

## **A Study on Water Purification Using UV Technique Water Treatment Plant**

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**Abstract** - *The raw water quality available in India varies significantly, resulting in modifications to the conventional water treatment scheme consisting of **aeration, chemical coagulation, flocculation, sedimentation, filtration and disinfection by UV technique.***

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### **I. INTRODUCTION**

Water Treatment Plants are installations where waste or dirty water is converted into better quality water through various physical and chemical processes. Wastewater treatment processes are designed to achieve improvements in the quality of the wastewater. Drinking water treatment plants are used to remove particles and organisms that lead to diseases and protect the public's welfare and supply pure drinkable water to the environment, people and living organisms. In addition, they also provide drinking water that is pleasant to the senses: taste, sight and smell and provide safe, reliable drinking water to the communities they serve. Water treatment, as a word originally means the act or process of making water more potable or useful, as by purifying, clarifying, softening or deodorizing it.

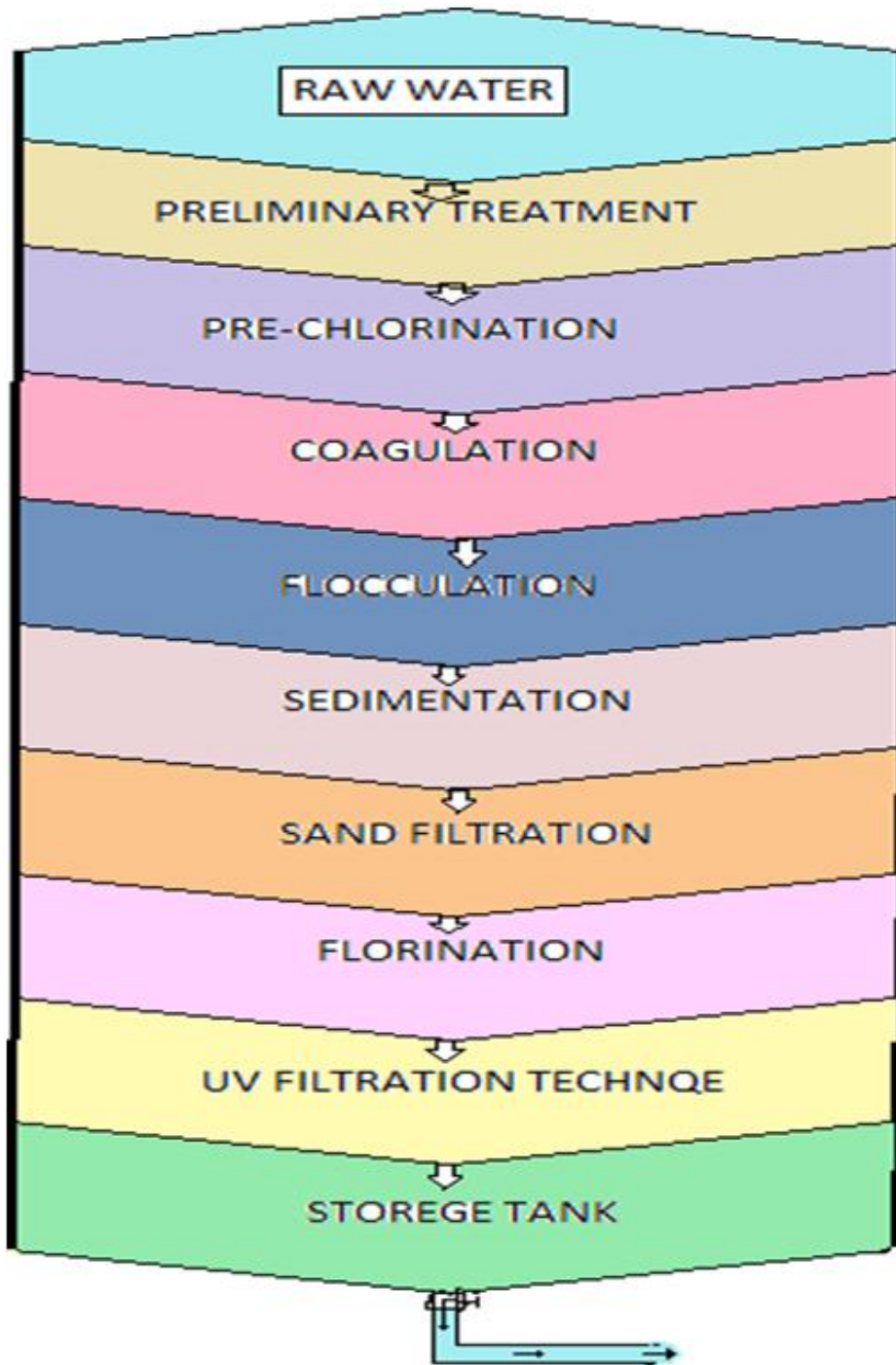
Water treatment and disinfection with high-energy UV radiation is an environmentally-friendly method established more than 100 years ago. It uses no chemicals, such as chlorine or ozone.

