

# TRAINING PROGRAMME FOR ETP OPERATORS IN TEXTILE INDUSTRY

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

# Chemical treatment - troubleshooting

GIZ FABRIC – ETP Operator Course



# Contents

- Responding to operational issues in chemical preparation and dosing
- Responding to operational issues in flash mixing and flocculation
- Responding to operational issues in primary clarifiers and sedimentation
- Responding to operation issues with pressure and activated carbon filters

# Responding to operational issues in chemical preparation and dosing

# Operational issues – Chemical preparation and dosing

Chemical preparation and dosing key challenge in primary ETPs

## Common issues and practices

- Wrong dosing
  - Setting dose without calculation or jar tests
- Deliberate too low dosing to minimize sludge generation
- Use of ferrous sulphate as a neutralization agent.
- Preparing and keeping chemical slurry with too low concentration



# Operational issues – Chemical preparation and dosing

Problem	Possible reasons	Common solutions
Chemical feed pump discharge clogged	<ul style="list-style-type: none"><li>• Chemical deposits</li></ul>	<ul style="list-style-type: none"><li>• Provide sufficient dilution in chemical slurry</li></ul>
Lime sludge deposits in lime preparation	<ul style="list-style-type: none"><li>• Bad quality lime used</li><li>• Slurry concentration too high</li></ul>	<ul style="list-style-type: none"><li>• Use lime with <math>&gt;90\%</math> <math>\text{Ca(OH)}_2</math></li><li>• Maintain slurry concentration of about 5%.</li></ul>
Chemical feed line rupture	<ul style="list-style-type: none"><li>• Positive displacement pumps started with closed valve</li></ul>	<ul style="list-style-type: none"><li>• Check and open valves in inlet line before starting dosing pump.</li></ul>
Chemical slurry concentration changing	<ul style="list-style-type: none"><li>• Mixing of water to preparation tank during chemical dosage</li><li>• Inferior quality chemical</li></ul>	<ul style="list-style-type: none"><li>• Use good quality chemical</li><li>• Use two sets of chem. preparation tank for alternate operations</li><li>• Never add running water to prep. tank during chemical dosing.</li></ul>

# Operational issues – Chemical preparation and dosing

Problem	Possible reasons	Common solutions
Slurry concentration inconsistent	<ul style="list-style-type: none"><li>• Mixer capacity insufficient.</li><li>• Intermittent switching off mixer</li><li>• Poor quality chemical</li></ul>	<ul style="list-style-type: none"><li>• Ensure sufficient capacity mixer</li><li>• Run agitators continuously.</li><li>• Use good quality lime.</li></ul>
Frequent failure of dosing pumps.	<ul style="list-style-type: none"><li>• Unsuitable dosing pumps</li><li>• Bad quality lime.</li><li>• Slurry concentration is too high.</li></ul>	<ul style="list-style-type: none"><li>• Use open impeller centrifugal pump for lime and metering pump for others.</li><li>• Use lime with <math>&gt;90\%</math> <math>\text{Ca(OH)}_2</math></li><li>• Maintain low slurry concentration</li></ul>
Wobbling of mixers	<ul style="list-style-type: none"><li>• Mixer shaft not supported.</li><li>• Impeller design not correct</li></ul>	<ul style="list-style-type: none"><li>• Provide support to mixers at 30 cm above paddle level.</li><li>• Design paddles with less curvature.</li></ul>

# Operational issues – Chemical preparation and dosing

Problem	Possible reasons	Common solutions
Heating of motors or gear box	<ul style="list-style-type: none"><li>• Too high slurry concentration</li><li>• Bad quality chemical.</li></ul>	<ul style="list-style-type: none"><li>• Use optimal slurry concentration.</li><li>• Use good quality chemicals with less sand content.</li><li>• Clean tank once in two weeks.</li></ul>
Polyelectrolyte dosing not consistent	<ul style="list-style-type: none"><li>• Incorrect dilution of polymers.</li><li>• Absence of stock preparation</li></ul>	<ul style="list-style-type: none"><li>• Always prepare PE in two stages: (1) stock solution (2) dosing solution.</li></ul>
PE dosing tank platform slippery	<ul style="list-style-type: none"><li>• Spillage of polyelectrolyte powder on platform</li></ul>	<ul style="list-style-type: none"><li>• Take care of spillages.</li><li>• Wash platform frequently.</li><li>• Use anti-skid pads</li></ul>



