New Methods of Textile waste water treatment

Lecture-37
Traditional method of Treatment

• A treatability study of textile wastewater by traditional method using coagulation by adding polyelectrolytes ((1-2 ppm) at pH (6.7-7.5) and primary sedimentation followed by aeration and final settling gave a good results.

• COD decreased from 1835 to 120 ppm, SS decreased from 960 to 120 ppm and sulphate from 1350 to 125ppm.

• In the full-scale treatment plant filtration is used to improved results by decreasing COD, from 263 to 55 and SS from 295 to 10 and Sulphate from 158 to 100 ppm respectively
Coagulation and aeration

• The primary treated wastewater from the industrial plant is generally discharged into the public sewer where it is mixed with domestic wastewater.

• Using coagulation and aeration with sedimentation as secondary or biological treatment improved the effluent quality.

• Textile wastewaters have impurities, dissolved colloidal and suspended form, at first are coagulated and precipitated to produce micro-flocs by simply adjusting pH (6.7-7.5) or by adding inorganic or organic coagulating chemical.

• Low molecular weight non-ionic polyelectrolytes (1-2 ppm) were used to reduce sludge production when the impurities are in the form of micro-flocs and other suspended solids. The bench scale reactor tanks was operated at HRT of 6 hours without filtration.
Usual process outcome

- Textile wastewater treatment study has been successfully operated at many textile mills.

- The simple aerobic treatment in combination with the use of filtration resulted in a significant Suspended solids, COD and color removal.

- Research was conducted on the development of applicable method of textile wastewater treatment to satisfy the values of SS, BOD, COD, SO₄ and PO₄ removal efficiency showing 76%, 84%, 86%, 92% and 100% respectively without filtration.

- Removal efficiency improved with filtration for SS, BOD, COD and SO₄ to be 98.3%, 91.2%, 95% and 92% respectively.

- Using filtration is essential to get treated textile wastewater satisfies permissible limits to be reused.
Technologies for colour removal

• There are more than 100,000 commercially available dye exist and more than 700000 tonnes per year are produced annually (Pearce et al., 2003, McMullan et al., 2001).

• Wastewater containing dyes is very difficult to treat, since the dyes are recalcitrant organic molecules, resistant to aerobic digestion, and are stable to light.

• A synthetic dye in wastewater cannot be efficiently decolorized by traditional methods.

• This is because of the high cost and disposal problems for treating dye wastewater at large scale in the textile and paper industries (Ghoreishi and Haghigi, 2003).

• The technologies for colour removal can be divided into three categories: biological, chemical and physical (Robinson et al., 2001). All of them have advantages and drawbacks.
Biological Methods

- Biological treatment is the often the most economical alternatives when compared with other physical and chemical processes. Biodegradation methods such as fungal decolourization, microbial degradation, adsorption by (living or dead) microbial biomass and bioremediation systems are commonly applied to the treatment of industrial effluents because many microorganisms such as bacteria, yeasts, alges and fungi are able to accumulate and degrade different pollutants (McMullan et al., 2001 and Fu and Viraraghavan, 2001).
Biological treatment

- However, their application is often restricted because of technical constraint.

- Biological treatment requires a large land area and is constrained by sensitivity toward diurnal variation as well as toxicity of some chemicals, and less flexibility in design and operation.

- Further, biological treatment is incapable of obtaining satisfactory colour elimination with current conventional biodegradation processes (Robinson et al., 2001).

- Moreover, although many organic molecules are degraded, many others are recalcitrant due to their complex chemical structure and synthetic organic origin (Ravi Kumar et al., 1998). In particular, due to their xenobiotic nature, azo dyes are not totally degraded.
Chemical methods

• Chemical methods include coagulation or flocculation combined with flotation and filtration, precipitation-flocculation with Fe(II)/Ca(OH)2, electroflotation, electrokinetic coagulation, conventional oxidation methods by oxidizing agents (ozone), irradiation or electrochemical processes.

• These chemical techniques are often expensive, and although the dyes are removed, accumulation of concentrated sludge creates a disposal problem.

• There is also the possibility that a secondary pollution problem will arise because of excessive chemical use.
Chemical Methods

- Recently, other emerging techniques, known as advanced oxidation processes, which are based on the generation of very powerful oxidizing agents such as hydroxyl radicals, have been applied with success for the pollutant degradation.

- Although these methods are efficient for the treatment of waters contaminated with pollutants, they are very costly and commercially unattractive. The high electrical energy demand and the consumption of chemical reagents are common problems.
Physical methods

- Different physical methods are also widely used, such as membrane – filtration processes (nanofiltration, reverse osmosis, electrodialysis) and adsorption techniques. The major disadvantages of the membrane processes is that they a limited lifetime before membrane fouling occurs and the cost of periodic replacement must thus be included in any analysis of their economic viability. In accordance with the very abundant literature data, liquid-phase adsorption is one of the most popular methods for the removal of pollutants from wastewater since proper design of the adsorption process will produce a high-quality treated effluent.
Physical methods

- This process provides an attractive alternative for the treatment of contaminated waters, especially if the sorbent is inexpensive and does not require an additional pre-treatment step before its application.

- Adsorption is a well known equilibrium separation process and an effective method for water decontamination applications (Dabrowski, 2001).

- Adsorption has been found to be superior to other techniques for water re-use in terms of initial cost, flexibility and simplicity of design, ease of operation and insensitivity to toxic pollutants. Decolourisation is a result of two mechanisms: adsorption and ion exchange (Slokar and Le Marechal, 1998), and is influenced by many physio-chemical factors, such as, dye/sorbent interaction, sorbent surface area, particle size, temperature, pH, and contact time (Kumar et al., 1998). Adsorption also does not result in the formation of harmful substance.