TRAINING PROGRAMME FOR ETP OPERATORS IN TEXTILE INDUSTRY

Promotion of Sustainability in the Textile and Garment Industry in Asia - FABRIC

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

FABRIC Asia

Effluent treatment in Bangladesh

GIZ FABRIC – ETP Operator Course

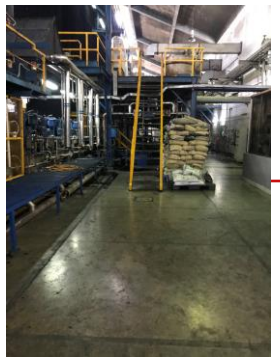
Contents

- Situation in Bangladesh
- Basic concept
- Common ETP models in Bangladesh

Wastewater management from textile factories

Water recovery facility

Textile factory



Process chemicals

Effluent Treatment Plant

Process water mostly from ground

Leacheate

Hazardous waste disposal

Discharge to river

Effluent generation in Bangladesh

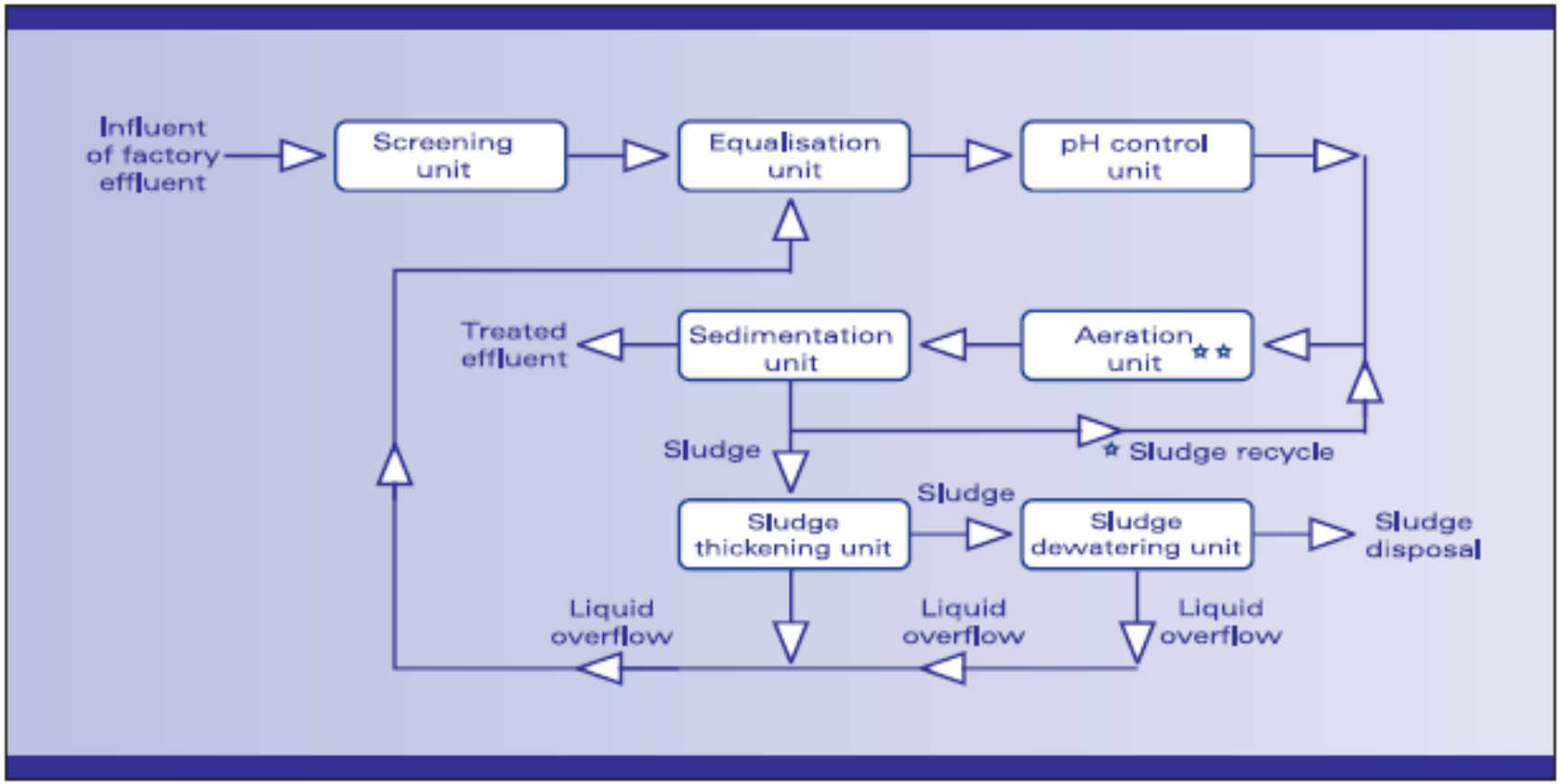
- Textile factories located in **several clusters in Bangladesh**; largest concentration of factories **in and around Dhaka**
- Consumption of **large quantities of water** and discharge **huge volumes of effluent**
- Collection of exact figure of effluent challenging
  1. Lack of measurement system on actual water consumption/ effluent,
  2. Huge variation in process culture, machinery and chemicals used in different factories,
  3. Underreporting to DoE
  4. Seasonal variations in production.
- Estimated current effluent generation from factories in around Dhaka around **4000 - 4500 million litres per day (MLD)**.

