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

Introduction to ETP Monitoring

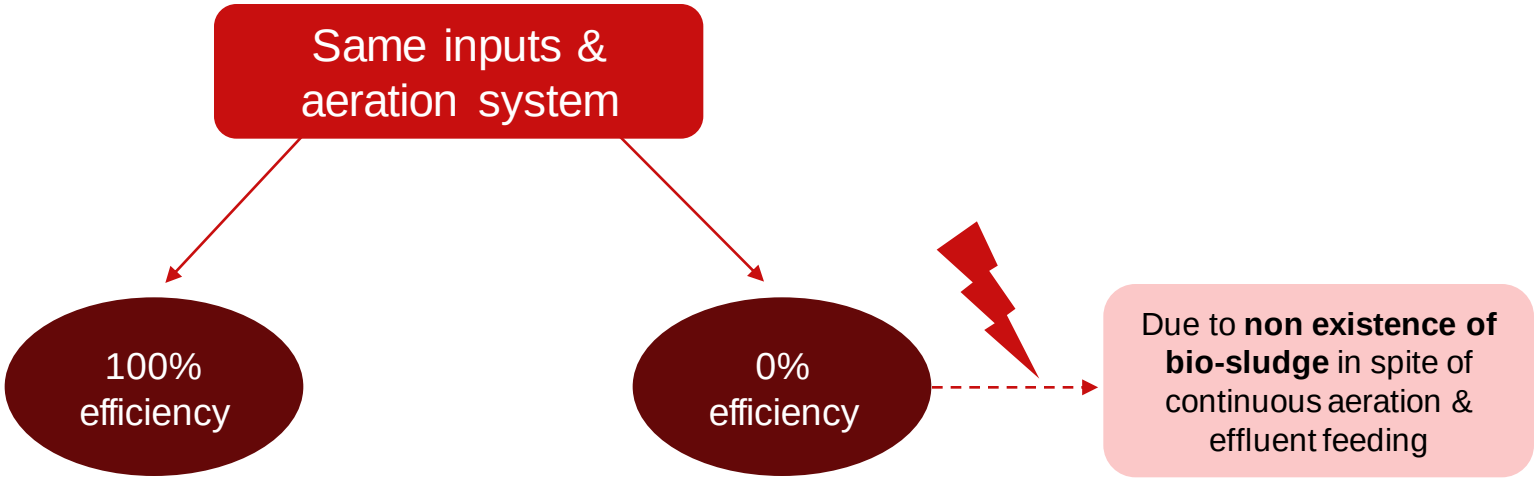
GIZ FABRIC – ETP Operator Course

Contents

- Basic concept of ETP monitoring
- Monitoring of different parameters

Basic concept of ETP monitoring

Basic concept of ETP monitoring



Presence of required bacterial population to be ensured through appropriate monitoring

Basic concept of ETP monitoring

Role of monitoring:

ETP manager and lab chemist

- ETP Manager sometimes doubling as chemist

Role of obtaining correct data/monitoring:

Operator

- Correct wastewater sampling
- Recording data collection from online monitoring

Correct and representative sample needed
to avoid misguiding ETP operation control!

Basic concept of ETP monitoring

Parameters impacting ETP performance

(1) Operational parameters such as operation times of equipment

(2) Wastewater quality parameters at various stages of treatment process

(3) Process control parameters such chemical dosing, pH, temperature, MLSS, RAS/WAS, nutrient dosing

(4) Operational problems, solutions adopted and maintenance features

(5) Inventory such as chemical stocks, spares and reorder quantities

(6) Expenditure (checking costs of treatment)

Monitoring operational parameters

Monitoring operational parameters

Need of …

- **continuous monitoring**
- proper **notation** of ETP equipment's **operation time**

Continuously operated units

- Aerators
- Blowers
- Clarifiers
- Return sludge pumps, etc.

versus

Intermittently operated units

- Raw effluent pumps
- Screens
- Cooling tower
- Chemical preparation units
- Sludge dewatering

Monitoring operational parameters

Recording of switch-on and switch-off incidences

To ensure sufficient utilization and absence of over- and under-operation

- for continuous operated equipment changing between main and standby units be recorded.
- the operator to
  - carry out above monitoring
  - record observations
  - review them.

