Chapter – 4

Available Conventional Technologies and the Suggested New Technology.

Available Conventional Technologies and the Suggested New Technology

4.1 Various Available Treatment Technologies for ETPs.

This chapter discusses in brief various treatment technologies involved in the treatment process of wastewater. For the better management of ETPs, the factors regulating the treatment mechanism and details knowledge of all these technologies are very important. Wastewater depending on its characteristics is subjected to different treatment options. The combined processes of physical, chemical, biological and operations for the removal of solids, organic matter and sometimes, nutrients from wastewater are the basic wastewater treatment processes. In order of increasing treatment level, the preliminary, primary, secondary, and tertiary are the general terms used to describe the different degrees of treatment of wastewater. These processes are described as below in brief.

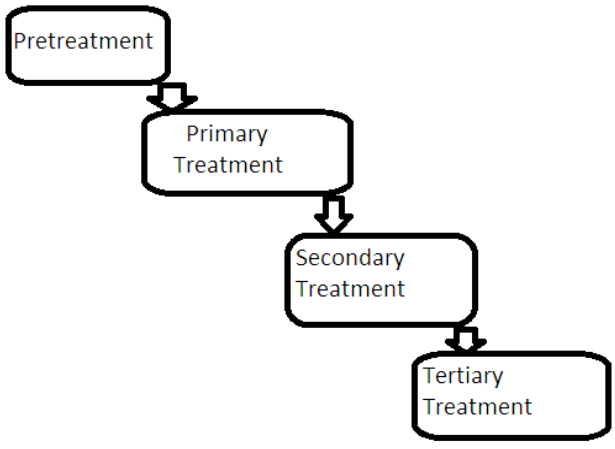

Figure: 4.1 Wastewater Treatment Process

4.1.1Preliminary Treatment:

The coarse solids and other large materials from the raw water waste are removed by the process of Preliminary treatment. The removal of these materials is very necessary to enhance the operation and maintenance of the subsequent treatment units. In the preliminary treatment of wastewater, a number of unit processes are engaged to eliminate the undesirable characteristics of wastewater. To control the odor, the operations like pre-aeration, coarse solid grinding, removal of large materials using screens & grates, are generally used. Many times the removal of oil & grease & pH correction is done. The industries first do the preliminary treatment in their premises then after the effluents are sent to ETP for the further treatment. The performance of ETP improves, if preliminary treatment or pre-treatment is taken up by individual industry.

4.1.2 Primary Treatment:

The first step in the waste water treatment process or may be the second step after the preliminary is the Primary treatment. The physical separation of suspended solids from the wastewater using primary clarifiers is the primary treatment. The TSS (total suspended solids) and the associated BOD (biochemical oxygen demand) levels are reduced with the help of the primary treatment process and prepare the waste for the next step in the process of the wastewater treatment. The removal of the settle able organic & inorganic solids by the sedimentation of materials that scum by the process of skimming is the main objective of this treatment system. During the primary treatment near about 35 to 55% of the total inward BOD (biochemical oxygen demand), 55 to 75% of TSS (the total suspended solids) & 70% of the oil and grease are generally removed. Few organic phosphorus & nitrogen and heavy metals associated with solids are removed during the primary sedimentation but the colloidal

and dissolved constituents are not affected. A satisfactory performance of the subsequent treatment units are ensured in the primary treatments. The various auxiliary processes such as fine screening, flocculation & floatation may be used as the primary treatment process and the main unit involved in this process is the sedimentation process. The second step preceded by flocculation is the chemical treatment, generally with lime and alum. The main purpose of the primary treatment process is to remove metals by precipitation further to this it also removes some related colloidal BOD & generates chemical sludge.

The Primary Treatment Involves Various Physical-Chemical Processes:

- **Flocculation:**

Flocculation is a physiochemical process which helps to encourage the aggregation of viscous colloidal & delicately separated suspended matters by mixing physically and by aiding chemical coagulant. This is a process of a rapid mixing tank & a flocculation tank. In this process the wastewater stream mixes with the coagulants in a rapid mix tank and is then passed through the flocculation basin and in the flocculation basin a slow mixing of waste occurs and then allows the particles to be collected in the form of a more settle able and heavier solids and a better mixing is facilitated with the help of a diffused air or the mechanical paddles.

The natural organic polymers, inorganic electrolytes and synthetic poly electrolytes are the various different types of chemicals used for the coagulation. Depending on the characteristics and the chemical properties of the contaminants, the specific chemicals are selected.

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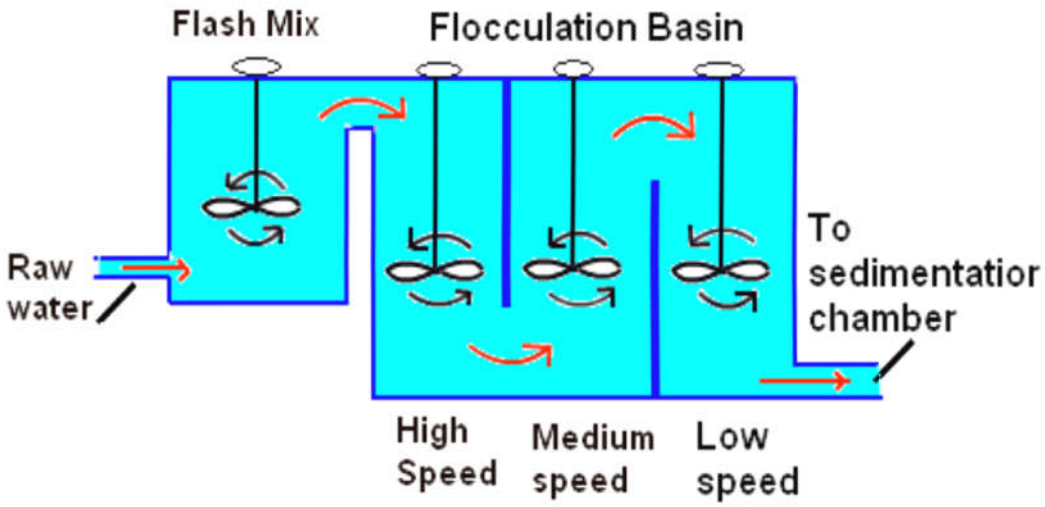


Figure: 4.2. Flocculation Tank

- **Sedimentation:**

A physical water treatment process to remove the suspended solids from water, using the gravity is a process of sedimentation. Basically this is a process for the easy removal of the settle able solids. The baffles & oil skimmers to remove the greases and floating solids are included in the sedimentation chamber and also there may be mechanical scrapers for the removal of sludge from the bottom of the chamber.