Effluent generation in Bangladesh

- Water consumption and effluent discharge likely to increase to 7000 MLD by 2030.
- **Most effluents** from factories in and around Dhaka **treated in own ETPs** and discharged into River Turag:
  - About 50% primary ETPs only plus 50% either full biological or primary plus secondary biological (combined) ETPs.
  - Many primary ETPs now being upgraded to combined ETP or converting to all-biological treatment.
- **Expansion of ETP capacity major challenge** to many industry:
  - Shortage of land
  - High capital investments needed

Common ETP models in Bangladesh

Treatment flow diagram of typical ETP in Bangladesh



Common ETP models in Bangladesh

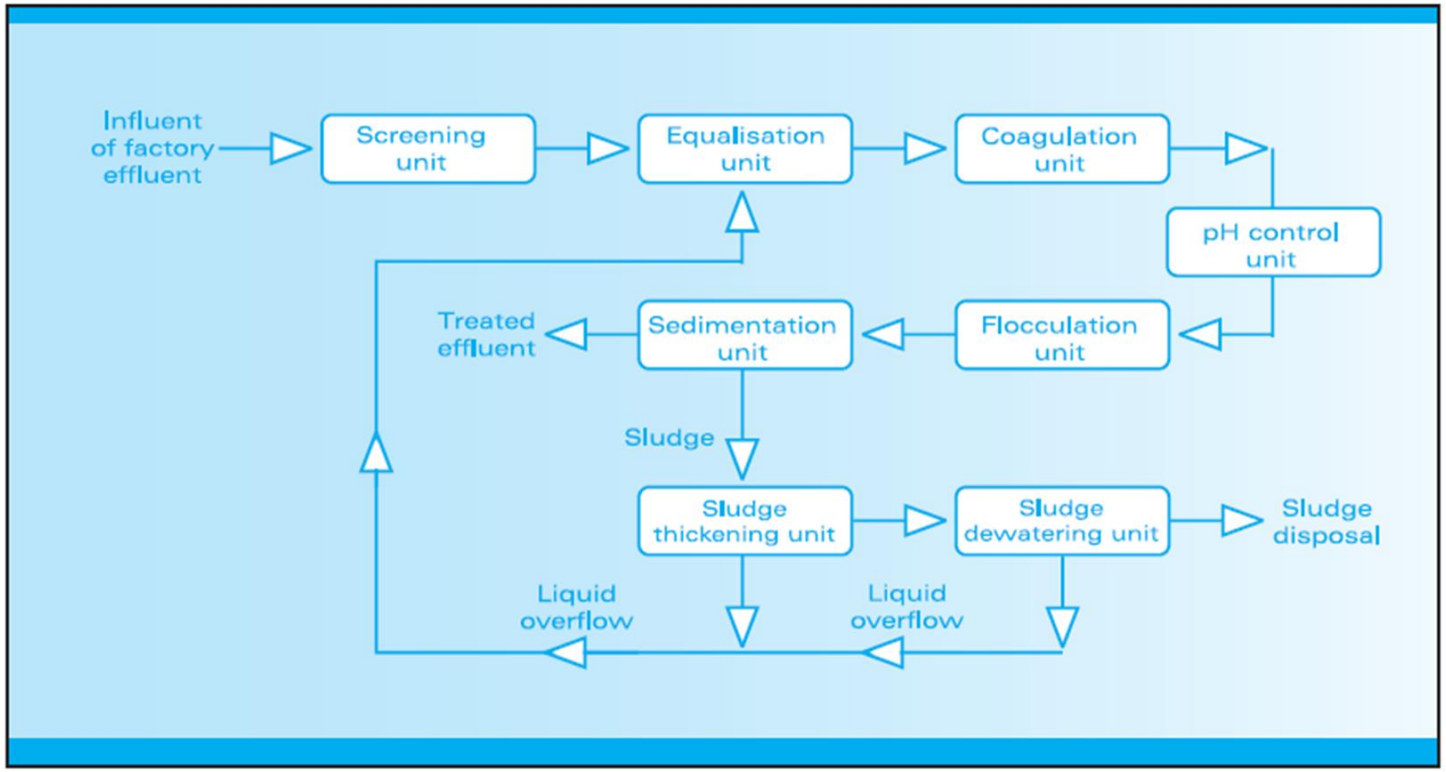
Three main types/models of ETPs installed and in operation in Bangladesh:

