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

Controls and good practices in primary treatment

GIZ FABRIC – ETP Operator Course

Contents

- Controls and good practices in screening
- Controls and good practices in equalisation
- Fine-tuning of chemical dosing
- Fine-tuning and control of chemical treatment
- Optimisation of filtration

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**

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.

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

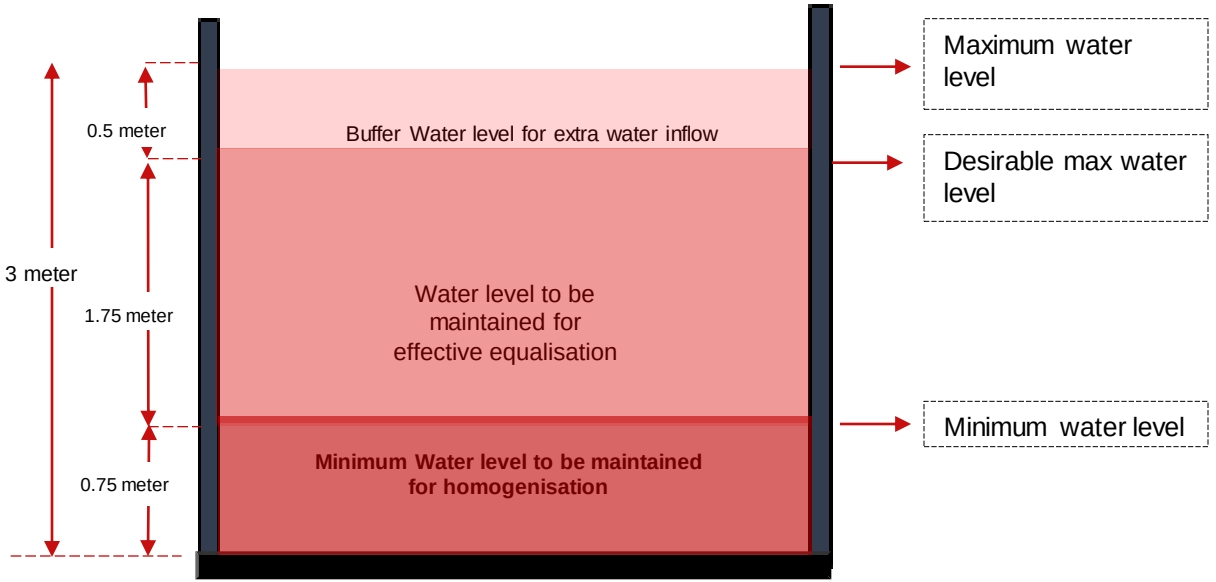
(2) Mixing different effluent streams to form a homogenized effluent, amenable for easy treatment

(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

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

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

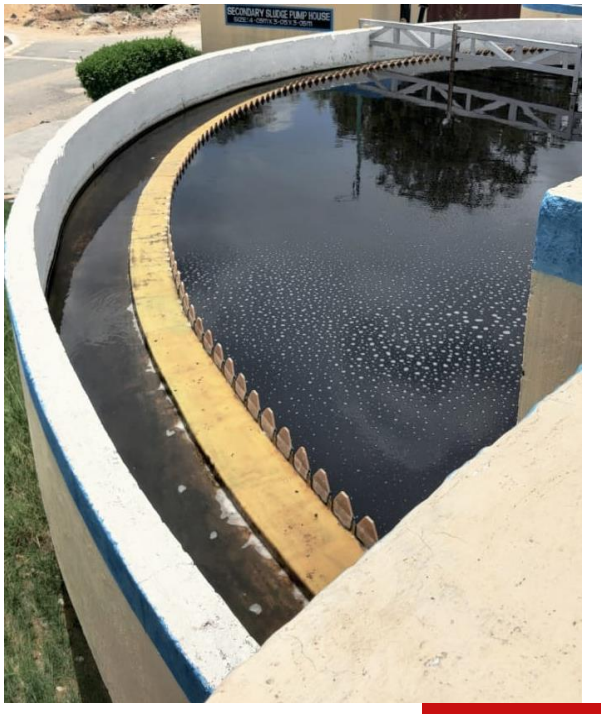
(4) Lower water level and tighten screws again.

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.**

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.

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

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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