Special UV lamps destroy microorganisms including bacteria, viruses and parasites and help decompose chemicals harmful to health.

UV treatment does not affect the smell or taste of the water.

This UV solution is used for example for treating ship ballast water, industrial process and drinking water, municipal sewage, industrial waste, water treatment for aquaculture and agriculture, and in recycling processes.

**II. The flow chart of water purification system**



**Figure 1**

Strong economic growth with the rapid urbanization of cities has resulted in an exponential rise in drinking water demand and wastewater generation. The per capita wastewater generated by the class-I and class-II cities and towns, representing more than 70% of urban population in India, has been estimated to be around 98 lpcd, while for metro cities like Mumbai and Delhi, the rate is a staggering 220 lpcd. An alarmingly high 70% of the urban wastewater flows untreated into the river and sea.

Water Purification Technique

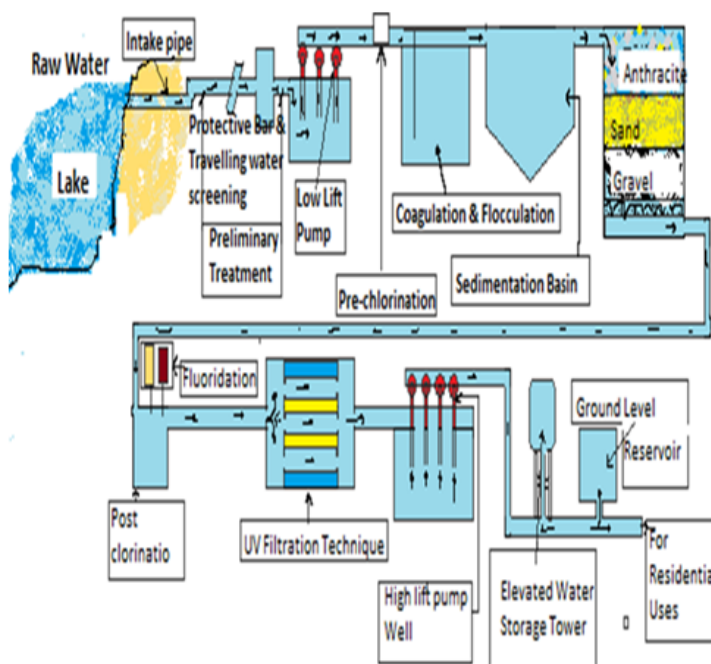


Figure 2

### III. Operation / Process of Water Treatment unit

**Bar Screening :** Screening of water a bar screen is a mechanical filter used to remove large objects, such as rags and plastics, from wastewater. It is part of the primary filtration flow and typically is the first, or preliminary, level of filtration, being installed at the influent to a wastewater treatment plant.