# Operational issues – Chemical preparation and dosing

Problem	Possible reasons	Common solutions
Oil spills	<ul style="list-style-type: none"><li>• Oil seal of drive leaking</li></ul>	<ul style="list-style-type: none"><li>• Check and change oil seal if needed.</li></ul>
Chemical feed pumps clogging	<ul style="list-style-type: none"><li>• Starting pump without agitator running</li></ul>	<ul style="list-style-type: none"><li>• Start dosing pumps only after smooth slurry formed.</li></ul>
Chemical preparation area messy	<ul style="list-style-type: none"><li>• Spillage of chemicals during loading.</li></ul>	<ul style="list-style-type: none"><li>• Take care not to spill any chemical during loading.</li><li>• Wash area with water jets.</li></ul>

# Responding to operational issues in flash mixing and flocculation

# Operational issues – Flash mixing and flocculation

## Common issues

Flash mixing & flocculation two separate activities needing different controls.

- Use of single unit for both functions.
- Incorrect dimensioning and poor operational control

## Remember

- Improper chemical mixing and flocculation affecting subsequent sedimentation
- Being aware of variants in flocculators (flocculation channels, multiple flocculators with reducing speeds, air induced mixers)



# Operational issues – Flash mixing and flocculation

Problem	Possible reasons	Common solutions
Sludge settling in flash mixer tank	<ul style="list-style-type: none"><li>• Excess lime dosage</li><li>• Bad quality chemicals</li><li>• Too much grit in influent</li></ul>	<ul style="list-style-type: none"><li>• Optimize dosage</li><li>• Use lime with less sand content</li><li>• Install grit chamber</li></ul>
Oil spill in tank(s)	<ul style="list-style-type: none"><li>• Oil seal failure</li></ul>	<ul style="list-style-type: none"><li>• Replace oil seal</li><li>• Use correct lubricant</li></ul>
Frothing or excess foam generation	<ul style="list-style-type: none"><li>• Splashing of inflow water</li><li>• Inlet flow force too high.</li></ul>	<ul style="list-style-type: none"><li>• Extend feed pipe into flash mixer below water level.</li><li>• Adjust the feed pump.</li></ul>
Flash mixer trips frequently	<ul style="list-style-type: none"><li>• Sediment deposit in flash mixer</li><li>• Too much chemical dosing</li><li>• Bad quality of chemicals</li></ul>	<ul style="list-style-type: none"><li>• Clean tank periodically</li><li>• Optimize chemical dosages.</li><li>• Use chemicals with less insoluble matter.</li></ul>

# Operational issues – Flash mixing and flocculation

Problem	Possible reasons	Common solutions
Poor floc formation	<ul style="list-style-type: none"><li>• Chemicals not properly mixed during flash mixing</li><li>• Too much retention time in flash mixer</li><li>• Improper coagulant dosages.</li></ul>	<ul style="list-style-type: none"><li>• Increase RPM of flash mixer.</li><li>• Reduce retention time in flash mixer by increasing pumping rate.</li><li>• Correct coagulant dosage based on jar tests.</li></ul>
Sheared floc	<ul style="list-style-type: none"><li>• Too much speed for flocculator</li></ul>	<ul style="list-style-type: none"><li>• Adjust speed of flocculator</li><li>• Flocculator mechanism</li></ul>
Sludge settling in the flocculator	<ul style="list-style-type: none"><li>• Too low feed rate.</li><li>• Excess chemical dosage</li><li>• Dead zones within the tank</li></ul>	<ul style="list-style-type: none"><li>• Increase feed rate for optimum HRT</li><li>• Reduce chemical dosage especially polymer.</li><li>• Re-construct mixer</li></ul>

# Operational issues – Flash mixing and flocculation

Problem	Possible reasons	Common solutions
Flash mixer blade damage	<ul style="list-style-type: none"><li>• Splashing of water on mixer blades</li><li>• Too much sediments in tank</li></ul>	<ul style="list-style-type: none"><li>• Adjust flow to prevent inflow hitting mixer blades directly</li><li>• Clean tank frequently</li></ul>
Bend shaft	<ul style="list-style-type: none"><li>• Too high load on mixer</li><li>• Bad quality chemicals</li></ul>	<ul style="list-style-type: none"><li>• Optimize water level in tank</li><li>• Use good quality chemical.</li></ul>
Rusty platform and handrails	<ul style="list-style-type: none"><li>• Corrosion of walkway and handrails.</li><li>• Chemical spills on platforms</li></ul>	<ul style="list-style-type: none"><li>• Construct platform and walkway in stainless steel.</li><li>• Coat MS unit with epoxy regularly</li><li>• Prevent and clean chemical spills</li></ul>
Torque switches trip	<ul style="list-style-type: none"><li>• Too much chemicals in speed</li><li>• Water level in tank too high</li></ul>	<ul style="list-style-type: none"><li>• Optimize chemicals and flow rate to flash mixer.</li><li>• Replace mixer blades with lower curvature if needed</li></ul>