Monitoring operational parameters

Documentation of operation time

- To assure management or regulatory agencies about continuous ETP operation
- To provides assurance to consultant or auditor of proper operation and maintenance
- To reveals health of ETP

Monitoring operational parameters

Examples for testing proper time

- Monitoring whether
  - return sludge pump operating for 24 hours
  - chemical dosing started only after sufficient mixing
  - filter press in operation for longer than usual cycle time

Wastewater monitoring

Wastewater monitoring

Wastewater monitoring

Main types of wastewater monitoring:

1. On-site monitoring

- Checking at site itself (e.g. pH, DO)

2. Off-site monitoring

- Checking of collected wastewater samples in in-house or external laboratory

3. Online monitoring

- Continuously checking (from within or outside ETP)

ETP operator involved in all types of monitoring operations

Wastewater monitoring

On-site monitoring

- Checking of **certain parameters**
  - Parameters changing in case of delayed testing
  - Parameters impacting immediate treatment control and needing regular checking
- **Testing equipment** to
  - be **portable**
  - be **simple to operate**
  - give **immediate readings**

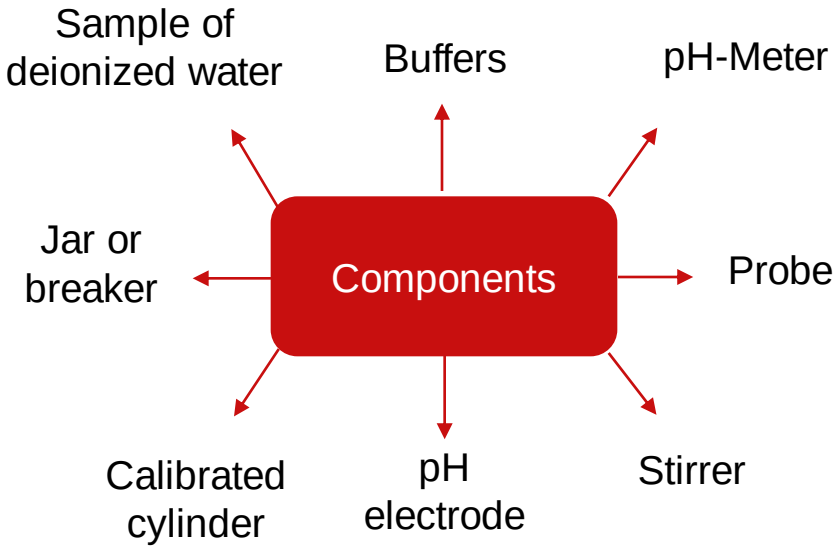
Wastewater monitoring

On-site monitoring - Examples

- **Dissolved oxygen (DO)**
  - Tested with **portable** (preferred) or **fixed DO meter** with laboratory check (see Winkler's method)
- Spot measurement of **toxic gases**
  - Tested with H2S meter
- **Temperature check**
  - Tested with thermometer
- **pH value** for treatment control
  - Tested with pH meter or paper

Wastewater monitoring

On-site monitoring – Usage of pH meter



Wastewater monitoring

On-site monitoring – Usage of pH meters

- **Preparations**
  - Take calibrated breaker and pour 100 ml water to be tested
  - Switch on pH meter to warm up
- **Step 1:**
  - Rinse electrode with distilled water,
  - Shake off any excess fluid on the device before placing in sample liquid or water.

Wastewater monitoring

On-site monitoring – Usage of pH meters

- **Step 2:**
  - Place device in sample and press “measure pH button”
  - Stable reading in about two minutes
- **Step 3:**
  - Take another reading for accuracy
  - Rinse and dry electrode well.
  - Clean electrode after use and keep stored.

Wastewater monitoring

On-site monitoring – Calibration of pH meters

Step 1 - Preparation

- Remove electrode from storage solution (potassium chloride)
- Rinse with deionized water and pat dry with wipe

Step 2 - Calibration to pH 7.00

- Clear previous calibration by pressing setup and enter
- Immerse electrode in fresh pH 7.00 buffer
- Stir without allowing stir bar to hit electrode
- Let pH reading stabilize and press standardize

Meter recognizes as pH 7 buffer and displays **calibration scope of 100%**

Wastewater monitoring

On-site monitoring – Calibration of pH meters

Step 3 – Calibration to 2nd buffer

- Remove electrode from pH 7.00 buffer, rinse & dry
- Immerse electrode in fresh 2nd buffer (pH 7/10) and stir
- Let pH reading stabilize S and press standardize

Meter recognizing 2nd buffer and displaying new **calibration scope**

Step 4 - Finishing

- Rinse and dry electrodes
- Slide rubber sleeve to cover fill hole
- Return electrode to storage solution

Wastewater monitoring

On-site monitoring – Calibration of pH meters

For consideration

- **Optimal** calibration scope 95-100%
- **Acceptable** calibration scope 90-105%
- **Meter errors** < 90% of >105%

