TRAINING PROGRAMME FOR ETP OPERATORS IN TEXTILE INDUSTRY

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

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

FABRIC Asia

Controls and good practices in primary treatment

GIZ FABRIC – ETP Operator Course

Contents

Controls and good practices in screening

Controls and good practices in screening

Manually cleaned screening – points to check

- **Screen cemented** to concrete wall (not removable)
- **No gaps** between the wall and the screen.
- Weekly inspection for **bars in place and not corroded**
- Spindle not bent or missing teeth
  - stainless steel against rusting & injury to operators.

Controls and good practices in screening

Manually cleaned screening – points to check

- Regular **cleaning of screen** (ideally **once in a shift** or more frequently if choking)
  - Removed screenings dried on draining platform
  - Prompt removal and proper disposal of screenings
- Screens kept clean and **protected against corrosion**

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Controls and good practices in screening

Mechanical screening – points to check

- Check mechanical screens
  - **Rotation of blades smooth**, without jerks and noise.
  - If yes, stop and check.
  - No gaps between screen wall and rotating brushes or water escaping without screening
- Routine **inspection of rake teeth** (susceptible to breakage and bending)
- Frequent inspection of **drive mechanisms**

Controls and good practices in screening

Mechanical screening – points to check

- Screenings placed in draining tray to allow **drained water to flow back** into channel
- Prompt and regular disposal of screenings done

Controls and good practices in screening

What to do

1. **Clean screen regularly** and prevent chamber to be flooded
2. **Inspect screen** so no teeth missing and no fiber entangled
3. Place removed screenings on drainage platform and **drain water into chamber**
4. **Keep mechanical screen in good condition** and carry out periodical oiling & greasing with recommended (SAE) grades
5. **Flush** and clean mechanical screen surface **once a week** with water jet
6. **Clean screen brush** and remove any entangled fibers or threads

Controls and good practices in screening

What not to do

1. **Never remove screen** for cleaning (forgetting to put back)
2. **Never enter screen chamber** for cleaning because possible dangerous concentration of hydrogen sulfide gas.
3. **Never** handle **screenings with bare hands** (if need, use gloves)
4. **Never** run mechanical screen with **excessive screenings** and/or when jerks or noise noticeable
5. **Never** allow **screen motor** getting **(over)heated** and consume more than allowed amperage at any time.
6. Never put hand into cleaning platform when screen operating.

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Controls and good practices in equalisation

Controls and good practices in equalisation

Remember

- Improper operation of equalization tank impacting whole treatment
- Equalization serving three purposes

(1) Balancing volume to manage ETP inflow

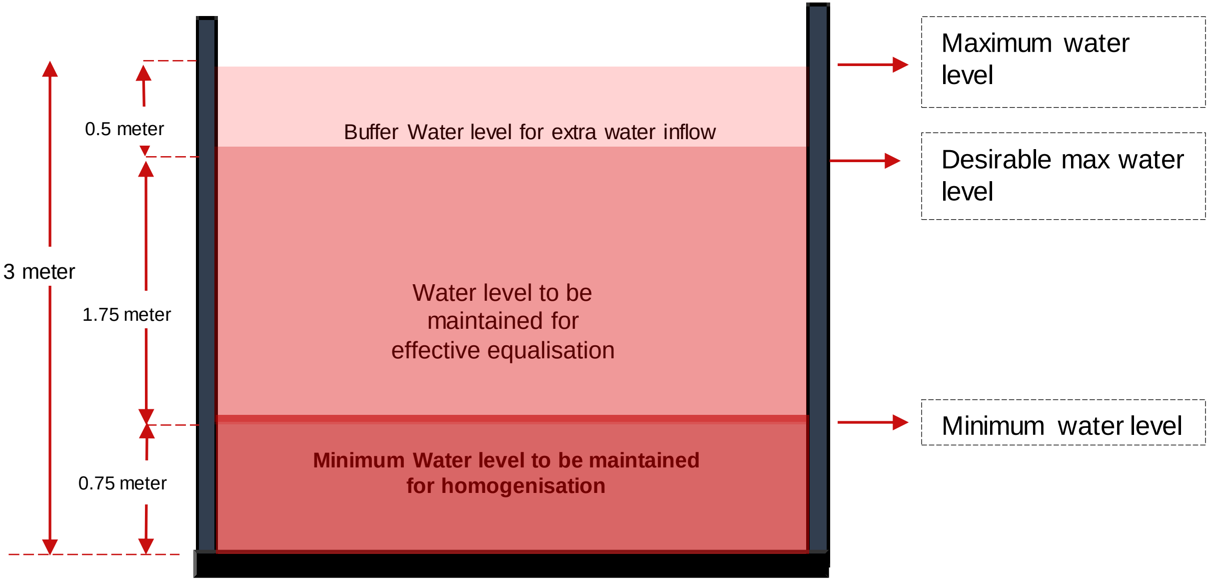
(2) Mixing different effluent streams to form a homogenized effluent, amenable for easy treatment