# Operational issues – Flash mixing and flocculation

Problem	Possible reasons	Common solutions
Drive motor heating and noise generation	<ul style="list-style-type: none"><li>• Overload on mixer</li><li>• Electrical controls faulty</li></ul>	<ul style="list-style-type: none"><li>• Optimize load.</li><li>• Check electrical controls</li></ul>
Agitator wobbling	<ul style="list-style-type: none"><li>• Free hanging agitator without support.</li><li>• Side support not tight enough</li></ul>	<ul style="list-style-type: none"><li>• Provide support in lower portion of agitator.</li><li>• Change support bush/bearings</li></ul>
Flocculator blade bending	<ul style="list-style-type: none"><li>• Too much load on mixer</li><li>• Unreacted chemicals in feed</li></ul>	<ul style="list-style-type: none"><li>• Adjust feed rate and maintain RPM of flocculator</li><li>• Use good quality chemicals</li></ul>
Corroded flocculator frame	<ul style="list-style-type: none"><li>• Corrosion of walkway and handrails</li></ul>	<ul style="list-style-type: none"><li>• Construct walkway in stainless steel</li><li>• If MS, coat structure with epoxy.</li></ul>

# Responding to operational issues in primary clarifiers and sedimentation



# Operational issues – Primary clarifiers and sedimentation

Wide range of issues related to construction and operational practices

## Common issues

- Solids overflow
- Too low or too high sludge concentration
- Wear & tear etc.



# Operational issues – Primary clarifiers and sedimentation

## Common causes

- Short-circuiting
- Too high or too low density currents
- Excessive or inadequate detention time
- Hydraulic overload or excessive influent flow
- Improper effluent flow over weirs
- Improper scum removal and disposal
- Excessive or inadequate sludge removal
- Excessive sludge pumping



# Operational issues – Primary clarifiers and sedimentation

Problem	Possible reasons	Common solutions
Floating sludge	<ul style="list-style-type: none"><li>• Feed well drum damaged or misaligned</li><li>• Excess sludge accumulation in clarifier tank.</li><li>• Scrapper worn-out or damaged</li><li>• Sludge withdrawal line clogged</li></ul>	<ul style="list-style-type: none"><li>• Replace or re-align feed well drum</li><li>• Remove sludge more frequently and/or take out more sludge.</li><li>• Flush and clean sludge line.</li></ul>
Black effluent or sludge	<ul style="list-style-type: none"><li>• Inadequate aeration in equalization.</li><li>• Improper sludge withdrawal</li><li>• Addition of ferrous chemical to organic rich and septic wastewater.</li></ul>	<ul style="list-style-type: none"><li>• Ensure DO in equalized effluent.</li><li>• Dose ferrous sulphate only to reactive dye effluents.</li><li>• Remove sludge regularly.</li></ul>

# Operational issues – Primary clarifiers and sedimentation

Problem	Possible reasons	Common solutions
Scum overflow	<ul style="list-style-type: none"><li>• Absence of skimmer mechanism</li><li>• Speed of skimmer inadequate</li><li>• Improper alignment of skimmer.</li><li>• Inadequate depth of scum baffle</li></ul>	<ul style="list-style-type: none"><li>• Install scum baffle and skimmer if too much scum</li><li>• Adjust speed of skimmer</li><li>• Clean and/or replace wiper blades</li><li>• Adjust scum baffle depth and increase depth of scum box.</li></ul>
Foul odor in sludge or effluent	<ul style="list-style-type: none"><li>• Too much sludge accumulation</li><li>• Septic equalized effluent</li><li>• Scrapper blade not working or squeegees worn out</li></ul>	<ul style="list-style-type: none"><li>• Withdraw sludge sufficiently and regularly</li><li>• Ensure DO level in equalized effluent.</li><li>• Check scrapper and replace squeegees if needed.</li></ul>