- Physico-chemical treatment
- Physico-chemical and biological treatment
- Full biological treatment

Common ETP models in Bangladesh

Physico-chemical treatment

- About 50% of ETPs in Bangladesh
- Many doing polishing with tertiary treatment
- Sludge dewatering with
  - sludge drying beds and/or
  - mechanical dewatering



Common ETP models in Bangladesh

Physico-chemical treatment

Basic units of stand-alone physico-chemical treatment plant in Bangladesh:

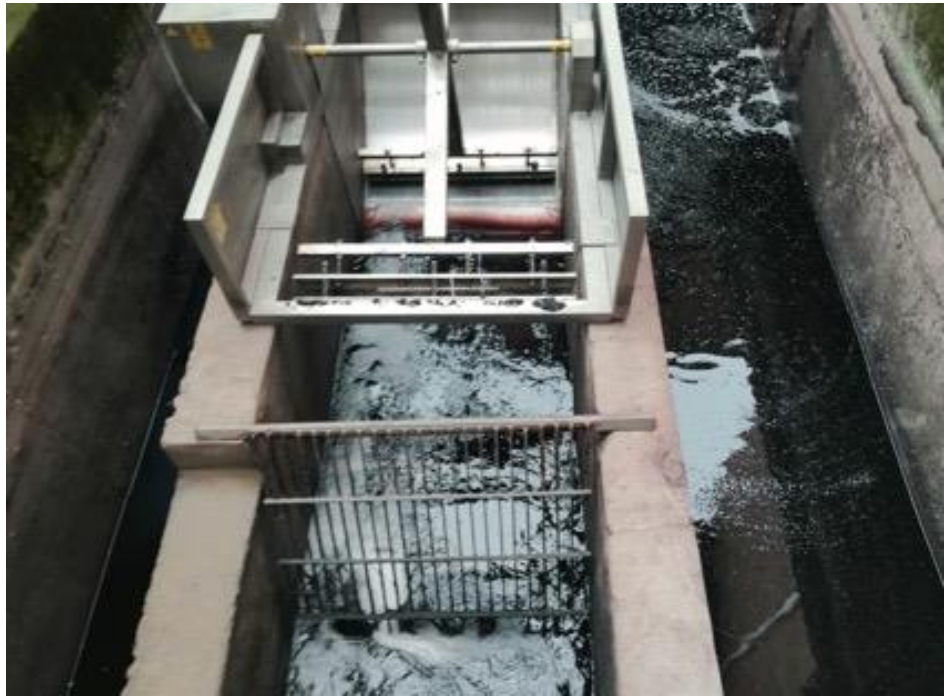
- Screening
- Equalization unit
- pH control unit
- Chemical storage tanks
- Mixing unit
- Coagulation and flocculation unit
- Settling unit
- Sludge dewatering unit

Common ETP models in Bangladesh

Primary treatment units and their performance

Screening and grit removal

- Most ETPs brush type trough screen (cleaned automatically)
- few ETPs with drum screens;
- only very few ETPS with any form of grit removal.



Common ETP models in Bangladesh

Primary treatment units and their performance

Equalisation

- Common use of submersible pump and lift wells for pumping effluent into equalization tanks.
- Slotted pipes for mixing and aeration common; only few with floating jet aeration.
- Diffused aeration with fine bubble diffusers most common
- Common challenge:
  - **Inadequate retention time** for effluent homogenization in equalization tanks (4-6 hours retention time only).