► **pH meter calibration at least once every month!**

Wastewater monitoring

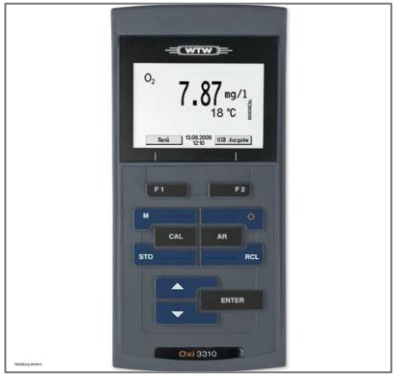
On-site monitoring – Using pH paper

- Either as a role of paper or a strip of papers
- **Color coded scale** to compare color developed on paper with chart.
- Paper **color changing when dipped** in solution.
  - Change due to soluble chemical called Flavin in paper.
- Usual range from 0-14.
  - Turning red for acidic liquid
  - Turning greenish-blue for alkaline liquid.
  - Staying light green in neutral solution
- To be stored away from sunlight in dry and cool place

Wastewater monitoring

On-site monitoring – Dissolved oxygen

- Laboratory analysis (Winkler´s method) preferred method
- DO meter convenient and fast method
- Types of DO meters:
  - Electro chemical
    - Measuring electric current generated by chemical reaction in meter
  - Optical
    - Measuring through change in color with dye layer.



Wastewater monitoring

On-site monitoring – Dissolved oxygen

Electro-chemical DO sensors:

- 2 types: Polarographic & **galvanic** (most common):
  - Galvanic sensor contains sensor with membrane only allowing gas to pass through

1. Dipping sensor in water
+
2. Oxygen dissolves in water and enters the sensor
+
3. Reaction produces electric current
=
4. Current measured to find the DO concentration

- easy to use and accurate
- need of flowing or stirred water and warm up time for measurement

Wastewater monitoring

On-site monitoring – Dissolved oxygen

Optical DO meters

- Containing a dye layer in the electrode

1. Oxygen enters the sensor

+

2. Membrane changes the colour

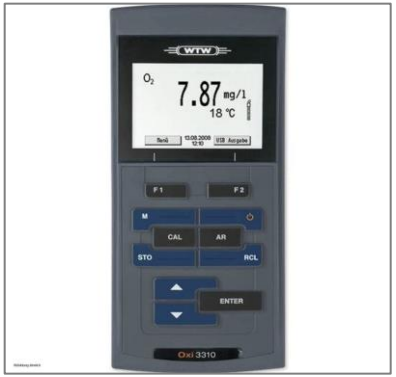
=

Intensity of colour shows the DO concentration

- can use still water and giving steady results
- not consume electrodes and give steadier results
- new technology not approved for all applications

Wastewater monitoring

On-site monitoring – Dissolved oxygen



- Different **calibration methods of DO meters** in air and water
- General calibration procedure:
    1. Pressure correction or altitude correction if so specified.
    2. Put wet sponge into beaker.
    3. Allow saturated of air with water vapour for 10-15 minutes
    4. Place DO sensor just above sponge and press first calibration (100%).
    5. Place water in beaker, put ‘0 DO’ tablet into beaker for zero dissolved oxygen
    6. Place DO sensor in beaker and press second calibration (0%).
    7. After calibration: counter check with any sample for same value with result from Winkler's test

Wastewater monitoring

On-site monitoring – Dissolved oxygen

Meter needs to be **regularly calibrated** to get reliable data !

- Different testing procedures
- General testing procedure
  1. Turn meter on by holding button for two seconds.
  2. Insert probe into wastewater sample bottle.
  3. Move probe to release any air bubbles and provide fresh sample to sensor cap
     - For galvanic sensors continuous stirring required (not for optical)
  4. Wait approximately 25-35 seconds for temperature and DO readings to stabilize.
  5. Record reading in mg/L in field logbook.
  6. Clean sensor using distilled water
  7. Conduct quick air check to verify calibration after testing

Wastewater monitoring

On-site monitoring – Settling Studies

- by ETP operator **at least once in every shift**
  - and whenever DoE officials visiting ETP
- Factors determining ETP health
  - **Color** of bio-sludge
  - **Rate of settling**
  - **Clarity** of supernatant
- **Sludge Volume Index (SVI):**
  - measurement of **sludge volume settling** in **30 minutes**
  - to be checked at least **once a week**

Wastewater monitoring

Off-site monitoring

Activities involved

- Proper **sampling** of wastewater or sludge
- **Preservation** of samples to prevent quality changes
- Proper sample **transport**
- **Laboratory analysis** or **safe storage**