# Operational issues – Primary clarifiers and sedimentation

Problem	Possible reasons	Common solutions
Sludge too watery	<ul style="list-style-type: none"><li>• Hydraulic overload.</li><li>• Short circuiting of flow within tank</li><li>• Over withdrawal of sludge</li></ul>	<ul style="list-style-type: none"><li>• Distribute pumping from equalization tank uniformly (normally <math>\sim 20</math> h/day)</li><li>• Check and adjust feedwell drum.</li><li>• Reduce sludge withdrawal frequency.</li></ul>
One-sided sludge overflow	<ul style="list-style-type: none"><li>• Uneven weir placement</li><li>• Missing teeth in V. notches</li></ul>	<ul style="list-style-type: none"><li>• Adjust V notch weir until giving uniform over-flow</li><li>• Replace V notch weir if needed.</li></ul>
Oil floating on top of tank	<ul style="list-style-type: none"><li>• Oil leak from drive</li></ul>	<ul style="list-style-type: none"><li>• Check drive and fix oil seal</li><li>• Prevent excessive heating.</li></ul>

# Operational issues – Primary clarifiers and sedimentation

Problem	Possible reasons	Common solutions
Scraper bridges jamming	<ul style="list-style-type: none"><li>• Sagging of bridge with scraper blades touching floor</li><li>• Uneven floor</li></ul>	<ul style="list-style-type: none"><li>• Check and correct bridge.</li><li>• Ensure minimum clearance between floor and scraper blades.</li></ul>
Sludge not flowing towards centre	<ul style="list-style-type: none"><li>• Scraper blade squeegee worn out.</li><li>• Length of scraper blades not converging.</li></ul>	<ul style="list-style-type: none"><li>• Replace rubber squeegee.</li><li>• Check scraper blades and ensure overlapping of rotation circles</li></ul>
Tripping of mechanism	<ul style="list-style-type: none"><li>• Accumulation of thick sludge</li><li>• Scraper blade jamming</li></ul>	<ul style="list-style-type: none"><li>• Ensure proper removal of sludge</li><li>• Check scraper blades and lift as well as correct alignment</li></ul>

# Operational issues – Primary clarifiers and sedimentation

Problem	Possible reasons	Common solutions
Excessive corrosion	<ul style="list-style-type: none"> <li>• Construction of walkway and mechanism handrails with mild steel (MS)</li> </ul>	<ul style="list-style-type: none"> <li>• Construct all metallic units in stainless steel.</li> <li>• Paint all units periodically or corrosion protective coat</li> </ul>
Rapid wear of chain drive	<ul style="list-style-type: none"> <li>• Faulty lubrication</li> <li>• Loose or misaligned chain</li> </ul>	<ul style="list-style-type: none"> <li>• Lubricate all parts properly</li> <li>• Align and tighten entire drive</li> </ul>
Noisy chain drive	<ul style="list-style-type: none"> <li>• Chain not fitting sprockets</li> <li>• Loose chain</li> <li>• Faulty lubrication</li> <li>• Misalignment or improper assembly`</li> </ul>	<ul style="list-style-type: none"> <li>• Tighten and align casing and chain</li> <li>• Lubricate properly</li> <li>• Correct drive assembly and alignment</li> <li>• Replace worn chain</li> </ul>
Bearing or joint failure	<ul style="list-style-type: none"> <li>• Excessive wear</li> <li>• Lack of lubrication</li> </ul>	<ul style="list-style-type: none"> <li>• Replace joint or bearing</li> <li>• Lubricate joint and/or bearings.</li> </ul>

# Operational issues – Primary clarifiers and sedimentation

Problem	Possible reasons	Common solutions
Surging flow	<ul style="list-style-type: none"><li>• Poor programming of influent pumping</li></ul>	<ul style="list-style-type: none"><li>• Modify equalized effluent pumping cycle</li></ul>
Excessive sludge settling in inlet channel	<ul style="list-style-type: none"><li>• Pumping velocity too low.</li><li>• Too much chemical dosing</li></ul>	<ul style="list-style-type: none"><li>• Increase flow</li><li>• Optimize chemical dosing.</li></ul>
TSS removal not good	<ul style="list-style-type: none"><li>• Hydraulic overloading</li><li>• Septic condition in tank</li><li>• Short circuiting</li><li>• Poor sludge removal</li></ul>	<ul style="list-style-type: none"><li>• Optimize feed rate</li><li>• Ensure proper sludge removal.</li><li>• Adjust V notches</li><li>• Frequent and consistent pumping</li></ul>
Fungus growth and dirty walls	<ul style="list-style-type: none"><li>• Accumulations of effluent solids and resultant growth</li></ul>	<ul style="list-style-type: none"><li>• Clean surfaces and channels periodically using bleaching powder.</li></ul>



# Responding to operational issues with pressure and activated carbon filters

# Operational issues – Pressure and activated carbon filters

## Common issues

- Too many solids at filter inlet of filters with inadequate backwashes
- Insufficient reduction of organics before reaching filters
- Exhaustion of carbon and poor replacement practices