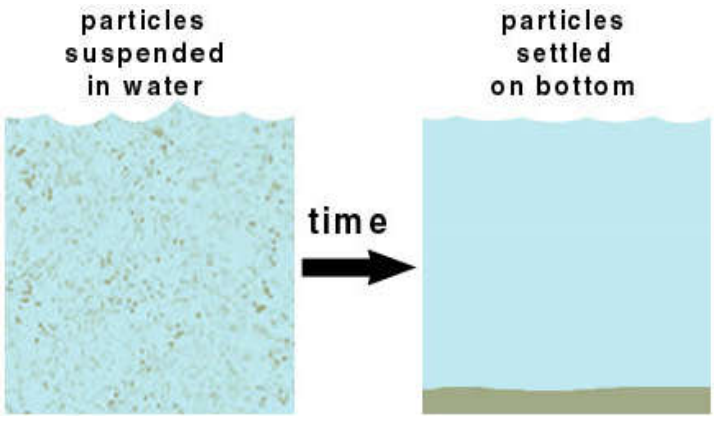


Figure: 4.3 Sedimentation

- **Dissolved Air Floatation:**

Use of bubbles in this process is required to raise the suspended particles in wastewater up to surface level and hence it is easy for the collection and removal of the same. The bubbles of air introduced from the wastewater are mainly attached with the particles and then the particles floats with the bubbles. The suspended solids, dispersed oil & greases from the oily wastewater and some other effluents can be removed by the process of diffused air floatation. In retention tank the wastewater is pressurized and contacted with air. The super-saturated & pressurized water is passed through a pressure-reducing valve to the bottom of the floatation tank. The super-saturated air begins to come out in the form of fine bubbles from the solution, as & when the pressure starts releasing. The air bubbles attached with the suspended particles and trapped in sludge flock float over the surface and these floats are always swept from the surface & the mud is then collected from the bottom of the tank. The oil removal efficiency of DAF units is increased by the addition of certain coagulants.

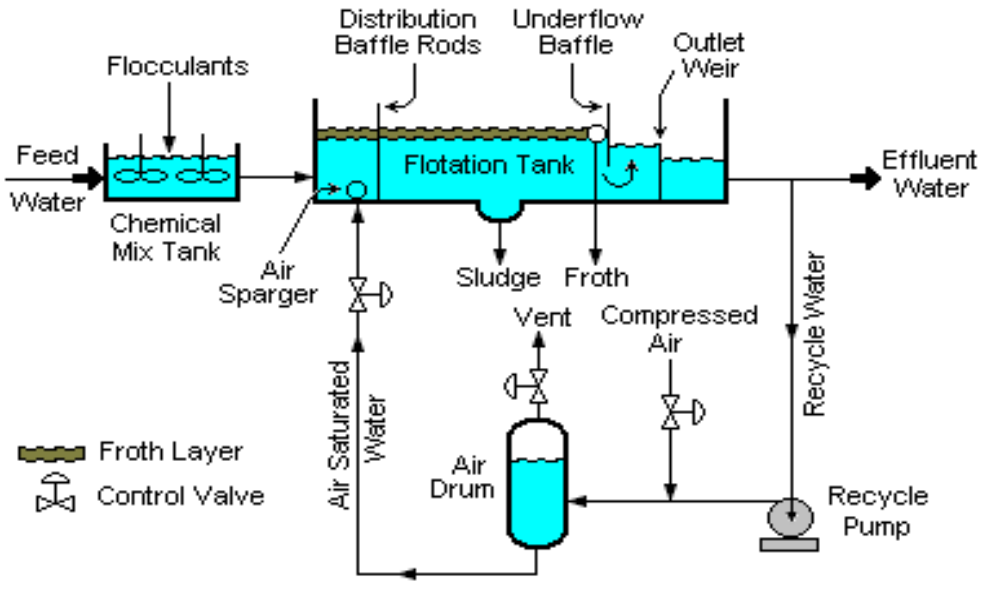


Figure: 4.4 A typical dissolved air flotation unit [DAF]

Figure: 4.5 DAF System of WWTP at TATA Steel

Figure: 4.6 Effluent Water after DAF.

- **Clarification:**

The clarification is a process to generate the suspended solids through the removal of particulate, flocculated impurity & the precipitates from the water by a low cost continuous separation method. The wastewater clarification in the clarifier allows flowing uniformly & slowly and also permits the solids to settle down. From the top of the clarifier over the weir, the clarified water flows after the clarification. The sludge is removed periodically, safely disposed & dewatered from the clarifier once the solid is collected at the bottom of the clarifier.

