Conditioning of Influent Upstream of Wastewater Treatment Plant

by Mahmood Akbar

For smooth operation of a wastewater treatment plant (WWTP) proper control of wastewater influent at the upstream is required. This article discusses some of the issues, which need to be addressed for trouble free operation of WWTP, as influent treatment technology is considered as new in Pakistan.

The influent treatment technology is a new subject in Pakistan. The effluents from some of the recently established WWTPs are not meeting the national environment quality standards (NEQS) of Pakistan due to improper selection of processes/suppliers, wrong choice of equipment, not taking into account ground realities, and non-availability of manpower having sufficient knowledge of operation of such plants.

The layout of process route and installed equipment cannot be reversed. However, in view of the above listed shortcomings attempts can be made to improve and or condition the physical characteristics of influent wastewater before feeding to a WWTP. Some of the main areas for conditioning of wastewater are being discussed as under:

1. Temperature Control

Several factors are to be considered for the collection and transfer of wastewater to a wastewater treatment plant WWTP in Pakistan.[1]

Temperature control for wastewater influent plays a major role in the smooth operation of WWTP. In a wet processing mills, wash water at 80-85°C is usually drained into U-channel/circular channels. By the time influent reaches underground collection tanks (CT), temperature of influent decreases to 65°C plus.

This influent is pumped to an equalizing tank (EQT) having 8-24 hrs retention time. At lower retention time temperature does not drop too much. However, if retention time of EQT is 24 hrs or more, temperature of influent may lower down to an average of 50°C.

The rise of temperature of process water in some of the processing mills is due to draining of condensate and or live steam from cylinders of dryers and also from steam headers. In such situations if adequate measures of stopping the draining of condensate and steam into the waste process water lines are not taken, it shall be sheer loss of available energy. The steam supply lines are sometimes installed without following basic principle of installation. The steam supply pressure of saturated steam at 8-10 bar which is generally used in wet processing mills reduces to 4-5 bar at the far end due to, (i) undrained condensate, (ii) faulty steam traps which pass live steam and (iii) accompanying of inerts with the steam.

Sometimes steam traps are installed without study of their capacity and type. This also becomes a cause of their malfunctioning.

In most of textile units regeneration of resin for making boiler feed water (BFW) is done by common-salt. After regeneration cycle, salt is not thoroughly flushed and this salty BFW slips into the boiler giving rise to low pH of steam. Most of the concerns also do not follow regime of monitoring pH of steam.

The pH range for steam in the steam drum should be 8.2-10.0 measured at 25°C for steam supply pressures ranging 0-900 Psig[3]. The quality of steam at low pH i.e. at or below pH 6 damages the steam pipes and flowing steam through the pipes carries iron particles because of erosion due to which fabric is damaged.[2] This phenomenon is observed more in older steam supply lines. A survey of new and old mills has shown that the problem of pinholes in fabric is being faced more in old mills. As a rule steam lines should be replaced after 15-20 yrs of service.

The thickness of steam supply pipes and or their schedule also goes down over the years due to the erosion. The condition of pipes with respect to thickness can further be checked by an ultrasonic thickness meter and based on thickness data decision to replace or otherwise can be taken.

Some of WWTP units are not equipped with cooling towers and or heat exchangers, probably ignored by the suppliers of technology to cut down cost of investment. However, installation of cooling towers/heat exchangers and various other means for lowering influent temperature is a must to bring it down in the range of 35-38°C, so that bacterial activity in biological section can be maintained. To imagine that the temperature of influent can be lowered without cooling towers/heat exchangers, etc is not a correct approach.

The supply of influent from CT to EQT can be done through a header connected with several down-comers with holes from which influent gets further cooled before falling into EQT.

Another way, if the design allows, to and achieve thorough mixing of influent along with its cooling is by installing 1-2 slow speed wooden blades mixers at the top of EQT with the vertical fitted shafts, having pinions/shafts arrangement coupled with the drives.

Most of the mills have covered U-channels/circular channels for receiving and transport of the process wastewater. In order to initially lower down the temperature, as soon as influent comes out of processing mills, it should preferably be brought to WWTP through an open channel covered with MS grating, having 1-1.5 inch square openings. In case space and location allows, open U-channel fitted gratings with can be installed even within the processing mill. Such channel should have a longer distance to cover in order to naturally lower down the temperature of wastewater before entering WWTP.

In the coastal areas, air can be brought over the U-channel through galvanized iron (GI) air ducts, installed at a distance of 100ft. This shall further cool the influent.

2. Control of pH

Since several processes are being going on in a textile wet processing mills at the same time, which cause the increase pH of wastewater, sometimes above 12 plus. Feeding of high pH process water is not desired at all as it increases the consumption of acid at WWTP, which is used to bring the influent pH to 8-9 level. In order to control pH of influent, a survey is to be carried out of all the processing machines so that those machines, which are contributing high pH to the influent are known and then necessary measures can be taken.

The major cause of high pH of wastewater is the mixing of caustic wash water, originating from mercerizing process with the wastewater steams. Two major sources of weak lye being produced from mercerizing are given on the next page.

- Caustic lye 6-7°Be coming from washing box of stabilizing zone.
- Weak caustic lye of 5°Be or lower from all the other wash boxes of mercerizing .