(3) Reducing temperature (for biological treatment)

Controls and good practices in equalisation

Remember

- Too low level in equalisation tank not allowing proper homogenization,
- Too high level risk of exceeding adequate storage volume.



Controls and good practices in equalisation

Points to check

- In case of two equalisation tanks or one tank divided into two compartments…
  - tanks loaded equally to ensure sufficient detention time
  - alternating use if both compartments >16 h retention time
- **Sludge pumped out**, not allowed to settle and solidify at bottom
- **Correct alignment of float Vs aerator** in floating aerators to prevent bearing failure
- **Sufficient distance between inlet and outlet point** to avoid effluent channelling and poor equalisation

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Controls and good practices in equalisation

Points to check

- **No sludge settlement in tank** (especially in corners)
- **Position of floating or jet aerators adjusted** to purge out solids.
- **Pumping lines extending to bottom** of tank for effective detention time
- **Precautions** taken and procedures established **against contact with hot and alkaline effluent** during sampling or maintenance

Controls and good practices in equalisation

What to do

1. Completely **empty tank every 3 days** to flush out sediments towards pump well using water jet flushing.
2. **Check amperage of blowers** and align standard values.
3. **Arrest** any undue **generation of foam** (especially in corners) with water spraying
4. **Set level controller of pump** to ensure minimum and maximum water level specified
5. Regularly **check aeration pattern** (especially looking any coarse bubble in any region (indicating torn/loose diffusers)
6. **Clean diffusers** once **every three months** with citric acid to save power and maintain efficiency

Controls and good practices in equalisation

What not to do

1. **Never run blowers** in case of **jerks, vibrations or noise** (instead stop, service and repair before resuming operations)
2. **Never add** any **coagulant** to equalization tank (to avoid sludge settling of sludge and damaged diffusers)
3. **Never** take **samples from tank** (but from pumping line).
4. **Never stop mixing/aeration** for more than 2 hours.
5. **Never** attempt **manual tank cleaning without all PPEs** (instead empty through pumping as much as possible).
6. **Never handle sludge with bare hands** (if needed, use gloves).

Fine-tuning of chemical dosing

Fine-tuning of chemical dosing

Remember

- Need to **optimize** chemical **dose** (using jar test) **when changes in chemicals**
- **Selection** of suitable chemicals **based on jar tests** only.
- Study of application methodology before attempting any dosage
  - e.g. at which pH level chemicals working well
- **Consideration of suitable dilution** for some chemicals
  - e.g. dilution of polyelectrolytes at 0.05% - 0.1% → all tests at this concentration.

Fine-tuning of chemical dosing

Remember

- Prepare **smooth slurry with lime** powder before dosing
- Continuous **stirring to obtain fine solution**
- Different **durations** for chemicals **to fully dissolve** (e.g. ferrous sulphate instantaneously, alum needing)
- Use of **polyelectrolyte (PE) as flocculant aid only** and not as coagulant replacement (costly!)
- PE overdosing resulting in very quick settling but poor supernatant quality.

