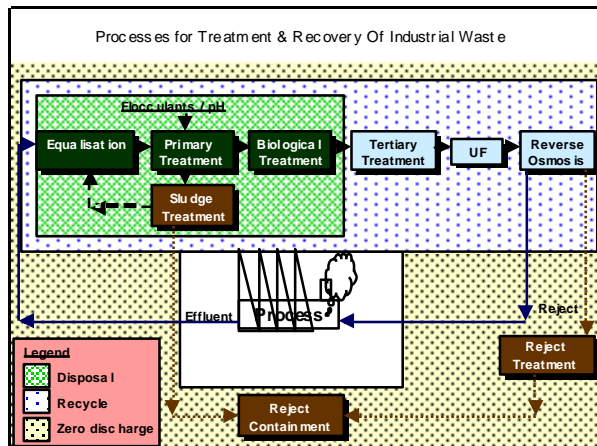
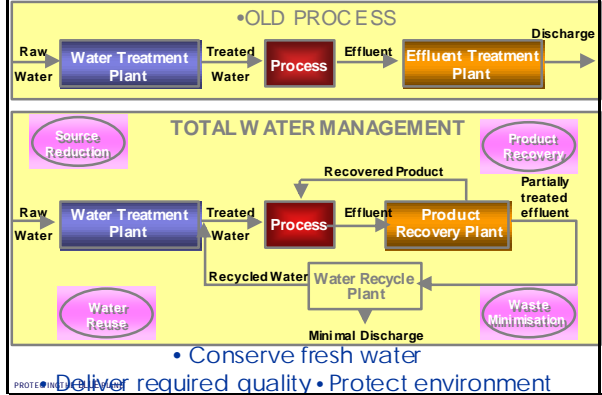


Technologies for COMPLEX WASTE TREATMENT



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APPLICABLE TECHNOLOGIES FOR WASTE WATER MANAGEMENT & RECOVERY

WASTEWATER

- Anaerobic treatment: WIDEST RANGE OF ANAEROBIC PROCESSES
- Aerobic treatment: LUCAS®
- Effluent recycle: INDION® MEMBRANE SYSTEMS

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ANAEROBIC TREATMENT vs AEROBIC TREATMENT

Advanta ges Anaerobic	Disadvan tages Aerobic	Advanta ges Anaerobic	Disadvan tages Anaerobic
<p>No process treatment:</p> <ul style="list-style-type: none"> Low effluent COD Bio-N and -P removal <p>No heating: range = 0 - 40 °C</p> <p>Very robust process Short start-up period</p>	<p>High exploitation cost:</p> <ul style="list-style-type: none"> Aeration energy 1.1 kWh/kg bCOD Sludge disposal 0.3 kg sludge/kg bCOD <p>No CH₄ production: No green energy</p>	<p>Low exploitation cost:</p> <ul style="list-style-type: none"> No aeration required 0.3 kWh/kg bCOD Sludge disposal 0.05 kg sludge/kg bCOD <p>Green energy source: CH₄ production</p>	<p>Post-treatment required?</p> <ul style="list-style-type: none"> COD-removal max. 90% No bio-N and -P removal <p>Heating required? range = 28 - 37 °C</p> <p>More sensitive to toxic shocks Relatively long start-up</p>

COD Balance Aerobic

COD Balance Anaerobic

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ANAEROBIC TREATMENT - DIFFERENT REACTOR TYPES

Anaerobic Contact Process

Anaerobic Filter Process

Anaerobic Filter Process

Upflow Anaerobic Sludge Blanket

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ANAEROBIC TREATMENT - UASB - UPFLOW ANAEROBIC SLUDGE BLANKET

Gas domes

Effluent weir

UPFLOW

Feed Loops

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ANAEROBIC TREATMENT - UASB - 3 PHASE SEPARATORS

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WATER & WASTEWATER

- Anaerobic treatment: BIOTIMUASB®, BIOTIMUAC®, BIOTIMFILTER HIBRID®
- Aerobic treatment: **LUCAS®**
- Effluent recycle: INDION® MEMBRANE SYSTEMS

