CONVENTIONAL TREATMENT SYSTEM

INTRODUCTION

Water for public use must be potable i.e., *satisfactory for drinking purposes from the standpoint of chemical, physical and biological characteristics. Drinking water should, preferably, be obtained from a source free from pollution. The* raw water, available from surface water sources, is however not directly suitable for drinking purposes. The objective of water treatment is to produce safe and potable drinking water.

Some of the common treatment processes used in the past include Plain sedimentation, Slow Sand filtration, and Rapid Sand filtration with Coagulation-flocculation units as essential pretreatment units. Pressure filters and diatomaceous filters have been used though very rarely. Roughing filters are used, under certain circumstances, as pretreatment units for the conventional filters.

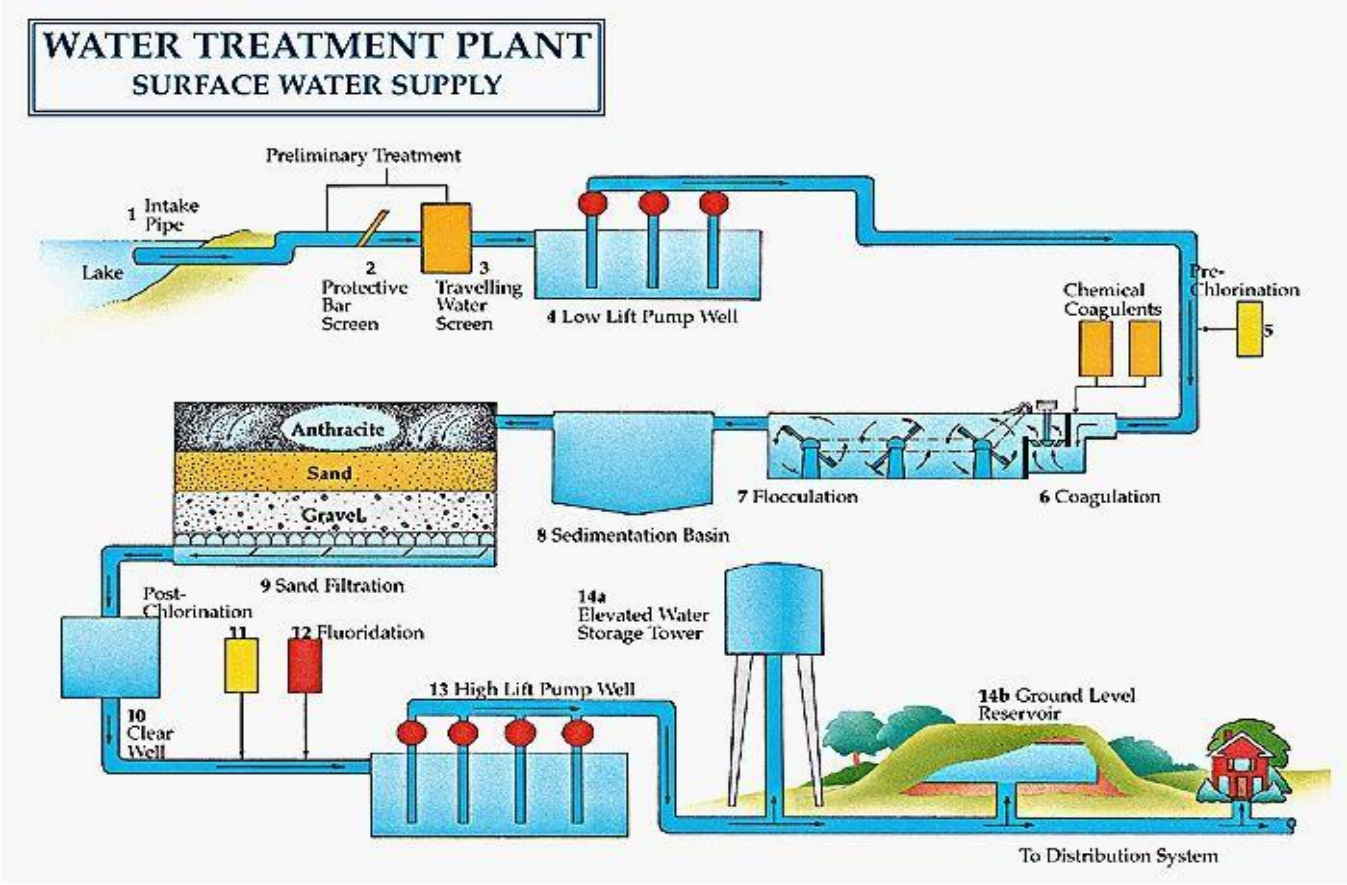


Fig 1: Conventional treatment system

COAGULATION & FLOCCULATION

Introduction

The purpose of coagulation and flocculation is to remove particulate impurities, especially non-settleable solids (particularly colloids) and colour from the water being treated. Non-settleable particles in water are removed by the use of coagulating chemicals.