Fine-tuning of chemical dosing

Remember

- Use of **ferrous sulphate** for primary treatment:
  - **Avoid overdosing** (solubility potential of excess ferrous sulphate.
  - Continue dosing as long as other colours persists
  - **Stop** immediately **when light green colour** appearing (!).
- Dosing of **neutralizing chemicals**:
  - **Avoid using alum or ferrous sulphate** (since acidic) since waste of money and producing excess sludge.
  - **Use acid** only .
- Avoid **lime dosing** since principal cause of **excess sludge production**

Fine-tuning and control of chemical treatment

Fine-tuning and control of chemical treatment

Control of overflows in settling tanks and thickener

- Overflows often not uniform or even
- Missing proper weirs leading to one-sided overflows
  - Efficiency settling tank inversely proportional to weir loading rates
  - Adjustment of V Notches and uniform overflow water essential

Optimisation action by ETP operator

- Install proper V-notch weir in all settling units
- Adjust V-notches in settling tanks

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Fine-tuning and control of chemical treatment

Steps for adjustment of V-notches

(1) Loosen fastening screws

(2) Allow wastewater to fill up till overflowing

(3) Slightly tilt V-notches box in areas with no overflows observed until overflow achieved

(4) Lower water level and tighten screws again.

Fine-tuning and control of chemical treatment

Control of chemical dosing

Improper control of chemical dosing with gravity dosing through manually controlled valves

- Proper control of **dosing chemicals** with **dosing (metered) pumps**
- Use of **automatic controls**
  - Automatic pH control linking online pH meter and a PID controller with dosing pump

Fine-tuning and control of chemical treatment

Control of chemical dosing

- **Use two separate tanks** for chemical preparation and dosing in turns.
  - One tank used for dosing chemical slurry to flash mixer, other tank for preparation of chemical slurry.
  - **Keep agitator** in slurry preparation tank **running** for good mixing and preventing sedimentation of slurry.

Savings off-setting cost for installation!

✓ Lower chemical consumption and costs

✓ Lower sludge generation and associated disposal costs

Fine-tuning and control of chemical treatment

Control of chemical dosing

- **Check purity of chemicals** used (easily done in-house laboratory) for following parameters:

(1) Active portion of chemical

- Calcium oxide (CaO) content in lime
- ferrous (Fe2) content in ferrous sulphate)

(2) Insoluble in chemical compared with standard values

– Example: Desirable CaO content in lime specified at 60% (upto 75.6% CaO in hydrated lime) insoluble % < 10% acceptable

▶ **Non-active portion → waste and increasing sludge generation.**

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Fine-tuning and control of chemical treatment

Control of chemical dosing

For consideration

- Link negotiated **price of chemicals** (e.g. lime, ferrous sulphate) to **level of active ingredient** to ensure supply of good quality chemicals
  - Example: Specify price X for lime with 50% CaO, price Y for 60% and so on.
- Ask for **safety data sheet** (SDS) of branded chemicals to understand hazards and take safety measures

Fine-tuning and control of chemical treatment

Control of chemical dosing

For consideration

- Take special care in ferrous sulphate usage.
  - Excess ferrous sulphate remaining in clarified effluent
  - Ferrous sulphate more soluble unlike the ferric sulphate produced as result of reaction of ferrous sulphate with dyes.

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Fine-tuning and control of chemical treatment

No overdosing of ferrous sulphate!


Ferrous sulphate`


Ferric sulphate

Fine-tuning and control of chemical treatment

Control of coagulants & flocculants

Too high dosage of coagulants resulting in wastage of chemical and excess sludge

- **Repeat jar tests periodically** (at least every month)
- Prevent excess dosage of special flocculant aids to avoid very fast settling of sludge
  - Settling discretely without properly trapping of organics in effluent and lower overall removal of BOD or COD

Fine-tuning and control of chemical treatment

What to do

- Use **two sets of tanks** for chemical dosing
- **Run agitators** of chemical preparation tanks whether used for dosing or not
- Check **pH at inlet** of primary clarifier.
- Check **pH** value in **chemical-effluent mix** and not on supernatant.
- Conduct online pH meter readings on **hourly basis**.

Fine-tuning and control of chemical treatment

What to do

- Check and **align amperage of all mixer motors** with standard values
- Use **chemicals with high purity**
  – >90% $Ca(OH)_2$ content in lime
- Check **correctness of chemicals** before use.
  – Anionic polyelectrolytes (PE) in primary treatment
  – Cationic PE used in sludge.