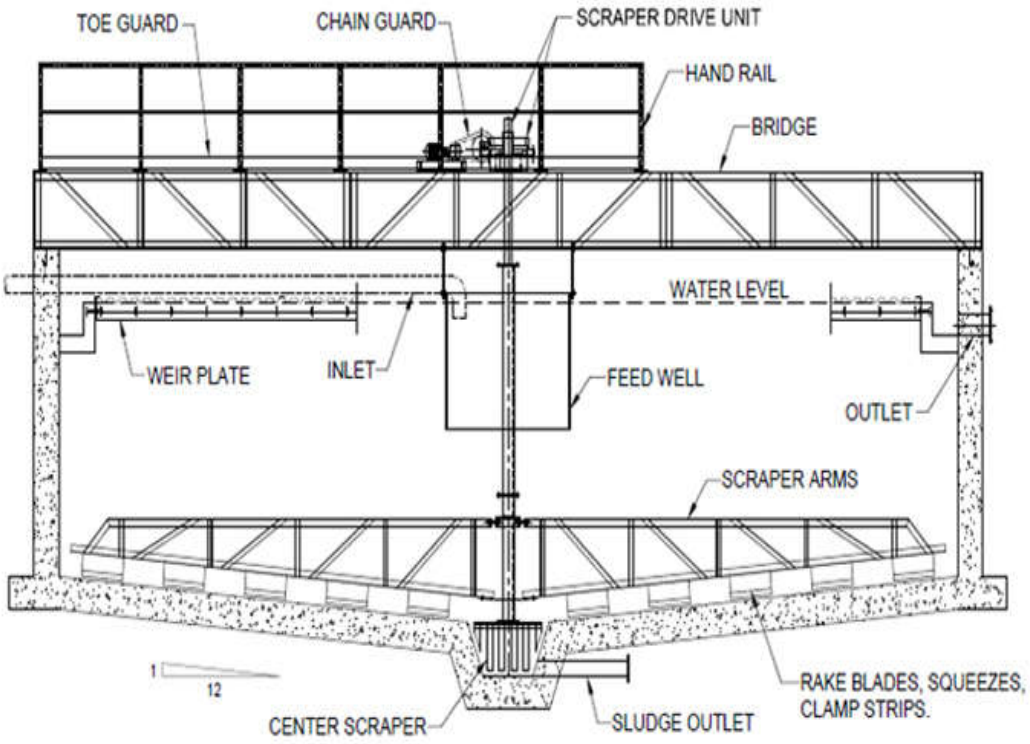


Figure: 4.7 Clarifier Systems

Figure: 4.8 Clarifier Tank at TATA Steel,JSR; Blast Furnace WWTP Site.

The above tank shown in figure 4.6 is the clarifier tank for the treatment of waste water coming from one of the blast furnace at TATA Steel, Jamshedpur.

- **Chemical Treatment Processes:**

The chemical treatment may be used, preferably before biological treatment as it removes the toxic chemicals which may kills the microorganisms and or at any stage in the treatment process as and when it necessary.

- **Neutralization:**

There is a wide range of pH of the untreated wastewater and it is not so easy to treat the wastewater with such type of varying range of the pH value. To optimize the treatment

efficiency the neutralization process is used to adjust the pH value. To reduce the pH value sulphuric or hydrochloric acids may be added and to raise the pH value, dehydrated lime or sodium hydroxide alkalis may be added. Generally the process of neutralization is carried in a rapid mix holding tank or in a tank used for equalization. To control the pH of the discharge in order to meet the standards the process of neutralization can be carried out at the end of the treatment.

- **Precipitation:**

The process of precipitation is carried out in two steps for the removal of the metal compounds from the stream of the wastewater. The mixing of precipitants with the wastewater and allowing a formation of the insoluble metal precipitants is the first step of the precipitation process. The removal of the precipitated metals from the wastewater through clarification & filtration is carried out in the second step and then the resulting sludge is being treated in a proper manner, and after treatment it is recycled or disposed off. The important parameter to be considered in a chemical precipitation is pH controlling. The solubility of metal hydroxides increases towards higher or lower pH and this is amphoteric in nature. Thus, for the precipitation of hydroxide for each metal, there is an optimum value of pH. As there is generally more than one metal in wastewater, hence therefore, it is very much difficult to select the optimum treatment chemical & the pH becomes more difficult and also it involves a transaction between the best possible removals of two or more metals. Lime, sodium hydroxide, soda ash, sodium sulphide and the ferrous sulphate are the various different chemicals used for the process of precipitation. The process for the effective removal of the metals like Antimony, Arsenic, Chromium, Copper, Lead, Nickel & Zinc is normally the hydroxide precipitation and for removing mercury, lead, copper, silver, cadmium etc. sulphide precipitation is used.

4.1.3 Secondary Treatment:

The secondary treatment process involves disintegration or decomposition of the suspended & dissolved organic substances present in the waste water using microorganisms. The activated sludge process & the biological filtration methods are the chiefly used biological treatment processes.

The biological treatment process which are mainly used for the secondary treatment process and is based on the microbiological action to decay the organic suspended & dissolved wastewater. The microbes can be used for the natural compound, both as a source of carbon sources and as an energy sources.

The biological treatments where microbes necessitate the oxygen to grow is aerobic and where bacteria grows in the absence of oxygen where germs can grow with or without oxygen are anaerobic. In trickling filter the microorganisms may attached to the surface or it may also be free in a liquid suspension in the activated sludge process.