Coagulation- Flocculation Process Actions

Typical jobs performed by an operator in the normal operation of the coagulation flocculation process include the following:

- Monitor process performance.
- Evaluate water quality conditions (raw and treated water).
- Check and adjust process controls and equipment, and
- Visually inspect facilities

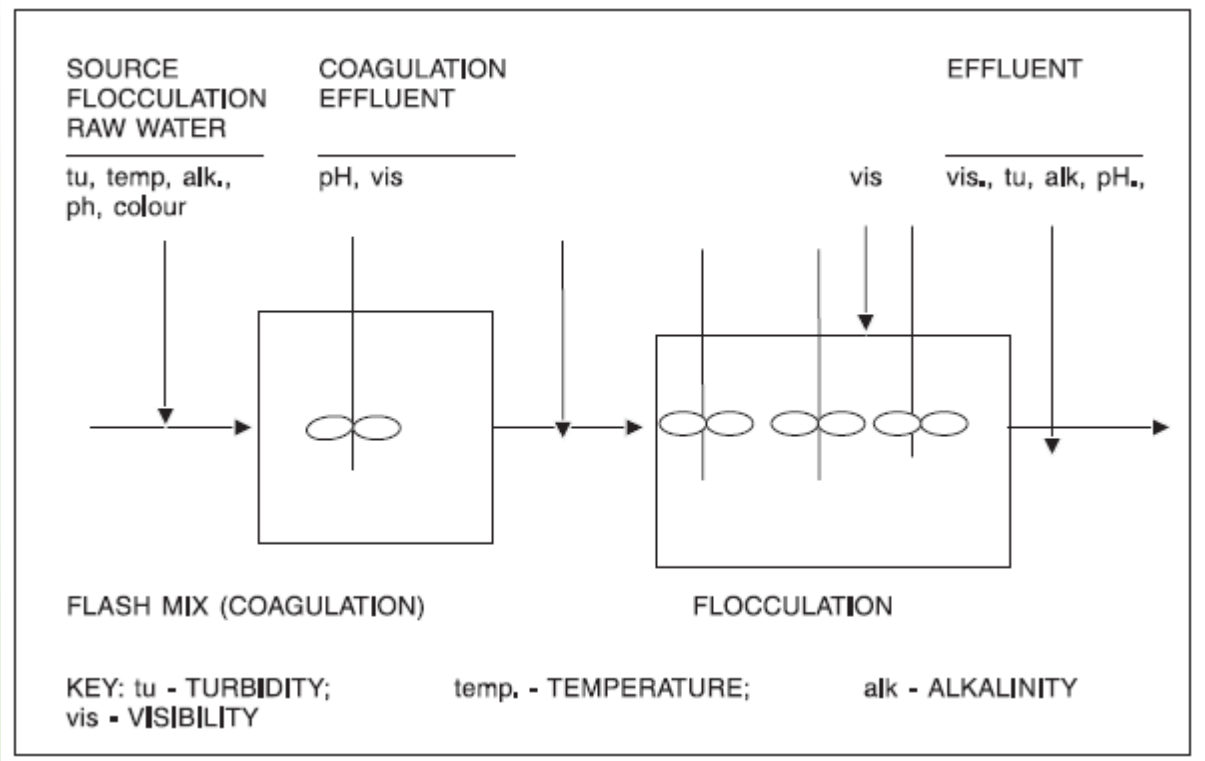


Fig 2: Coagulation – Flocculation monitoring guidelines

Examination of the flocs

Examine the water samples at several points enroute the flow line of the water. Look at the clarity of the water between the flocs and study the shape and size of the floc.