Fine-tuning and control of chemical treatment

What to do

- **Remove sludge** from clarifier during **every shift.**
  - More frequent in tuber settlers
- Maintain **proper slurry concentration**
  - Lime at 5%
  - Other chemicals at 10%
  - Too high dosages resulting in chemical wastage

Fine-tuning and control of chemical treatment

What to do

- Keep angle of media in tube settlers in parallel
- **Clean media in tube settlers** once a month with water jet
- Check and ensure **scrapper blades sweeping bottom** of tank.
- Check **looseness and wear of rubber squeegees** attached to scrapper blades
- Check and **adjust V-notch weir** for uniform overflow

Fine-tuning and control of chemical treatment

What to do

- After every repair **start operation with dry run** and then with 1 m fresh water to ensure trouble free operation
- In case of skimmer mechanism **remove collected scum** at least **once in two days**
- **Check for any unusual jerks**, vibrations or noise in drives and initiate immediate repairs

Fine-tuning and control of chemical treatment

What not to do

- **Never** maintain **dosage based ETP designer recommendation**, since conditions changing
- Never let **running water into chemical dosing tanks** to avoid jeopardizing dosing.
- **Never** let **excess dosage** occur.
- **Never** use **alum or ferrous sulphate** as **neutralizing** chemicals.
- Never allow launder of clarifiers filled with sludge since causing flooding of channel and adversely affecting settling.

Fine-tuning and control of chemical treatment

What not to do

- **Never** add any **coagulants to equalization tank** since resulting in settling of sludge and damage to diffusers.
- **Never touch chemicals** with **bare hands**
- Never run primary treatment without proper equalization since wastage of chemical and excess sludge
- Never allow primary sludge to overflow from clarifier.
  - Chemical sludge damaging biological treatment and diffusers.

Fine-tuning and control of chemical treatment

What not to do

- Never allow **skimmer unit to touch motor cables** and influent pipes
- Never operate **skimmer without aligned and balanced scum baffle**.
- Never allow anybody to **walk on corroded walkway**.
- Never **lean on handrails**, especially if corroded.

Fine-tuning and control of chemical treatment

What not to do

- Never **correct pH** by adding chemicals directly to **primary clarifier.**
- Never **keep sludge in clarifier** for long, since resulting in putrefaction of sludge.
- Never run unit with **chain sprocket gears without checking** tension during start up.
- Never keep **worm gear box and motor coupling open** since exposure to dust and risk of injuries.

Fine-tuning and control of chemical treatment

What not to do

- Never **withdraw too little or much sludge**
  - Sludge concentration to be 2 - 4%
  - Start when thick and stop when watery.
- Never let **wastewater flood overflow channel**
  - Check for any blockage in overflow pipe
- Never let unit **operate without sludge evacuation**, since accumulated sludge damaging mechanism.

Optimisation of filtration

Optimisation of filtration

Situation and issues

- Multi-grade and activated carbon filters in primary ETPs in Bangladesh
- Poor efficiency after chemical oxidation and addition of bleach liquor or peroxide
  - Plain oxidation in textile effluents not easy
- Drop in efficiency in case of activated carbon for primary treated effluent
  - Excess organics in primary treated effluent quickly exhausting carbon.
- Media in MGF eroded over time requiring prompt replacement

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Optimisation of filtration

Possible measures

- Use **multiple layers of coarse and fine sand** (pebbles and gravels) in fixed proportion
- Make **proper backwash arrangement** in both kind of filters
  - Water backwash most common,
  - Air scouring in many units

To note

- Filters after primary ETP not ‘tertiary’ treatment´
- Very common ensuring treated effluent to be clearer and less turbid

To remember

- Primary treatment performance depending control by operator, i.e. exerting in system
- Treatment units building on each other; poor performance at one level in primary treatment affecting next one as well as subsequent ones
- Systematically explore optimization potentials for different units as shown
- Optimisation efforts resulting better treatment performance and cost savings
- Use do`s and don’t`s as guideline for establishing good daily operational and maintenance routines

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