- **Activated Sludge Process:**

Activated sludge process is an aerobic biological treatment & continuous flow process which involves suspended growth of aerobic microbes to biodegrade organic contaminated effluents. The effluent is first introduced to the aeration basin and then is allowed to mix-up with the contents. In the aeration tank, the suspension of aerobic microorganisms is maintained. In the basin the organics are degraded through a series of various different biochemical reactions & then generate new bio mass. By using the supplied oxygen the microorganisms oxidize the matter into carbon dioxide and water. The colloidal & the particulate solids are agglomerated by these organisms. The micro-organisms are separated from the treated water, when the mixture is passed to a settling tank or a clarifier. To maintain a preferred concentration of microorganisms in the reactor, the settled solids are recycled

back to the aeration tank and from there some of the excess solids are sent to sludge management services. An adequate nutrient levels of nitrogen and phosphorous must be available to the bio mass, to ensure biological stabilization of organic compounds. For the effectiveness of the system, the key variables are:

a) The food to microorganism ratio [F/M] ratio or Kg of biological oxygen demand [BOD] applied daily to the system per Kg of biological solids in aeration tank is the organic loading. The BOD removal, requirement of oxygen and the production of biomass is determined by the F/M ratio. High efficiency treatment is provided by the systems designed and operated at lower F/M.

b) Higher treatment efficiency is provided by the systems designed & operated at higher SRT. The SRT (Sludge retention time) or sludge age is to determine the average retention time of solids in the system and the SRT affects the level of treatment, requirements of oxygen and the waste sludge production.

c) The quantity required for biodegradation of organic matter and the total quantity required for the endogenous respiration of microorganisms decides the requirements of oxygen.

By changing one or more of the key parameters, various modifications in the activated sludge process are possible. The process where aeration, sedimentation & separation are performed in a single reactor is the sequential batch reactor is a form of the activated sludge process.

- **Biological Filters:**

Biological filters are the reactors, basically filled with medium which provides a surface exposed to the air & wastewater where a microbiological layer can grow. The most common type of organic or biological filters is as below:-

a) **Trickling Filters:**

In trickling filtering systems, the fixed films of microorganism's forms on the surface of the filter soak up organic particles & then break up them aerobically. In this system the wastewater is dispersed over a bed made up of plastic & rocks and then it flows over the media by action of gravity.

b) **Rotating Biological Contractor:**

The RBC (rotating biological contactor) is consisting of a series of discs of which 40-45% of the area is wrapped up with the waste water and the rest of the surface is open to atmosphere; and basically used to provide a surface for microbiological substance film. The growth of the attached microorganisms is enhanced with the alternating immersion & aeration of a given portion of the disc and facilitates oxidation of organic matter in a comparatively short time and provides a high level of treatment.

- **Anaerobic Treatment Systems:**

The anaerobic processes are basically slower than the aerobic degradation and then obnoxious hydrogen sulphide gas is generated when sulphur is present there. By recovering the biogas a part of the high capital cost can be compensated. These systems are not very commonly used effluent treatment systems except the stabilization of the sludge.

4.1.4 Tertiary Treatment:

To obtain the objectives of the treatment a tertiary treatment processes can be included as a number of physical & chemical treatment processes after the biological treatment.

Tertiary treatment process is just next to the secondary water treatment process. The persistent contaminants that the secondary treatment is not able to remove are removed by the tertiary treatment process. Before the reused, recycle & discharge to the environment, the tertiary treatment process is used as a final cleaning process cleaning process to improve the quality of the waste water. For the removal of nutrient [N, P], removal of toxin [pesticides, VOC & metals] and for the polishing of the effluent like BOD & TSS; the tertiary treatment processes are used.

As the extension of conventional secondary biological treatment process for the further stabilization of the substances which demands oxygen in the wastewater, and also to remove the nitrogen & phosphorus the tertiary treatment can be used. The physical & chemical separation techniques like activated carbon adsorption, flocculation or precipitation are the process involved in the tertiary treatments.

Some advanced water treatment processes basically may be a part of the tertiary treatment may also be used as primary or secondary treatment occasionally in place of secondary treatment.

4.2 Suggested Additional Best Available Technologies (BAT) / Processes for Steel Industry Effluent Treatment Plant:

4.2.1 Suggested Additional Process:

The settling, activated sludge treatment, bio-filtration (tricking filters), biological nutrient removal, media filtration &chlorine disinfection and clarifier system are basically the conventional wastewater treatment processes commonly used for the treatment of industrial wastewater prior to discharge to the environment.

An additional treatment process as an advanced treatment process may be applied to the conventional treated wastewater to improve the quality up to a degree suitable for various applications of recycle and reuse including the potable reuse. The different membrane treatment processes like microfiltration, ultra filtration, nanofiltration and other processes like reverse osmosis, advanced oxidation processes & additional disinfection processes like ozonation & the use of ultraviolet radiation are the additional treatment processes.

In the process of tertiary treatment, for the better results towards getting clean water from the steel wastewater, we can introduce the advanced processes of Membrane technology, Ion-exchange, de-chlorination & reverse osmosis.

- **Membrane Technology:**

For the development of the sustainable environment the membrane technology will be very fruitful and this technology will also be very useful & efficient for the treatment of industrial effluents.

The membrane technology is like a discriminating barrier, which allows pass some things through it but stops things like molecules, ions & some other minute particles. The semi-permeable material specially designed to separate the particulate, colloidal & dissolved substances from liquid solutes are the membranes.

The feed stream is the influent of an artificial membrane whereas the permeate is that liquid which passes through the membrane and the concentrate is that liquid which is retained.

Now a day, the membrane technology has a big role in the wastewater treatment throughout the world. During last few years, the use of the membrane technologies has become very extensive with the growth of a variety of membranes for the newer applications like membrane bioreactors. Earlier these technologies were mainly limited to the reverse osmosis only.