# Operational issues – Pressure filters

Problem	Possible reasons	Common solutions
Effluent turbidity too high	<ul style="list-style-type: none"> <li>Filter without intense backwashing.</li> <li>Primary treatment not effective (too high TSS load)</li> </ul>	<ul style="list-style-type: none"> <li>Provide intense backwashing.</li> <li>Control primary treatment properly to reduce TSS load to filter.</li> </ul>
Percentage of backwash water high (>5%)	<ul style="list-style-type: none"> <li>High solids carryover to filter</li> <li>Surface wash system not working.</li> <li>Backwash done for too long.</li> </ul>	<ul style="list-style-type: none"> <li>Better control of primary treatment</li> <li>Repair surface wash system</li> <li>Increase surface wash cycle time</li> <li>Reduce period of backwash</li> </ul>
High head-loss in filter	<ul style="list-style-type: none"> <li>Too high suspended solids in inlet</li> <li>No proper backwash</li> </ul>	<ul style="list-style-type: none"> <li>Ensure auto backwash based on pressure drop</li> <li>Ensure influent quality</li> </ul>
Mud ball formation	<ul style="list-style-type: none"> <li>Inadequate back wash</li> <li>Absence of surface wash</li> </ul>	<ul style="list-style-type: none"> <li>Continue backwash until clear</li> <li>Do regularly surface washes</li> </ul>

# Operational issues – Pressure filters

Problem	Possible reasons	Common solutions
High headless even after backwashing	<ul style="list-style-type: none"><li>• Insufficient backwash time</li><li>• Media life nearing its end of life</li><li>• Inoperative surface wash cycle.</li></ul>	<ul style="list-style-type: none"><li>• Increase backwash time</li><li>• Check, clean or replace media</li><li>• Institute surface wash</li></ul>
Filtered water turbidity high but headloss low	<ul style="list-style-type: none"><li>• Too many fine suspended solids.</li><li>• Absence of any filter aid</li></ul>	<ul style="list-style-type: none"><li>• Control primary clarifier operation</li><li>• Use polymer as filter aid</li></ul>
Loss of media during backwashing	<ul style="list-style-type: none"><li>• Excessive flows used for backwashing</li><li>• Too much air scouring</li><li>• Strainer not working properly</li></ul>	<ul style="list-style-type: none"><li>• Regulate backwash flow</li><li>• Control air scouring to desired level</li><li>• Re-align, clean or replace strainer</li></ul>

# Operational issues – Pressure filters

Problem	Possible reasons	Common solutions
Gravel displacement	<ul style="list-style-type: none"><li>Air scouring pressure too high</li></ul>	<ul style="list-style-type: none"><li>Regulate air flow.</li><li>Replace media if displacement high</li></ul>

# Operational issues – Pressure filters

Problem	Possible reasons	Common solutions
Excessive headloss	<ul style="list-style-type: none"><li>• Inlet too turbid</li><li>• Carbon deteriorated and started crumbling.</li><li>• Inlet and outlet strainers clogged</li></ul>	<ul style="list-style-type: none"><li>• Provide vigorous backwash.</li><li>• Reduce inlet turbidity</li><li>• If necessary, replace carbon</li><li>• Backflush strainers</li></ul>
System inefficient	<ul style="list-style-type: none"><li>• Carbon exhausted</li></ul>	<ul style="list-style-type: none"><li>• Replace carbon</li><li>• Reduce organic load at inlet</li></ul>
Septic condition in carbon	<ul style="list-style-type: none"><li>• Low concentration of DO inlet</li><li>• High BOD in influent</li><li>• Too high retention time</li></ul>	<ul style="list-style-type: none"><li>• Ensure inlet of some DO and low BOD</li><li>• Maintain only desired retention time in filter.</li></ul>

# Operational issues – Pressure filters

Problem	Possible reasons	Common solutions
Carbon in effluent	<ul style="list-style-type: none"><li>• Carbon exhausted and pulverized to come out as powder in effluent.</li><li>• Strainers are not placed properly.</li></ul>	<ul style="list-style-type: none"><li>• Replace carbon.</li><li>• Properly fix the strainers.</li></ul>

# To remember



- Primary treatment important part in effluent management
  - High efficiency in removal of organics and other parameters required
  - Understanding common troubles and tackling same key for optimizing primary treatment
  - Filters without maintenance and media replacement only show-piece
- ▶ **Take print out of trouble shooting measures and keep for reference!**



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