**Low Lift Pump & Intake pipe :** Pumps are used in water work for the following main reasons

- To lift raw water from a surface source of supply.
- To lift raw water from the wells (under ground source of supply).
- To fill elevated storage tank (distribution reservoirs).
- To deliver treated water to consumer taps at desired pressure.
- To boost line pressure.
- Supply fire pressure for fire hydrants.
- To back wash filters.
- To dewater tank basins sumps etc.
- To pump chemical solutions.

A water work intake is a device or structure placed in surface water source to permit water the withdrawal of water from this source & then discharge in to an intake conduit through which it will flow into the water work system.

**Per – Chlorination :** In the treatment of water for the purpose of corrosion control and disinfection, both pre- and post chlorination are involved. In pre-chlorination, chlorine is added to the raw water prior to flash mixing and post screening. The excess chlorine is beneficial in the various stages of treatment by: Aiding coagulation.

**Coagulation :** Coagulation is the chemical water treatment process used to remove solids from water, by manipulating electrostatic charges of particles suspended in water. This process introduces small, highly charged molecules into water to destabilize the charges on particles, colloids, or oily materials in suspension.

**Sedimentation :** Sedimentation is a physical water treatment process using gravity to remove suspended solids from water. Solid particles entrained by the turbulence of moving water may be removed naturally by sedimentation in the still water of lakes and oceans.

**Flocculation:** Flocculation is the agglomeration of destabilized particles and colloids toward settleable (or

filterable) particles (flocs). Flocculated particles may be small (less than 0.1 mm diameter) microflocs or large, visible flocks (0.1 to 3.0 mm diameter). Normally flocculation involves process of gentle stirring to enhance contact of destabilized particles and to build floc particles of optimum size, density, and strength to be subsequently removed by settling or filtration.

**CLARIFIER :** After proper flocculation (floc formation process) the tanks in which water is allowed to settle is known as coagulation basin. In these tank flocs settle down at the bottom and clear coming out taken for further purification. The sedimentation tank is also called settling tank or clarification.

**FILTRATION:** Filtration is the most relied water treatment process to remove particulate material from water. Coagulation, flocculation, and settling are used to assist the ration process to function more effectively. The coagulation and settling processes have become so effective that sometimes filtration may not be necessary. However, where filtration has been avoided, severe losses in water main carrying capacity have occurred as the result of slime formation in the mains. Filtration is steel essential.

**DISINFECTION:** Chlorination became the accepted means of disinfection, and it is the single most important discovery in potable water treatment. Disinfection of potable water is the specialized treatment for destruction or removal of organisms capable of causing disease; it should not be confused with sterilization, which is the destruction or removal of all life. Pathogens (disease producing organisms) are present in both groundwater and surface water supplies

**CHLORINATION:** chlorine is the chemical predominantly used in the disinfection of potable water supplies The first application of chlorine in potable water treatment was for test and odors control in the 1830s Currently, chlorine is used as a primary disinfectant in potable water treatment . Chlorine is available in a variety of forms, including elemental chlorine (liquid of gas). solid hypo chlorine compounds of calcium or sodium, and gaseous chlorine dioxide

**OZONATION :** Ozone has used for disinfection and for taste and odor control in water supplies. In addition to its use as a disinfectant, pre-ozonation is also used for (a) removal of taste and odors. (b) removal of color, (c) removal of iron and manganese, (d) enhanced removal of organic matters and (e) oxidation and volatilization of organics. Ozone is an unstable gas; therefore, it has to be generated on site. In addition, ozone cannot be used as a secondary disinfectant. Because of its high oxidation potential, ozone requires certain contact time between the dissolved ozone and water. The challenge is to reduce the spreading in contact time (CT concentration times hydraulic residence time). This spreading is mainly caused by (turbulent) flow and mixing properties. As a micro flocculation aid, ozone is added during or before rapid mix followed by coagulation:

#### UV WATER PURIFICATION TECHNIQUE

UV Have you ever wondered how modern water purifiers completely purify water and make it safe to drink? Well, it's the water purification technology used that's doing all the work. UV (ultraviolet) purification is one of the leading water purification technologies modern water purifiers use.