Wastewater monitoring

Off-site monitoring

Usual parameters

- for process management in addition to on-site tests
  - COD
  - pH
  - TSS
- stipulated by DoE for discharge of treated effluent
- Specified by environmental agencies or international buyers
  - heavy metals
  - Manufacturer restricted substances lists (MRSL)

Process control parameters

Process control parameters

Process control parameters

Chemical dosing control

- Most important process for primary ETP
- Dosages based on **flow of effluent**
  - Ferrous sulphate
  - Polyelectrolytes
  - Color removal agents
- Dosages based on **pH values**
  - Lime
  - Acid for neutralization

Process control parameters

Chemical dosing control

- Dosages based on **flow of effluent**:
  - Check **chemical slurry prepared** in line with requirement (5% or 10%)
  - No change during entire process
    - Dosing of chemical slurry proportional to flow rate of effluent
- Dosages based on **pH values**:
  - Check pH after addition frequently
    - **Counter check** if automatic pH control available
    - **Monitor pH** at equalized effluent, chemically treated effluent and/or inlet of aeration tank **at least once a shift**

Process control parameters

Temperature, RAS and WAS

- **Temperature** control at **inlet of aeration tank** to ensure right (low) temperature
- Rate of **return activated sludge (RAS)** flow:
  - To be monitored at least **twice every shift**
  - To be maintained at 100% of RAS in general
- **Wasting of excess bio-sludge (WAS)**:
  - To be measured quantity wasted at fixed pumping rate several times using timer and bucket
  - Time of WAS pumping to be monitored

Process control parameters

Nutrient addition to biological treatment

- Calculation of standard values of Urea and DAP dosages with respect to influent BOD
- Checking active nitrogen and phosphorous in DAP and Urea if possible
- Counter-checking of nutrient sufficiency **once a week:**
  - Collected samples from aeration tank checked for ammoniacal nitrogen/kjeldahl nitrogen and phosphates
- Checking of nutrient values in **treated effluent once a month**
  - No exceeding of limits specified

Monitoring of operational problems

Monitoring of operational problems

Factors leading to operational problems

- Non-consistency of input
- Variable nature of biological treatment being ‘live’ process
- Exposed nature of ETP
- High potential of corrosion

Common operational problems

(1) Related to regular operation issues

- foam in aeration tank
- overflow of tanks
- odor problems

(2) Related to break down of any ETP equipment

Monitoring of operational problems

Dealing with regular operation issues

- Clear any stagnated effluent, spill-overs
- Increase aeration
- Prevent any stagnation
- If not working, use oxidizing chemicals

Monitoring of operational problems

Dealing with break down of any ETP equipment

- Switch over operation to standby unit
- Arrange immediate repair of affected unit
- Study external causes for failure
- Inform ETP or factory management in case of repeated unit failures

Monitoring of operational problems

Examples

Problem 1: Excessive foaming

- Resort to water sprays to control foam
- Add anti-foaming agents

Problem 2: Overflow

- Reduce feed to unit and/or increase output from unit

Problem 3: Odor

- "Immune" to smell and others only noting
- Take note of smell when entering the ETP
- Operator may ask visitor about unusual smells

Inventory monitoring

Inventory monitoring

Inventory monitoring

Importance

- Necessary for continuously operating unit and maintaining sufficient spare parts

Different kind of stores

- Factory store
  - General spare parts
- ETP store
  - ETP chemicals
  - Spare parts
  - Imported chemicals with short life span

Inventory monitoring

Responsibilities

- Large ETP: dedicated store-in-charge
- Small ETP: Operators under direction of manager

Tasks

- Keep track on spare part utilization and stocks
- Request inventory refill requests
- Verify cause of any item being consumed faster than expected
- Undertake remedial measures

Expenditure monitoring

Expenditure monitoring

Expenditure monitoring

Importance

- **ETP** seen as **non-productive asset** for
  - environment protection
  - compliance with requirements of government
  - conforming to buyers´ expectations
  - but no business benefit
  - ▶ Imperative to **keep costs to minimum** possible

Expenditure monitoring

Different types of costs in ETPS

- **Fixed costs**
  - Salaries
  - Depreciation on investment and equipment
- **Variable costs**
  - Power
  - Chemicals
  - Maintenance (highly variable)

Expenditure monitoring

Tasks for ETP management (including the operator)

- Prepare cost estimates for operation and maintenance based on generally accepted figures
- Compare actual costs of treatment
- Take corrective measures if needed

To remember

- Absence of proper monitoring and preventive maintenance often as cause of system failure
- Proper monitoring as pre-requisite for good ETP operation
- Need for clear monitoring plan with meticulous observation
- Operators responsible for regular checking of on-site parameters
  - Need for operator to check and record parameters once per shift
- Special attention to parameters affecting ETP performance

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