If the processing units do not have caustic recovery units (CRU) then controlling pH of wastewater, in which above two type of caustic lye are mixing, is difficult and it is not only the loss of weak lye which should be recovered in CRU, but also lot of acid is consumed unnecessarily for lowering pH of influent. A low pH of wastewater also results in the decrease of total dissolved solids (TDS).

The installation of CRU not only recovers upto 35°Be caustic solution from weak lye for reuse in but also hot water, and distillate etc. The payback period of installation of CRU is 1.5-2 years maximum.

In order to disallow mixing of weak lye below 5°Be, conductivity probes are installed in lye collection tank of mercerizing which through automatic control send only caustic of 6°Be or above to CRU while low lye concentration can be routed to a Recycle Unit (RCU) in which weak caustic contaminated wash water from all the other stages of mercerizing can be sent. This RCU can be designed to filter and send the filtered wash water to a tank from where the same can be reused for the following purposes, (a) scouring stage of a bleaching range, (b) preparing desizing bath and (c) preparing bleaching bath.

All the above measures shall result in saving of fresh water and acid, as well as the recovery of caustic for reuse and recovery of energy.

3. Lowering of COD / BOD

Parameters of influent wastewater such as chemical oxygen demand (COD) and biological oxygen demand (BOD) can be decreased before feeding to an effluent treatment plant by (i) installing a size recovery unit (SRU) and (ii) physically separating desized stuff from the J-box / bleaching range.

Problem being encountered by wet processing mills is that sizing recipe is not PVA specific and in most of the recipes PVA is being used only in very small quantities. The sized fabric being received from un-organized mills is based on tallow, and starch etc. For the fabric supplied to processing mills from such units, SRU cannot be installed as it shall not recover PVA. In order to make beneficial investment for the installation of SRU, sizing recipe has to be first switched over to PVA specific. For some of the bigger wet processing mills, which have weaving mills at different locations, an effective logistic system has also to be developed for feeding recovered PVA from SRU to the weaving mills through bouzers and then arrangement of storage for recovered PVA at weaving sties is to be done. This is an additional investment. Therefore, SRUs are not a favoured option.

Loading of parameters in influent can be lowered however, by eliminating desized stuff using physical separation by specially designed RCU. The decrease of COD/BOD/TDS values in influent etc results in saving of coagulants, and flocculants etc. This low investment option is quite viable. The desized stuff retained in RCU can be collected in drums and disposed outside the mills, like a normal waste.

4. Miscellaneous

In order to keep (CT) free of dust and foreign matter, U-channels/circular channels should be cleaned at least once in a week. Slippage of debris / dust into the WWTP system shall cause extra buildup of sludge and also may cause choking of suction lines of the pumps. Another way to keep (CT) clean is by installation of effective screen upstream of CT and the discharge line from supply pumps to EQT should be fitted with bypass lines into CT which are operated 2-3 times, within 8 hours in order to take out duct/refuse from CT which eventually is pumped into EQT etc.

References

1. Effluent water collection & transfer in textile units, Mahmood Akbar. Pak Tex. Journal P42-45 Jan 2006.
2. Iron slippage during bleaching of fabric, Mahmood Akbar, Pak Tex. Journal P66-67, August 2006.
3. The Chemical Treatment of Boiler Water. James, W. McCoy, 1981, Chemical Publishing Co, New York.◆

Demand soars for specialist footwear fibres and fabrics

Demand for specialist footwear fibres and fabrics is increasing rapidly, according to a new report, "Fibres and Fabrics for Performance Footwear", published by Textiles Intelligence.

The increase stems partly from a growing awareness of the health and safety benefits of wearing footwear designed for specific sports, activities and occupations, says the report. The specialist footwear market divided into footwear for sports and recreation; and footwear for safety at work.

In the case of sports footwear, one of the main market drivers is the ability of the shoe to improve the performance of the wearer. In some sectors, such as football boots, this feature is regarded by companies such as Adidas and Nike as being more important than cost. Fabric manufacturers are therefore being encouraged to develop high performance products which continually push the boundaries in terms of weight, moisture management properties and grip.

In the case of footwear for work, by contrast, one of the main market drivers is the need to meet ever more stringent safety regulations governing the workplace.

For this reason, the performance of the shoe remains of high importance. Fabrics for footwear include those which are flame retardant, those which provide anti-static properties and those which regulate the temperature of the foot - and many footwear manufacturers are utilising a number of advances in performance fabrics to impart these characteristics. One way of regulating the temperature of the foot, for example, is to incorporate phase-change materials, such as those contained in Thermocules produced by Outlast Technologies.

One of the most important requirements is the management of moisture, whereby perspiration is transferred from the skin of the foot to the outside of the shoe. Noble Fiber Technologies, Transpor, and BHA Group are examples.

However, one of the main challenges in today's market is to produce technologically advanced fibres and fabrics which can also manage moisture, in addition to providing other specialist benefits.The market is moving away from natural products such as leather and canvas and towards fabrics made from synthetic fibres. Manufacturers are also applying advanced coatings and topical finishes to provide additional benefits without impairing the original properties of the fabric. Examples include 3XDRY, Fosshield, Ion Mask, Microspike, and SmartSilver.

Companies which manufacture fibres and fabrics for performance footwear have risen to the challenge and the resulting fabrics, such Gore-Tex XCR by WL Gore, Schoeller-Keprotec by Schoeller and Temptrol by Innovative Insulation are a testament to the exciting developments which continue to emerge in this field. ◆