Chemically Enhanced Primary Treatment of Textile Effluents

Lecture-29
Chemically Enhanced Primary Treatment (CEPT)

- Textile industries consume substantial volumes of water and chemicals for wet processing of textiles.

- Effluent discharge from textile industries to neighbouring water bodies and wastewater treatment systems is currently causing significant health concerns.

- Chemically enhanced primary treatment (CEPT) involves the use of chemical coagulants to enhance the coagulation or flocculation of wastewater particles.

- The chemicals of aluminium sulphate (alum), ferric chloride (FeCl₃) and cationic polymer were studied by jar test to select the most suitable coagulant for effective treatment of textile industrial effluents.
What is Chemically enhanced primary treatment?

- Chemically enhanced primary treatment is the process by which chemicals, typically metal salts and polymers in the form of organic polyelectrolytes, are added to primary sedimentation basins.

- The chemicals cause the suspended particles to clump together via the processes of coagulation and flocculation.

- The particle aggregates, or flocs, settle faster, thereby enhancing treatment efficiency, measured as removal of solids, organic matter and nutrients from the wastewater.
Simple technology

CEPT is a relatively simple technology providing a low-cost and effective treatment, which is easily implemented over existing infrastructure. No new structural reforms are required.

Additionally, CEPT provides the opportunity for either reducing the size of subsequent treatment units, or increasing the capacity of existing conventional treatment plants, such as activated sludge basins.
Experimental results of CEPT

- The results showed that the optimum dosage for the removal of 75% of colour, 64% turbidity and 69% of chemical oxygen demand (COD) was obtained by just adding 300 ppm of alum after pH adjustment at pH = 7.2.

- An experiment further revealed that the addition of 300 mg/l of alum and 1 mg/l of polymer could provide a reduction of colour, turbidity, COD and phosphorous even higher than 95%, 75%, 76% and 90%, respectively.

- The experimental results confirmed that CEPT can be adopted as a decolorization of textile industrial effluents. Moreover, it can improve sludge setting and dehydration properties, and decrease the treatment cost.
Combined effect of the three

- The combined effect of alum, ferric chloride and a cationic polymer on
- Removal of colour,
- turbidity, and
- organic substances (BOD and COD) and
- heavy metals of textile effluents

Could be very effective at the primary treatment stage
Effect of pH Adjustment before Primary Coagulation

• The effect of pH adjustment before primary coagulation with alum addition as coagulants.

• In general, reducing the pH from alkaline (pH=11.5) to natural levels had a strong positive effect on turbidity removal is very important.

• Turbidity removal ranged from 0-20% at pH (11.5) to 60-98% at pH (6.8-7.2). Thus lowering of pH is a must.
Raising Alum content

- Raising alum dosages had a slight effect on turbidity removal at pH=11.5, it could be due to consumption of hydroxyl ions of alum hydrolysis in decrease of water alkalinity.

- This would slightly affect organic and inorganic substances that produce turbidity. Coagulation with alum involves three steps

  (i) destabilization begins after the operational solubility limit of aluminum hydroxide has been exceeded;

  (ii) aluminum hydroxide species are then deposited onto the colloidal surfaces;

  (iii) under typical conditions, aluminum hydroxide is positively charged, while the original colloidal particles are negatively charged.

- The process thus can lead to charge neutralization or charge reversal at certain doses.

- The results showed that pH must be adjusted before coagulation.
Conclusion

• Thus it confirms that CEPT could be used as a simple and low-cost technology for treating textile effluents.

• Although decolorization is a challenging process to both the textile industry and wastewater-treatment facilities, it is suggested as a great potential for microbial decolorizing systems for achieving total colour removal.

• CEPT was capable of removing more than 95% of colour and heavy metals. Thus, CEPT can be adopted for decolorization of textile industrial effluents.