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AEROBIC TREATMENT-CONVENTIONAL SYSTEMS

How does a conventional continuous system work

ADVANTAGES:

- continuous influent and effluent flow rate
- no buffer tank
- constant water level
- efficient aeration

DISADVANTAGES:

- limited operational flexibility (N/D/N)
- moderate process control
- devices for sludge raking
- expensive / maintenance
- devices for recirculation flow
- expensive / maintenance
- circular configuration of sedimentation tanks
- high footprint

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AEROBIC TREATMENT-BATCH REACTOR

How does an SBR system work

ADVANTAGES:

- Easy compact construction
- economical system
- Process control in time
- flexibility that allows control of all specific phases
- Substrate gradients resulting in microbial selection of well settling sludge
- high effluent quality

DISADVANTAGES:

- Discontinuous influent feeding and effluent discharge
- buffer tank required (not suitable for big flows)
- The variable level and volume
- volume not used efficiently
- less efficient aeration

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AEROBIC TREATMENT:

LUCAS® combines advantages of CONVENTIONAL ASP and BATCH REACTOR (SBR)

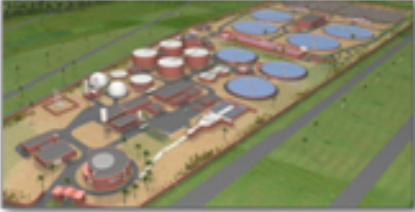
- continuous influent and effluent flow rate
- constant water level
- efficient aeration
- Process control in time
- flexibility that allows control of all specific phases

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New Energy from wastewater

Municipal wastewater – anaerobic sludge digestion



Project Marrakech

- 1,100,00 P.E. ;
- 58,100kg BOD/day
- 100,00 m³/day
- 1.6 MWe production by anaerobic sludge digestion
- Re-use for irrigation of the golf courses



Project Fès

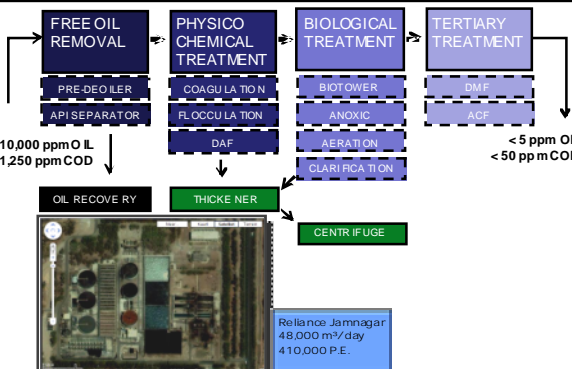
- 1,300,00 P.E. ;
- 72,000kg BOD/day
- 157,000 m³/day
- 2.75 MWe production by anaerobic sludge digestion

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Water Reuse

Water Reuse in the world with new technology



10,000 ppm OIL
1,250 ppm COD

< 5 ppm OIL
< 50 ppm COD

Reliance Jamnagar
48,000 m³/day
410,000 P.E.

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New Energy from wastewater

Anaerobic digestion of industrial wastewater



Biotin® Anaerobic

- More than 200 references
- More than 65 million P.E.
- Top 3 players in the world
- 1.75 million N m³ biogas / day produced



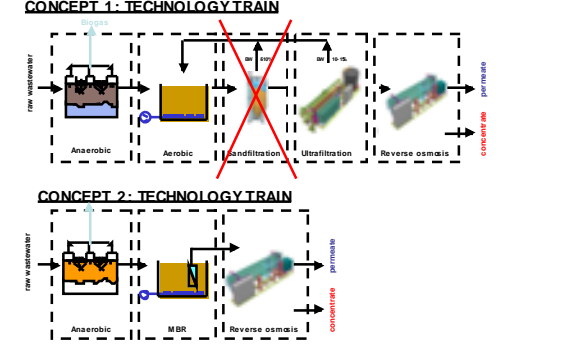
Key India References
EID Parry
Jubilant Organosys
Inda Glycol
TNP L

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Water Reuse

Water Reuse in the world with new technology



CONCEPT 1 - TECHNOLOGY TRAIN

Anaerobic → Anoxic → nitrification → Ultrafiltration → Reverse osmosis

CONCEPT 2 - TECHNOLOGY TRAIN

Anaerobic → MBR → Reverse osmosis

permeate
concentrate

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Case Study

Customer : Chennai Petroleum Corporation Limited (CPCL)

Problem : Acute water scarcity in the region which led to shutdown of refinery few years back.