- Observe the floc as it enters the flocculation basins. The floc should be small and well dispersed throughout the flow.
- Tiny alum floc may be an indication that the chemical dose is too low. A 'popcorn flake' is a desirable floc. If the water has a milky appearance or a bluish tint, the alum dose is probably too high.
- As the floc moves through the flocculation basins the size of the floc should be increasing. If the size of the floc increases and then later starts to break up, the mixing intensity of the downstream flocculator may be too high. Try reducing the speed of these flocculators or increasing the coagulant dosage.
- Examine the settlement of the floc in the sedimentation basin. If a lot of floc is observed flowing over the laundering weirs the floc is too light for the detention time. By increasing the chemical dose or adding a coagulant aid such as a polymer, a heavier, larger floc may be produced. The appearance of the fine floc particles washing over the effluent weir could be an indication of too much alum and the dose should be reduced. For precise evaluation you should make only one change at a time and evaluate the results.

Record Keeping

- Records of the following items should be maintained:
- Source water quality (pH, turbidity, temperature, alkalinity, chlorine demand and colour.
- Process water quality (pH, turbidity, and alkalinity).
- Process production inventories (chemicals used, chemical feed rates, amount of water processed, and amount of chemicals in storage).
- Process equipment performance (types of equipment in operation, maintenance procedures performed, equipment calibration and adjustments).
- A plot of key process variables should be maintained. A plot of source water turbidity vs. coagulant dosage should be maintained. If other process variables such as alkalinity or pH vary significantly, these should also be plotted.