Equalisation tank

Common ETP models in Bangladesh

Primary treatment units and their performance

- Equalisation
  - Common use of submersible pump and lift wells for pumping into equalization tanks.
  - Inadequate retention time for effluent homogenization in equalization tanks (4-6 hours retention time only).
  - Slotted pipes for mixing and aeration common; only few with floating jet aeration.
  - Diffused aeration with fine bubble diffusers most common

Equalisation tank

Chemical dosing system

Common ETP models in Bangladesh

Primary treatment units and their performance

Flash mixing and chemical dosing

- Combined flash mixer/flocculator (though very effective) in several ETPS.
- Manual dosing in most primary ETPs of Bangladesh; no jar tests done.
- Common treatment chemicals:
  - Ferrous sulphate
  - Lime
  - Polyelectrolytes
  - Alum in few units use alum

Common ETP models in Bangladesh

Primary treatment units and their performance

Primary clarification

- Primary clarifiers not popular in Bangladesh.
- Mostly tube settler/lamella clarifiers (probably to save space).
- Common challenges
  - **Missing V-notches** at overflow of many sedimentation units
  - **Uneven overflows** through only portion of the weir common.

Common ETP models in Bangladesh

Primary treatment units and their performance

Final treatments

- Filtration, both with multi-grade filters and activate carbon filters.
- Challenges
  - In most ETPs, exhaustion of activated carbon after few weeks due to high organics in outlet of primary clarifier;
  - Seldomly regular replacement of carbon.

Common ETP models in Bangladesh

Primary treatment units and their performance

Sludge dewatering

- Dewatering with
  - decanter centrifuges and filter press in medium-large ETPs;
  - sludge drying beds in small ETPs.
- Storage of dewatered sludge in maturation pits
- Only limited data regarding the ultimate disposal of sludge.