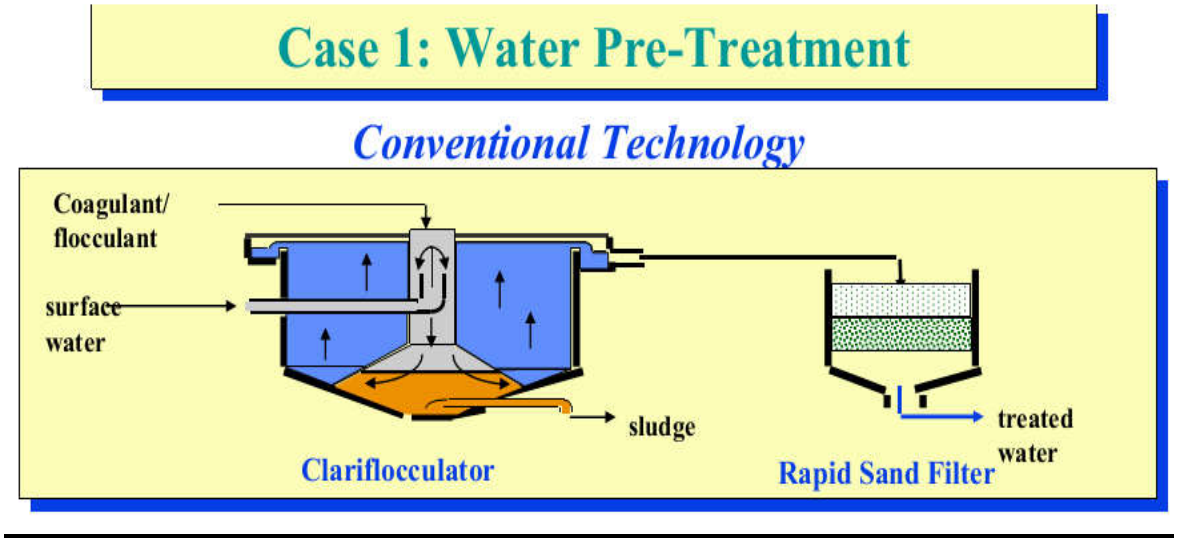
A wide range of materials like cellulose Acetate, Polyamides, Poly sulfones, Poly-propylene, nylon, Poly-acrylonitrile, Poly-carbonate, Polyvinyl alcohol, Poly-tetra-fluoro-ethylene, Ceramic & metal composites are basically used to produce the membranes.

The membrane pore size is the parameter for the degree of selectivity of a membrane. On the basis of the pore size, the membrane may be differentiated as Microfiltration (MF), Ultra filtration (UF), Nano filtration (NF) & Reverse osmosis (RO) membranes.

- **Microfiltration (MF):**

The membrane used for the turbidity removal, solid separation after biological treatments in membrane bioreactors [MBRs]; from the waste water is the microfiltration membrane having Pores > 50 nm. These membranes are the least expensive membranes. In this filteration process the operating pressures are generally below 350kpa i.e 50 Lbs/sq and their flux rates average between 450-1650 kg / m²-d or L/m²-d. Before nanofiltration and reverse osmosis the micro filters are generally used in MBRs for producing reclaimed water for non-potable purposes and for pre-treatment of waters.

- **Water Treatment through Microfiltration:**



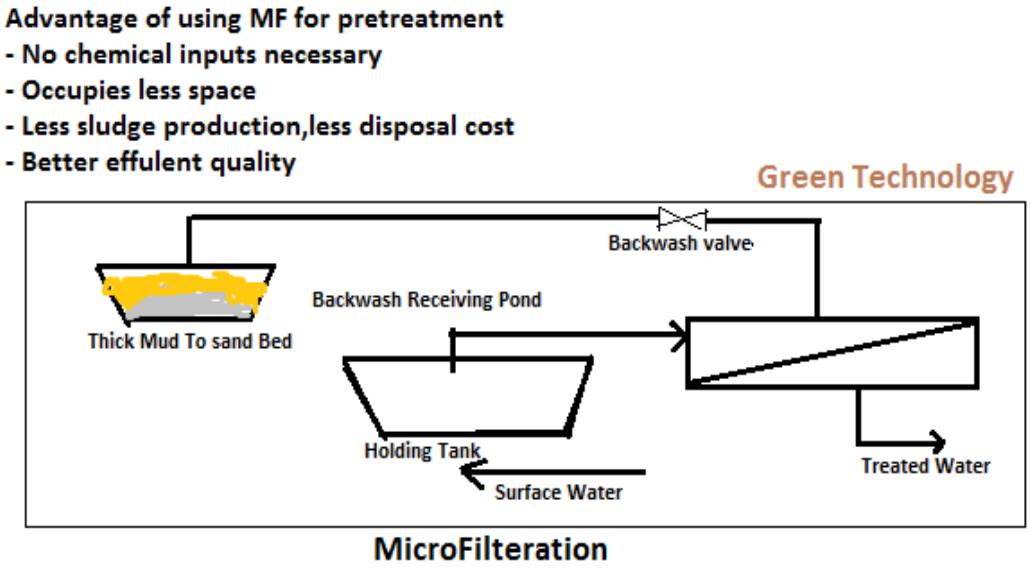
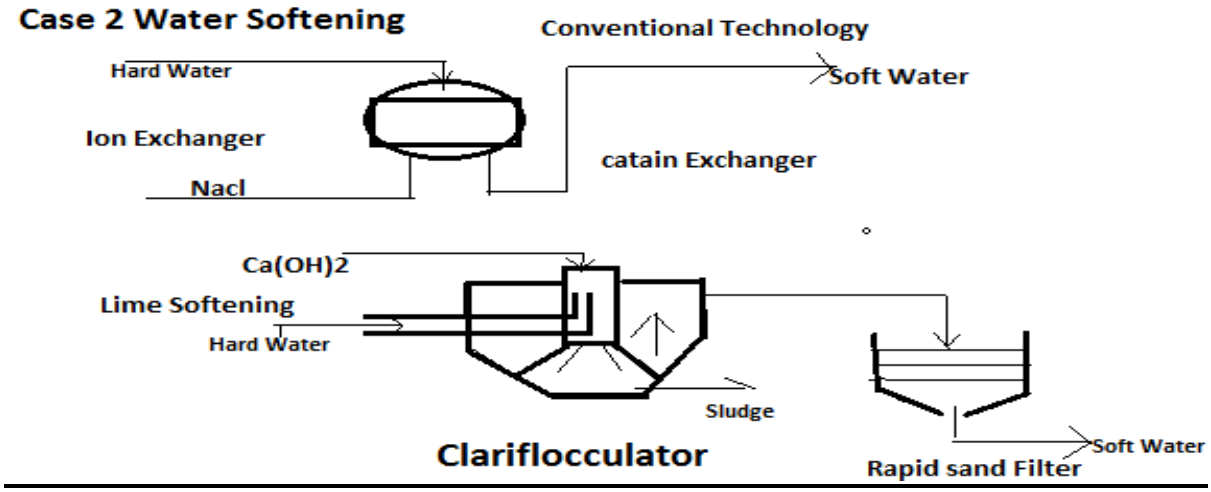


Figure: 4.9 Water Treatment Through Microfiltration.

- **Nanofiltration (NF):**

The nanofiltration can reject particle smaller than 0.0001 µm, and is also known as loose RO. The selected dissolved constituents of the wastewater can be removed by the nanofilteration. An alternative to chemical softening is primarily developed membrane softening process is the nanofilteration. Before the process of reverse osmosis the nanofiltration can be used as a pre-treatment process. To minimize the particulate & microbiological fouling of the reverse osmosis membranes after the removal of turbidity & bacteria andto prevent the scaling by the removal of the hardness ions and also to lower the operating pressure of the reverse osmosis process by reducing the feed water TDS (total dissolved solids) concentration are the main objectives of the nanofilteration pretreatment process.

- **Water softening using Nanofilteration:**



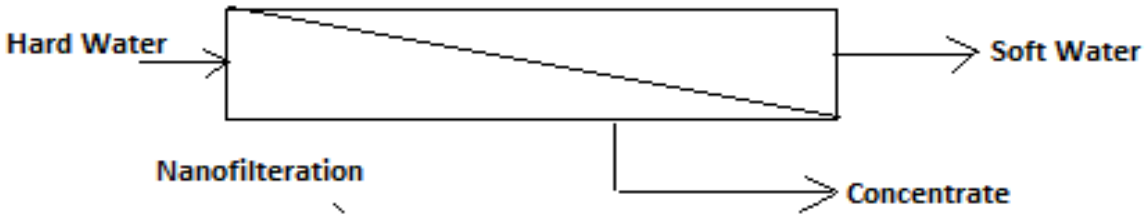


Figure: 4.10 Water Treatment Through Nanofilteration

Advantage of using NF for water softening

- No Chemical regenerates necessary
- Occupies Less space
- Better effluent quality
- Continuous process possible
- Possible NaCl rejection 70- 90%
- Reduced boiler blow down
- Partial demineralization.

- **Ultra filtration (UF):**

The ultra filtration process operates between a range of 70-700kpa and used to removes the particles higher than 0.005-2 μm. For several of the same applications like microfiltration the ultra filtration process is used. To remove the dissolved compound with high molecular weight

likes proteins & carbohydrates; the ultra filtration membranes are used. And also additionally the ultra filtration process are able to remove viruses & toxins upto some extent.

- **High Purity Water Production using UF & RO:**

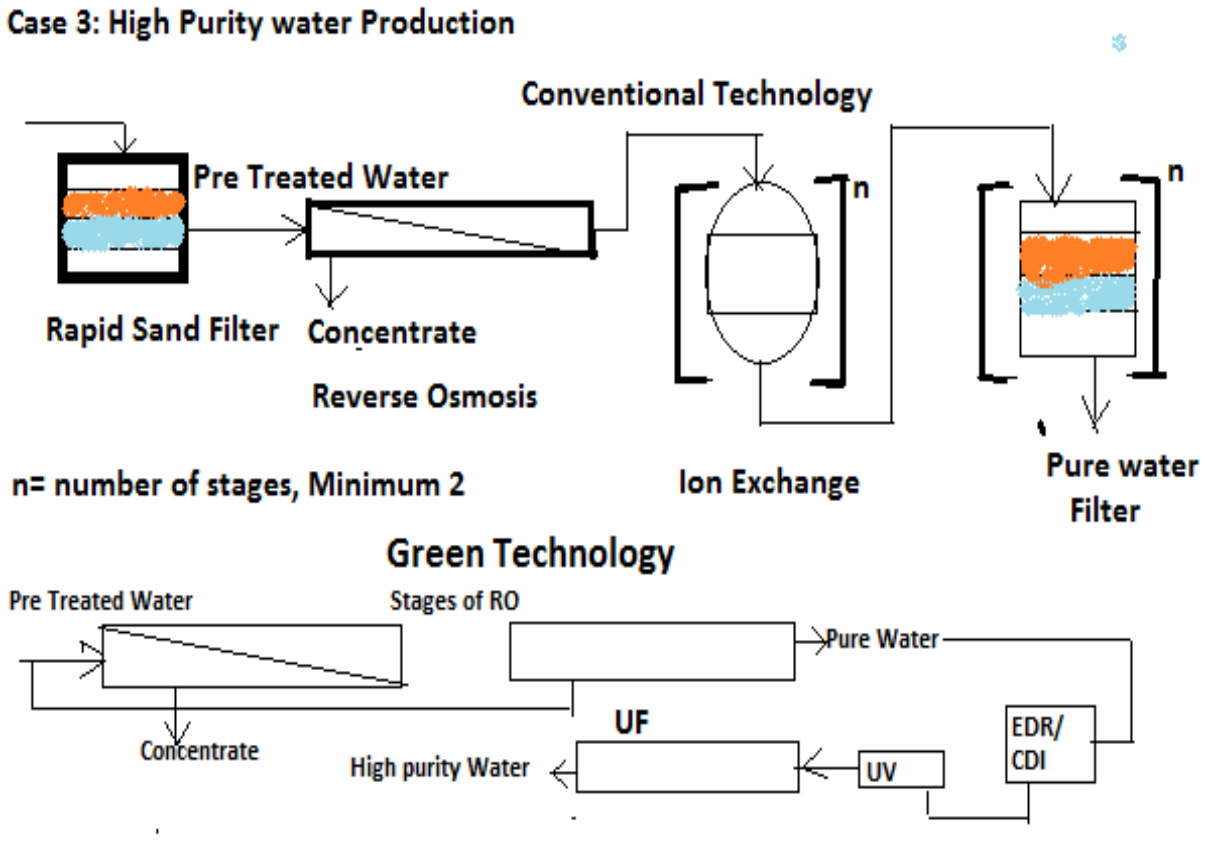


Figure : 4.11 Water Filteration through Ultra filtration and Reverse Osmosis.

- **Colour & Natural Organic Compounds Removal Through Nanofilteration:**

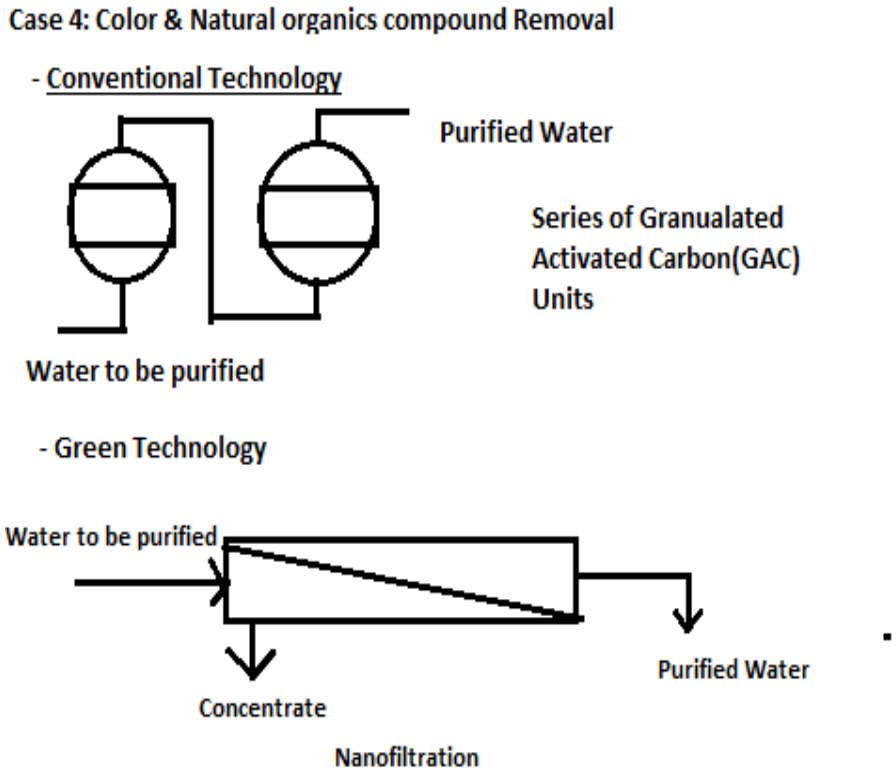


Figure: 4.12 Color and Natural Organic Compound Removal Through Nanofiltration

- **Membrane Filtration:**

To purify the liquid & separate the particles from it the membrane filtration technique is used. A solvent is passed through a semi-permeable membrane in the process of membrane filtration. The size of the pores in the membrane decides the permeability of the membranes and this size of the pores has to be designed very carefully to keep out the undesirable particles and has to be also planned for the best possible operating efficiency. A cleaned & filtered fluid is the result on

one side of the membrane with the removal of solute on the other side of the same membrane. The best examples of membrane filtration are the Microfiltration, Ultrafiltration & Nano-filtration techniques.

- **Reverse Osmosis Systems:**

The membrane separation method used for the removal of several types of large molecules & ions from the solutions by the application of pressure to the wastewater on one side of a selective membrane is basically the reverse osmosis system. In the result, the treated wastewater is allowed to pass though one side and the Contaminant is retained on the pressurized side of the membrane. This is a process commonly used for the desalination as well as also used for the elimination of the dissolved particles from the remaining wastewater after the process of advanced treatment along with micro-filtration. Reverse osmosis requires a high pressure to produce de-ionized water [860-7050kpa].

- **Ion- Exchange:**

Ion exchange is a The process of exchanging ions between two electrolytes or may be between a complex & an electrolyte solution, is the Ion exchange process. For the purpose of demineralization to swap one ion for another for treating the wastewater, the process of ion can be used. The anion exchange resins & the cation exchange resins are the two basic types of ion exchange systems. It can be used For the process of water softening, sanitization, purifying distillation, recycle, heavy metals removal through electroplating wastewaters & some other industrial processes like polishing of wastewater before discharge, ammonium ion removal from wastewaters, removal of salt, to decontaminate acids & bases for the reuse & removal of the radioactive impurities present in the nuclear industry etc.

- **Activated Carbon:**

In the process of tertiary waste treatment the activated carbon has a very wide use in so many applications applied for the treatment of waste water. For the de-chlorination purpose of organic compounds, the powdered as well as the granular activated carbons are used. On the surface of the activated carbon, the organic compounds present in the waste water are absorbed. The effectiveness of the activated carbon is depends on a various number of factors like the size is pores, the concentration & the composition of the contaminant, the pH of the water, temperature and the flow rate i.e. time of contact of exposure. The application of the activated carbon is a very broad for the organic pollutants and the activated carbon is characteristically used to remove the contaminants present in the water like pesticides, perfumed compounds like phenol, absorbable organic halogens, organic compounds which are non-biodegradable, dyes & the compound having colors, organic compounds which are basically chlorinated & halogenated, the removal of the compounds that normally slow down the biological treatments, compounds having toxicity, the removal of oil removal during the process of condensation, especially chlorine & halogens that basically oxidizes downstream processes and the removal of the organics that have the potential to unclean reverse osmosis membranes & or ion exchange resins.

4.2.2. Suggested Best Available Technology (BAT): A Common Effluent Treatment Plant (CEPT):

The best available technology (BAT) refers to the "Best" in reference to the technology i.e. the most effective way to achieve a high universal level of safety of the environment in whole, the "Available Technology" means the technique developed on a level allowing the execution in the related group of activities under the viable conditions of economic & techniques and by considering the costs & the advantages and also whether the technique produced or used are

logically & practically accessible. The "Techniques" include equally the technology & equipment used and the methods of installation which is considered & designed, managed & maintained and operated & decommissioned.

The best available technique means the most efficient, effective & the advanced stages of the development of activities and the methods of their of operations indicating the practical aptness of a particular technique for providing the basis for the limiting values of the emissions designed principally to prevent and may be usually to reduce the emissions & as a whole the impact on the surrounding atmosphere.

Waste minimization is the measure of best available techniques. The major ways of Waste minimization is as below:

- Process Modification [PM]
- Equipment Modification [EM]
- Material Substitution [MS]
- Reuse / Recovery / Recycle [RRR]
- Housekeeping [H]

This chapter of the dissertation discusses the development of a Common Effluent Treatment Plants [CETPs] in the Indian context and their performance evaluation. To understand the best case study, a report is also discussed here separately in a section of this report. As the case study for the common effluent treatment plants (CETP) is not available very easily, so this study also discusses the treatment technologies in effluent treatment plants (ETPs) for the various industries. For effective wastewater treatments within all the small to the medium enterprises, the CETPs (Common Effluent Treatment Plants) are considered as one of the most viable solution.

In the year 1991, the Ministry of Environment & Forest (MOEF) has initiated an inventive economic support system for the CETPs to ensure the growth of all the small & medium entrepreneurs (SMEs) in an environmentally well-matched approach.

The fund provision for the scheme is as follows:

- The grant by the Central Government -25% of the capital cost project, which has been increased to 50% in the year of 2012 onwards.
- Subsidy by the state government - 25% of the capital cost of the project
- Financial institutions Loans- 30% of the capital cost of the project,
- And the contribution from the SMEs-20% of the capital cost of the project.

As per the need & considerations, the scheme which was initially launched only for the first ten years, was extended further more. And hence therefore the ministry of environment & forest (MOEF) has examined the possibilities to establish the common effluent treatment plants (CETPs) in the various industrial estates in their respective states.

The main objectives of establishing C.E.T.P is:

- While protecting the environment the objective of CETP is to reduce the treatment cost for the individual units.
- By reducing the cost of pollution abatement for individual factory, the "Economies of scale" in waste treatment is achieved.
- The CEPTs require less or very few trained personnel so it minimizes the problem of lack of technical assistants & trained personnel.

- The centralized facility can be planned in advance to ensure the adequate space availability, which solves the problem of lack of space.
- This technique is also used to reduce the problems of monitoring.
- The disposal of treated wastes and sludge are well organized and improved recycling & reuse is possible.

Table: 4.1 Experimental Results of Feed Wastewater & Treated Wastewater:

Analytical Results:

	S.No	Radicals	Result	Unit	Method of Analysis
(A). Weak Alkali Waste	1.	Conductivity	580	µs/cm	Conductometer
	2.	Total Alkanity	103.4	mg/L	Conventional
	3.	Total dissolved Solids(TDS)	388	mg/L	Conventional
	4.	Total Suspended Solids(TSS)	9.1	mg/L	Conventional
	5.	Iron(Fe)	<0.2	Ppm	AAS
(B). Treated Water Before R.O	**1.**	Total Arsenic	0.017	mg/L	ICP-OES
(C). Oily Waste	1.	Conductivity	6092	µs/cm	Conductometer
	2.	Total Alkanity	3960	mg/L	Conventional
	3.	Total dissolved Solids(TDS)	4081	mg/L	Conventional
	4.	Total Suspended Solids(TSS)	5.4	mg/L	Conventional
	5.	Iron(Fe)	<0.2	mg/L	AAS

Source: Test Report CSIR-National Metallurgical Laboratory (NML),Jamshedpur.

Cost Analysis for C.E.T.P :

In case of the steel industries WWTP or any others' WWTP:

Table: 4 2: Economics of different levels of treatments through conventional measures:

For a Sludge Sump Capacity of 12 m^3 and approx 20 to 25 m^3 treatment of sludge water in a day, the initial plant erection cost and running cost involved is tabulated as below:

Particulars	**Primary Treatment System(A)**	**Primary+ Ultra Filtration (B)**	**Primary+Ultra filtration+Reverse Osmosis (c)**
Capital cost (Rs lakhs)	**30.0**	**90.64**	**145**
Annualized capital cost@15% per annum interest & depreciation	**5.79**	**18.06**	**29.69**
Operation & Maintenance cost(Lakhs/annum)	**5.88**	**7.04**	**12.63**
Annual Burdon(Annualized Cost + O&M cost)Rs.Lakhs	**11.85**	**27.1**	**14.5**
Treatment Cost Rs. / kl(without interest & derreciation)	**34.08**	**52.40**	**73.22.**
Total	**87.6**	**195.24**	**275.04**

Grand Total (A + B+ C) =557.88 Lakh per annum

i.e. for the initial installation and running/treatment cost / kl of a single WWTP

Result & Conclusion from Cost analysis:

In Steel industry or any other industry the total Initial & running cost for a single WWTP is **approx. 557.88 Lakh per annum.** The separate system installation for such more than one processes or plant, say as for example for such four different process of the same plant(like may be either different blast furnaces, rolling mills, sintering mills, coke plants etc.), the cost will be **Four times(04) more.**

But by making **one large CETPs** for all such four process it will be nearly halve or less that of the separate systems. And again the **man power required will be one fourth (1/4) only.**