UV water purification systems purify water by using ultraviolet rays to kill microorganisms present in the water. UV rays completely kill water-borne microorganisms and prevent their reproduction by disrupting their DNA. Also, UV rays do not lead to chemical changes in the water. As such, water purified from UV rays doesn't contain any harmful microorganisms and retain their original taste.

A research shows that in the chlorination, ozone-tion, fluoridation are time taken by a small particle such as a 0.06 mm trembling particle to sit in the bottom of a tank of the same height is 10 times more than the time it takes for a 0.02 mm tremor particle to sit in the tank. In sitting down on the floor of. In UV as well as technique possible to remove the tremor particle.

Modern water purifiers use low-pressure mercury vapor lamps which produce ultraviolet radiation at a specific level. The mercury vapor lamps are installed in such a way that they do not contact water.

#### Benefits of UV water purification

There are many benefits of choosing a water purifier with UV purification. These include:

- Water purification in a jiffy  
One of the biggest advantages of using a UV water purifier is instant purification of water. UV water purifiers can purify water as soon as you switch on the electric supply.
- No purification chemicals used  
UV water purification systems do not any chemicals. As such, the color, odors, and taste of the water are unadulterated.

- **Cost-effective method**

UV water purifiers are cost-effective; the mercury vapor lamp of the appliance is similar to a standard light bulb in terms of power consumption and price.

- **Removes a number of germs and bacteria**

UV rays of UV water purifiers can kill a number of disease-causing germs and bacteria present in the water, including Cryptosporidium, Giardia, and E. Coli.

**Maintenance tips for UV water purifiers**

UV water purifiers can last long, especially if you regularly maintain the appliance. Here are a few maintenance tips to help you keep your UV water purifier functioning smoothly:

- **Clean the internal parts regularly**

The internal parts of UV water purifiers get dirty over time as minerals and tiny debris present in the water accumulate and build-up. This can, in turn, lower the appliance's performance as the deposit build-up in the glass housing of the mercury vapor lamp can interfere with the penetration of the UV rays. Depending on the quality of water that's supplied to your home, clean the internal parts of the appliance every 1 or 2 months.

- **Changing the UV lamp**

UV lamps tend to Solaris and their intensity can decrease over time. This is true if the UV lamp of a water purifier is turned on and off frequently. Have a professional check your water purifier's UV lamp checked every year, and replace if it has started to Solaris.

### **Acknowledgement**

This water is collected and then directed to treatment plant using drainage system. The water treatment process may vary slightly at different locations, depending on the technology of the plant and the water it needs to process.

### **Reference:**

- [1]. Water Supply And Sanitary Engineering (Environmental Engineering] By Gurucharan Singh Jagdish Singh
- [2]. Fundamentals Of Water Supply And Sanitary Engineering By S.C.Rangwala
- [3]. Elements Of Public Health Engineering By Bharat Singh D. L. Gupta
- [4]. Central Pollution Control Board (Ministry Of ENVIRONMENT AND FORESTS) Website : [Www.Cpcb.Nic.In](http://www.Cpcb.Nic.In) E-Mail : [Cpcb@Nic.In](mailto:Cpcb@Nic.In) Info@[Sciencefaircenter.Com](http://Sciencefaircenter.Com)
- [5]. Water purification technologies. Explore our collection at <https://www.kutchina.com/product-category/water-purifiers/>.
- [6]. [https://www.heraeus.com/en/hng/industries\\_and\\_applications/uv\\_technology/uv\\_water\\_treatment.html#:~:text=Water%20treatment%20and%20disinfection%20with%20high,and%20agriculture%2C%20and%20in%20recycling%20processes.](https://www.heraeus.com/en/hng/industries_and_applications/uv_technology/uv_water_treatment.html#:~:text=Water%20treatment%20and%20disinfection%20with%20high,and%20agriculture%2C%20and%20in%20recycling%20processes.)