Common ETP models in Bangladesh

Primary treatment units and their performance

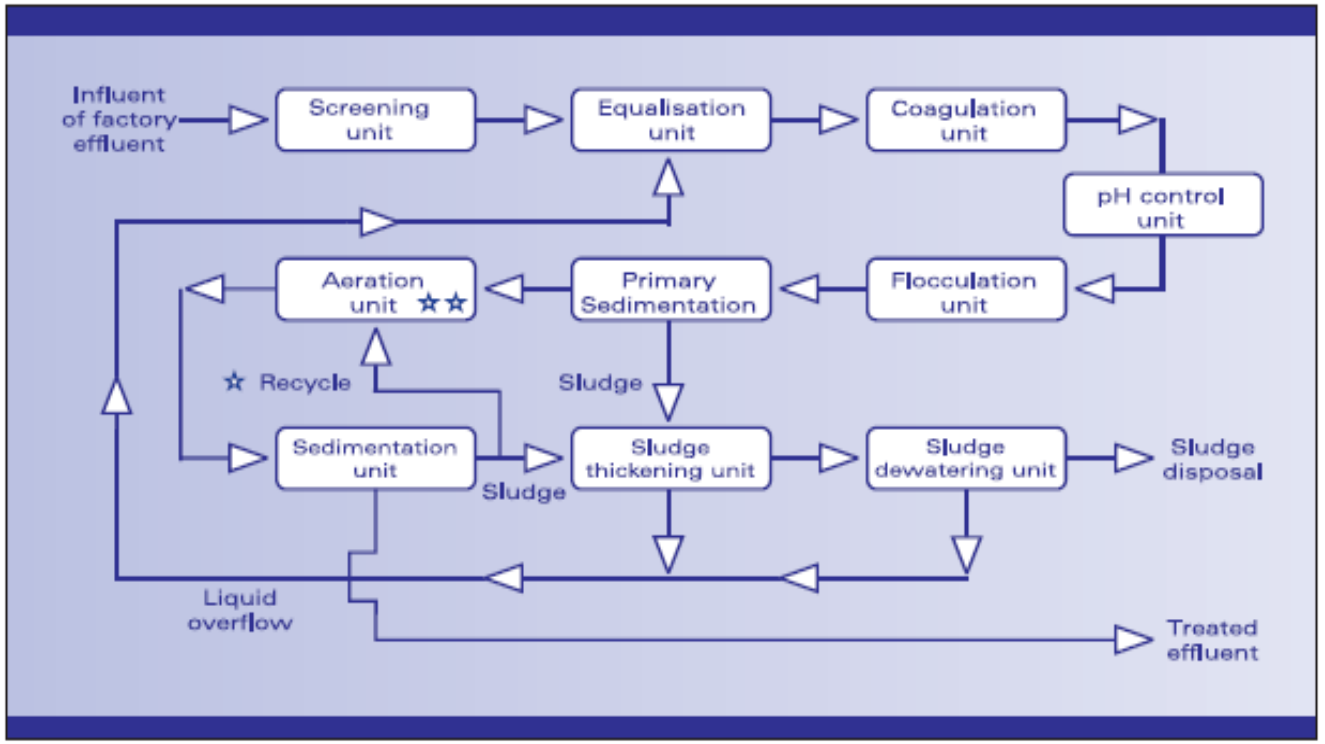
Conclusion

- Primary ETPs generally effective in removal of good amount of colour, suspended solids and part of BOD/COD;
- Meeting BOD standards sometimes challenging.

Common ETP models in Bangladesh

Typical physico-chemical and biological treatment plant (combined)

- Many earlier primary treatment ETPs expanded with biological treatment and upgraded to combined ETPs.
- Commonly activated sludge plant with surface/diffused aeration
- Sludge dewatering with sludge drying beds/mechanical dewatering.



Common ETP models in Bangladesh

Typical physico-chemical and biological treatment plant

Physico-chemical and biological units commonly installed:

- Screening
- Equalization unit
- pH control unit
- Chemical preparation tanks
- Mixing units including coagulation and flocculation units
- Primary settling unit
- Aeration unit
- Secondary settling unit
- Sludge thickener.
- Sludge dewatering unit
- Sludge maturation/disposal.

Common ETP models in Bangladesh

Combined treatment units and their performance

- Usually all units as mentioned in primary treatment plant units, except for final carbon and pressure filters for polishing.
- Aeration and secondary settling tank with sludge recirculation in addition.
- Surface aeration and diffused aeration most common in ETPs; in addition disk diffusers in use; also tubular diffusers
- Secondary clarifier
  - conventional circular units in about 30% of ETPs
  - most units using tube settlers for secondary settling (saving space).

Common ETP models in Bangladesh

Combined treatment units and their performance

Primary and secondary sedimentation

Common challenges

- Poor adjustment of V notches resulting in irregular overflows

Additional treatment

- Common dosing of colour removal agent (e.g. polymer flocculant) at inlet of secondary settling.

Common ETP models in Bangladesh

Combined treatment units and their performance

Sludge dewatering

- Sludge drying beds in small ETPs;
- Decanter centrifuges and filter presses in medium-large ETPs.
- Storage of sludge in maturation pit.
- Limited data available on final disposal of sludge.

Common ETP models in Bangladesh

Combined treatment units and their performance

Conclusion:

- Combined ETPs generally meeting all standards specified by DoE.
- No removal of TDS.

Common ETP models in Bangladesh

Full biological treatment systems

- Increasingly preferred option of ETP in Bangladesh
- Main reason **less sludge generation** vis-à-vis primary ETPs.
  - Main drawback: **Higher land requirement** – a common and growing challenge in Bangladesh!
- Main difference to combined ETP model
  - Need for neutralization and cooling before admitting equalized effluent into aeration tank.
  - Neutralization often done with addition of sulphuric acid at small chamber in inlet to aeration tank; challenge: Few ETPs equipped with auto pH correction.
  - Cooling of effluent in cooling towers: Conventional towers popular; heat exchanger type cooling systems in few ETPs only.

All-biological ETP in Bangladesh with cooling towers

Common ETP models in Bangladesh

Full biological treatment systems

- Preferred system for textile effluents with mostly organic wastewater and less colour and heavy metals contaminants.
- Seeding of aeration system with bio-sludge required in view of no suitable microorganisms textile wastewater (unlike sewage); often necessary obtaining bio-sludge from other ETPs.
  - Earlier cow dung used as a source of microorganisms; but potential problem with filamentous organisms and possible sludge bulking.
- Surface/diffused aeration systems for aeration common
  - Most new ETPs using diffused aeration with disk type EPDM diffuser.
  - Surface aerators used in few ETPs only

Common ETP models in Bangladesh

Full biological treatment systems

Aeration tank constructed as double decker to save space.