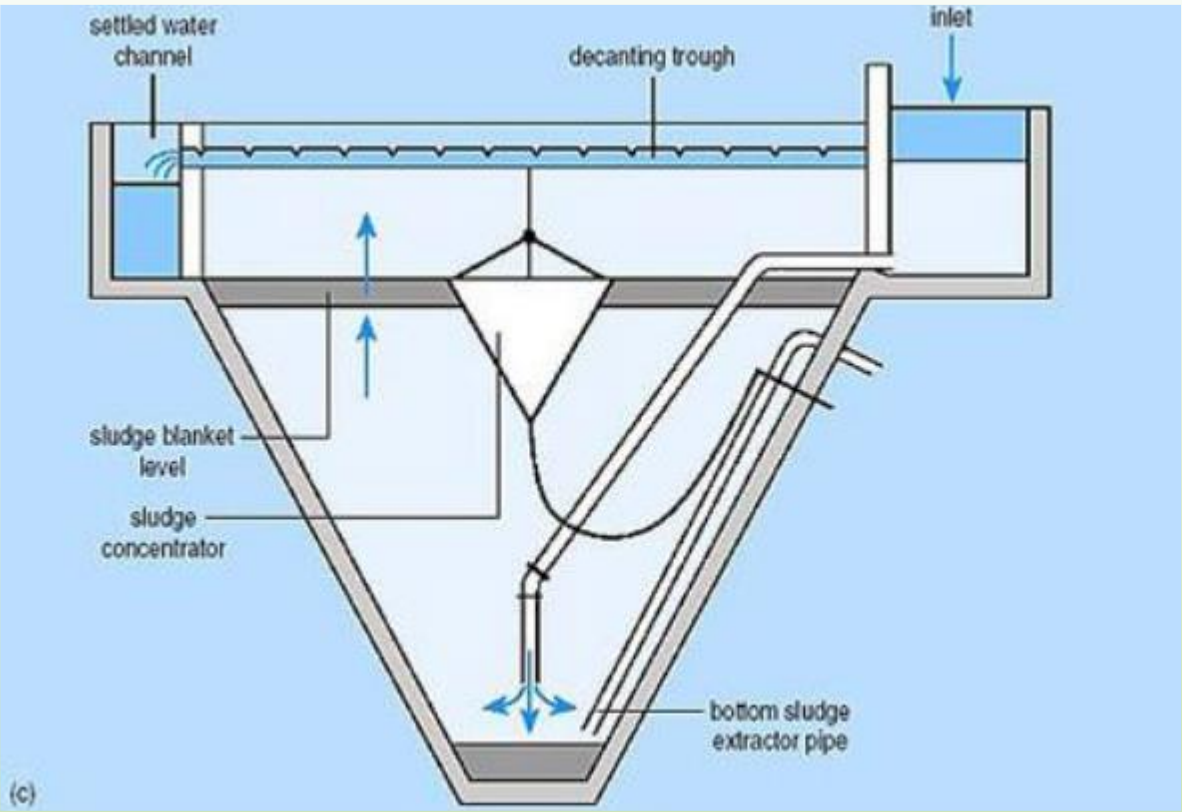
Trouble shooting

Source WaterQuality Changes	Operator Actions	Possible Process Changes
Turbidity Temperature	👍 Perform necessary analyses to determine extent of change 👍 Evaluate overall process performance 👍 Perform jar tests 👍 Make appropriate process changes 👍 Increase frequency of process monitoring	👍 Adjust coagulant dosage 👍 Adjust flash mixer/flocculator mixing intensity 👍 Add coagulant aid or filter aid 👍 Adjust alkalinity or PH 👍 Change Coagulant(s)
Coagulation Process Effluent Quality Changes	**Operator Actions**	**Possible Process Changes**
Turbidity Alkalinity PH	Evaluate source water quality Perform jar tests Verify process performance Make appropriate process changes	👍 Adjust coagulant dosage 👍 Adjust flash mixer/flocculator mixing intensity 👍 Adjust alkalinity or PH 👍 Change Coagulant(s)
Flocculation basins floc quality changes	**Operator Actions**	**Possible Process Changes**
Floc formation	👍 Observe floc condition in basin: ✓ Dispersion, ✓ Size, and ✓ Floc strength (breakup). 👍 Evaluate overall process performance 👍 Perform jar tests ✓ Evaluate floc size, settling rate and strength ✓ Evaluate quality of supernatant clarity (turbidity), pH, and color 👍 Make appropriate	👍 Adjust coagulant dosage 👍 Adjust flash mixer/flocculator mixing intensity 👍 Add coagulant aid or filter aid 👍 Adjust alkalinity or PH 👍 Change Coagulant(s)

SEDIMENTATION BASINS

General

The Basin can be divided into four zones.
Inlet zone
Settling zone
Sludge zone
Outlet zone



Routine Sedimentation Process Actions

Monitor Process Performance and Evaluate Water Quality Conditions	**Location**	**Frequency**	**Possible Operator Actions**
Turbidity Temperature	Influent/ Effluent Influent	At least once every 8-hour shift occasionally	👍 Increase sampling frequency when process water quality is variable 👍 Perform jar tests 👍 Make necessary process changes: ✓ Change coagulant dosage. ✓ Adjust flash mixer/flocculator mixing intensity. 👍 Change frequency of sludge removal 👍 Change coagulant
Make Visual Observations	**Location**	**Frequency**	**Possible Operator Actions**
Floc settling characteristics Floc distribution Turbidity (clarity) of settled water	First half of basin Inlet Launders of settled water conduit	At least once per 8-hour shift At least once per 8-hour shift At least once per 8-hour shift Note- Depends on size of plant	👍 Perform jar tests. 👍 Make necessary process changes: a. Change coagulant dosage. b. Adjust flash mixer/flocculator mixing Intensity. c. Change frequency of sludge removal. d. Change coagulant

Routine Sedimentation Process Actions

Check Sludge Removal Equipment	**Location**	**Frequency**	**Possible Operator Actions**
Noise, Vibration, Leakage, Overheating	Various	Once per 8-hour shift	👍 Correct minor problems. 👍 Notify others of major problems.
Operate Sludge Removal Equipment	**Location**	**Frequency**	**Possible Operator Actions**
Perform normal operations sequence Observe conditions of sludge being removed	Sed. Basin	Depends on processconditions(may vary fromonce per dayto severaldays or more)	Change frequency of operation: a. If sludge is too watery, decrease frequency of operation and/or pumping rate. b. If sludge is too dense, bulks, or clogs discharge lines, increase frequency of operation and/or pumping rate. c. If sludge is septic, increase frequency of operation and/or pumping rate.
Inspect Facilities	**Location**	**Frequency**	**Possible Operator Actions**
Check sedimentation basins Observe basin water over launder weirs. Observe basin water surface Check for algae buildup on basin walls and launders	Various Various Various Various	Once every 8- hour shift Once per 8- hour shift Once per 8- hour shift Occasionally	👍 Report abnormal conditions. 👍 Make flow changes or adjust launder weirs. 👍 Remove debris from basin water surface.

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