Quantitative Analysis : Zero discharge 200 m³/hr capacity Effluent treatment & recycling plant
 Inlet TDS : 1860 ppm, BOD : 20 ppm, COD : 250 ppm,

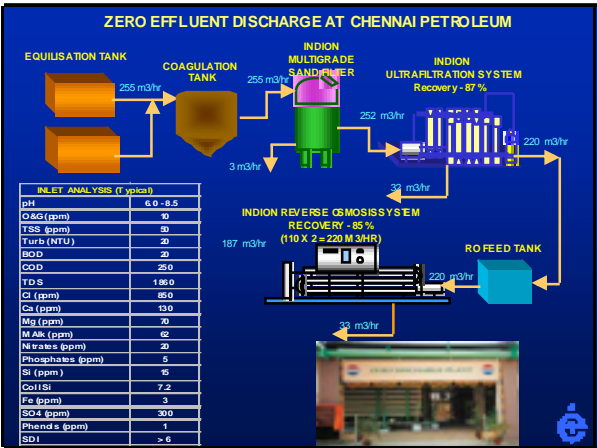
Solution : Zero effluent discharge effluent treatment plant was designed with 200 m³/hr capacity UF plant followed by 220 m³/hr RO plant.

Outlet Quality : TDS < 40 ppm,
 BOD : Below detectable limit
 COD : Below detectable limit

Chennai Petroleum

Industrial waste water recovery for reuse

4 MLD Refinery Waste water recovery at Chennai Petroleum

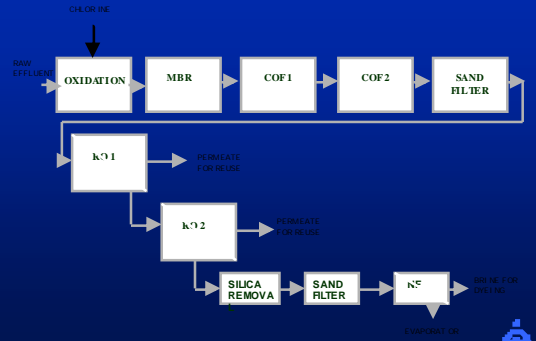


Case Study

ZERO DISCHARGE PLANT AT ANGERIPALAYAM CETP



FINAL SCHEME SUGGESTED FOR ULTIMATE CAPACITY PLANT



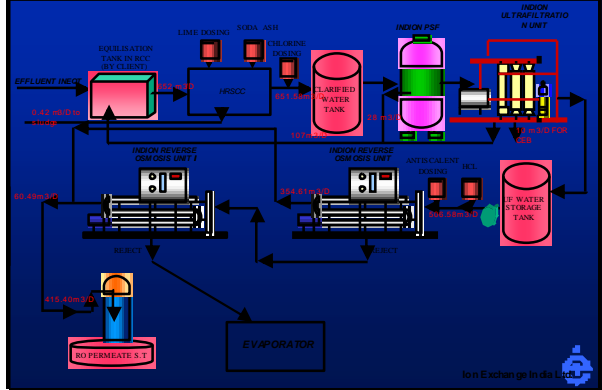
Angeripalayam CETP

Angeripalayam - first large installation of MBR for textile wastewater recycle.




Capacity:
10 MLD


Water Balance for Zero Discharge at Gujarat Ambuja Cement Case Study - 3




Zero Discharge Plant at Gujarat Ambuja Cements (Holicim)




Evaporator



RO Section



UF Section




WASTE TREATMENT- ALL WASTE CAN BE AN SOURCE OF SUSTAINABLE ENERGY

- Municipal solid waste (MSW)
- Agro industrial waste
 - Vegetable oil refinery residues
 - Manure and chicken litter
 - Meat and bone meal
 - Animal fat
 - Animal residues
 - Crop residues (grape skins, olive residues,...)
 - Residues from sugar industry
- Industrial sludge
 - Refinery sludge
 - Spent activated carbon
 - Chemical sludge
 - Physicochemical sludge from WWTP plants
 - Paper mill sludge
 - Oily sludge
 - Tars
 - Paint and paint sludge

- Hazardous waste
- Medical waste
- Solid waste
 - RDF granules
 - Saw dust and wood pellets
 - Shredded plastics, packaging waste,...
 - Liquid effluents
 - Waste solvents
 - Waste waters
 - Waste oils
 - Shipping effluents
 - Organic acid waste
 - Petrochemical waste
- Municipal & industrial biosolids
 - Mechanically dewatered sludge
 - Primary and secondary sludge
 - Anaerobic and aerobic sludge
 - Dissolved Air Flotation (DAF) sludge
- Concentrated wastewater


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WASTE TREATMENT- THERMAL VALORISATION OF WASTE = SUSTAINABLE ENERGY

- WASTE IS AN EXHAUSTIBLE SOURCE OF ENERGY
- WASTE CAN REPLACE FOSSIL FUELS
 - e.g. 2 ton of municipal solid waste produces between 0.8 and 1.5 MW of electricity
 - e.g. 1 ton of waste oil produces between 1 and 2 MW of electricity
 - e.g. 1 m³ waste water produces between 1 and 5 m³ biogas
 - e.g. 1 ton BOD produces about 1 MW electricity
- USE OF WASTE AS FUEL REDUCES DEPENDENCY ON FOSSIL FUEL IMPORTS
- WASTE TREATMENT PROBLEM AND ENERGY REQUIREMENTS ARE MET AT THE SAME TIME

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COMBUSTION OF WASTE

Thermal Systems

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WASTE TREATMENT - WHY IS COMBUSTION OF WASTE MORE DIFFICULT THAN COMBUSTION OF FUEL

- Waste is an undefined, heterogeneous mixture of products that do not burn
 - Water: requires energy to be evaporated
 - Inert matter: has to be heated up and cooled down
 - Combustible matter of different calorific value (wood, plastic, etc)
- This means that:
 - the installation cannot be run at one single design point, but rather has to be very flexible and be adjusted continuously
 - It's very difficult to design and calculate the equipment
 - Selection of the correct combustion technology is crucial
 - Spedal burner
 - Rotary drum
 - Fluidised bed
 - Combustion grate
 - Combination of several technologies

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WASTE TREATMENT - COMBUSTION - INCINERATION

Vapours, liquids and slurries:

- The DynaFluid® multifluid thermal oxidiser

Low emission burner with integrated fuel mixing and internal fluegas recycling, resulting in a very high efficiency: > 99,9999 %

Complex mixtures, solid wastes, sludges, liquids:

- The TurnOver® rotary furnace

Flexible furnace for a wide range of wastes and waste mixtures

Sludges and solid wastes:

- The Hello Solids® fluidized bed reactor

Efficient fluidised bed reactor with staged combustion (3 levels if needed)

Solid industrial waste, domestic waste, RDF, packaging waste:

- The Energize® multi-stage WIE grate

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WASTE TREATMENT - TURNOVER ROTARY DRUM FURNACE WITH RECOVERY BOILER

- Waste is fed to the drum by screws or ram feeder
- Combustion air and/or contaminated/odorous air is injected at high velocity through the front wall
- An internal recirculation of combustion gases is created, resulting in a homogeneous residence time and temperature of the gases in the oxidation chamber





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WASTE COMBUSTION - The TurnOver® rotary furnace

- Can handle a wide range of wastes:
 - Liquids, gases, sludges, solid wastes
 - MBM, hospital waste, chemical waste
 - Municipal waste, packaging waste
 - Capacities ranging from 500 kg/h to 3 T/h
 - Post-combustion chamber and heat recovery possible
 - Proprietary drive and seal design





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Total Water Solutions for
Industry, Homes & Communities