Ultra fine diffused aeration

Common ETP models in Bangladesh

Full biological treatment units and their performance

Secondary settling

- Tube settler/ lamella clarifier most commonly used

Common ETP models in Bangladesh

Full biological treatment units and their performance

Sludge management

- Continuous sludge recirculation important, but irregular recirculation of bio-sludge very common.
- Approximately 5 - 20% of bio-sludge to be wasted every time to preserve health of biomass, but uncommon practice
- No withdrawal of sludge for wasting in required quantity; some ETPs without any sludge dewatering facility
- Filter presses in some ETPs, otherwise use of sludge drying beds.

Common ETP models in Bangladesh

Full biological treatment units and their performance

Sludge management

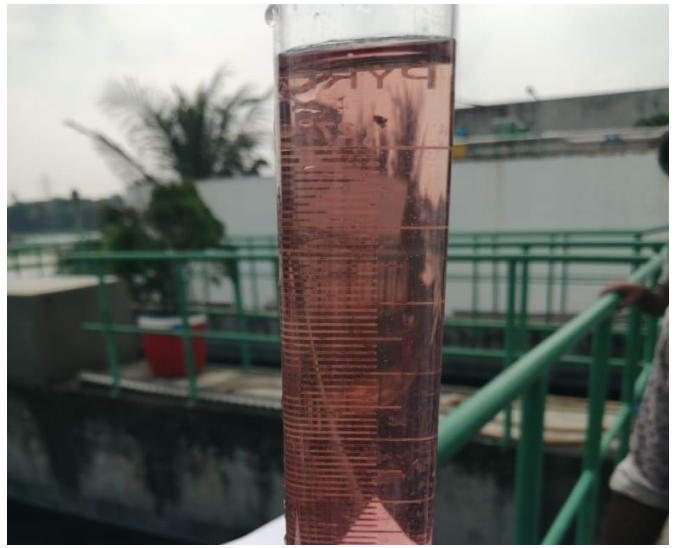
- Challenges
  - Most ETPs keep sludge return rate at about 60-100% of inflow to the aeration tank,
  - Some ETPs not practicing return of bio-sludge; as result very low MLSS in aeration tank.

Common ETP models in Bangladesh

Full biological treatment units and their performance

Colour removal

- Use of colour removal agent at inlet of secondary clarifier common practice in many medium and large ETPs
- Commonly good reduction of colour to a good extent.
- Challenges:
  - Composition of colour removal agent not fully known (probably a flocculant with polyelectrolytes).
  - Proportional contribution of chemical to sludge generation not clear, but appear to be low.



Common ETP models in Bangladesh

Full biological treatment units and their performance

Common challenge

- High level of foam common in aeration tanks (dark brown colour in most cases)
- in some aeration tank with very low MLSS
- Foam being blown away

Common ETP models in Bangladesh

Full biological treatment units and their performance

Conclusion

- Most of all-biological treatment plants capable of meeting all national standards for most of required parameter.
- **Not very effective for removing color**, especially when no colour removal agent used (of concerns to general public).
- **Generally efficiently** meeting BOD, pH, TSS, oil and grease requirements in treated effluent.
- **Inefficient in remove heavy metals** present in the raw effluent; only minimal presence of heavy metals in bio sludge

Common ETP models in Bangladesh

Common observations

- **TDS treatment challenging**
  - Most ETPs in Bangladesh not equipped with any system to remove the salts from effluent.
  - Membrane based ZLD units installed in few units, but their performance not much known.
- **Systematic acclimatization of microbes**
- No attempts in biological treatment to increase tolerance and removal of complex chemicals contained in dyeing chemicals

To remember

- Fast track installation of effluent treatment systems in textile industry of Bangladesh
- Most factories equipped with functional ETP
- New treatment systems mostly all biological ETPs only
- Sludge disposal key issues and driving force in adoption of all-biological treatment systems;
- Scarcity of available space for biological treatment system key challenge
- Be aware of limitations and challenges in operation of all-biological treatment systems

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonnand Eschborn

GIZ Bangladesh
PO Box 6091, Gulshan 1
Dhaka 1212, Bangladesh
T +880 2 5506 8744-52, +880 9666 701 000
F +880 2 5506 8753
E giz-Bangladesh@giz.de
I www.giz.de/bangladesh

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH