilizer production

In Jiujiang Sinopec, China‘s biggest petroleum company, operates a plant for urea production. The urea is used as a fertiliser and is produced by gasifying crude oil.

This production process yields several highly contaminated wastewater streams, containing ash, heavy metals, methanol, ammonia, cyanide and organic compounds.

The wastewater treatment plant designed by Lurgi Bamag combines several process steps such as mechanical, physical / chemical and biological treatment. This ensures the removal of the major part of the contaminants before water discharge.

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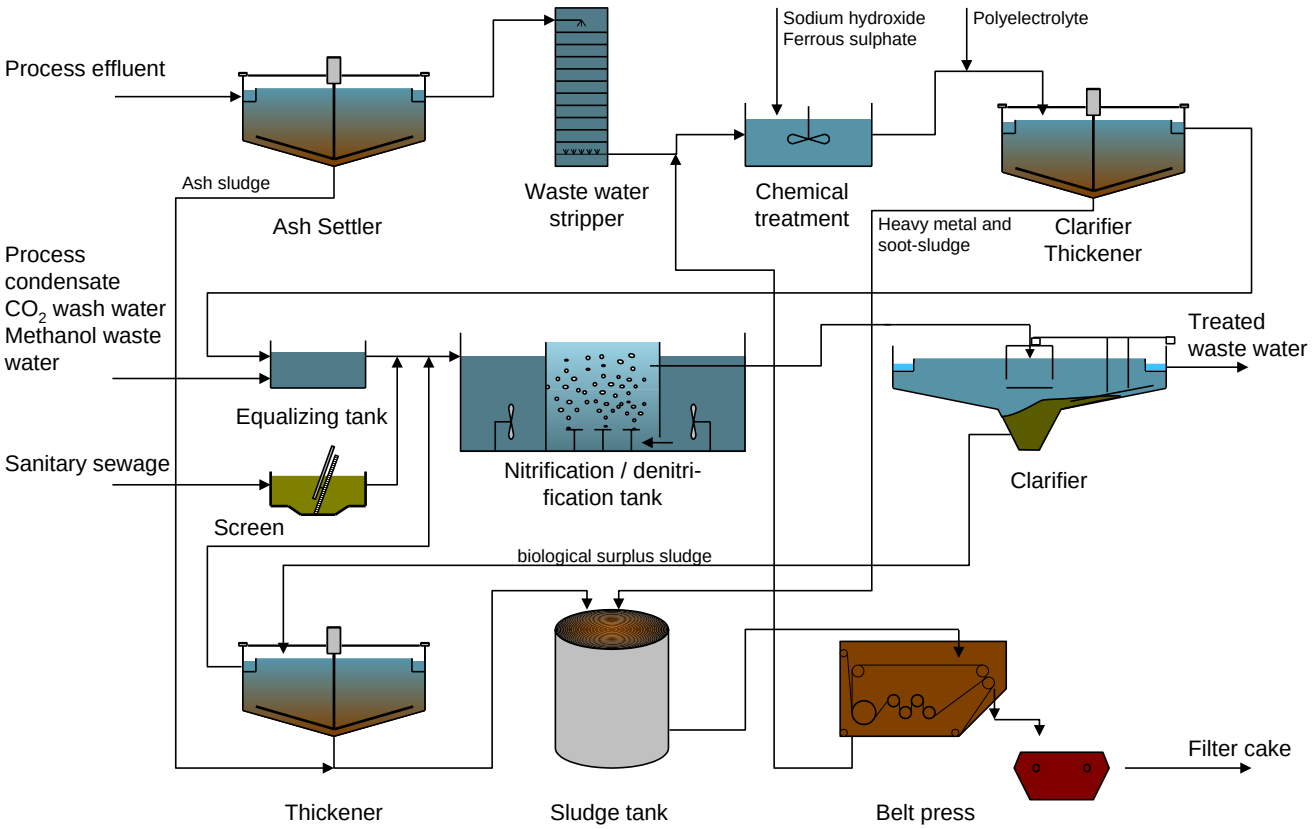

1. Objective

Treatment of industrial wastewater

- Design data

Throughput	1,180 m³/d
COD load	1,340 kg/d
Total N	92 kg/d

- Treatment criteria

BOD_5	≤ 60 mg/l
COD	≤ 150 mg/l
NH_4	≤ 50 mg/l
CN	≤ 0,5 mg/l
Ni	≤ 1 mg/l
Suspended solids	≤ 200 mg/l
Oil	≤ 10 mg/l
Phenol	≤ 0,5 mg/l
pH values	6-9

- Process steps

  Equilization, neutralization, heavy metal precipitation, flocculation, sedimentation, aerobic treatment incl. nitrification and denitrification, clarification, sludge thickening and dewatering

- Brief description

  The waste water treatment process was implemented in three plant areas: ash settler, precipitation of heavy metals, biological treatment of pre-treated process effluents.

  The suspended ash originating from the feed products is largely removed by controlled sedimentation in an ash settler. The settled ash is moved by a scraper to the sludge hopper and routed towards the sludge treatment.

  The clear effluent discharge is treated in a stripper column to remove volatile organics and ammonia components.

  The stripper effluent is laced with organic and inorganic pollutants. As the inorganic pollutants, especially the heavy metals (V, Ni) would interfere with the downstream biological treatment step, they have to be removed before the water is admitted to the bioreactor.

  Precipitation of heavy metals is achieved by adding ferrous sulphate to the waste water while the pH is adjusted to 9.5 - 11 with caustic soda. Added polyelectrolyte solution supports the flocculation and the growth of the generated hydroxide flocs which are then precipitated in the clarifier / thickener.

  The pre-treated process effluent is combined with sanitary sewage, CO_2 wash water and contaminated rain water in a buffer tank from where it is fed into the two-line biological treatment stage.

  The biological stage consists of two circular concrete tanks for biodegradation of the organic pollutant load.

  A concentric circular partition wall divides each tank into an internal nitrification zone and an external denitrification zone. Diffusors in the nitrification zone provide the necessary oxygen supply and ensure proper agitation of the reactor contents. The denitrification zone is equipped with a mixer to ensure optimum mixing conditions.

  In the downstream clarifier the activated sludge is settled and drawn off.

  The waste activated sludge is thickened and then mixed with the ash sludge and the hydroxide sludge from pre-treatment. After dewatering on a belt filter press, the sludge will be transported to a landfill.

3. Characteristic plant data

- 1 ash settler
  Ø 8 m
- 1 neutralization / flocculation unit
  volume 5 m³
- 1 thickener / clarifier
  clarification area 19 m²
- 2 aeration tanks
  volume 650 m³/ tank
- 2 clarifiers
  clarification area 85 m² each
- dosing units
- sludge treatment
  sludge storage tank 20 m³
  thickener
  belt filter press

4. Operating experience

The wastewater treatment plant achieved the guaranteed effluent discharge criteria after a short running-in period and has been operating without any troubles ever since successful acceptance testing.

Achieved effluent parameters are:

COD	≤ 90 mg/l
NH_4	≤ 40 mg/l
Suspended solids	≤ 50 mg/l