

## DISINFECTION OF WATER BY UV- RADIATION AS COMPARED WITH CHLORINE DISINFECTION

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**Abstract:-**The main objective of this research was to study disinfection of Coliform bacteria as water microbial pollution index using a low pressure UV lamp in a batch reactor. Disinfection of water containing E. coli is a major concern. The ultraviolet (UV) irradiations are used to solve the bacteriological problem of the drinking water quality. A discharge-gas lamp is used to produce this type of irradiation. In particular, I introduce the complicated UV lamp model and the water disinfection kinetics, where the radiant energy flux emitted by the discharge gas lamp and the arc voltage are a complex functions of the current and time. This system is intended to be mainly used in rural zones, the photovoltaic modules as source of energy is an adequate solution. This paper is reviewed on the cost and compare of disinfection by chlorine and UV light. The dominant use of chlorine in small water system may be due to historical reason and a failure to modernize after the wide spread availability of electricity in small and rural communities. In some paper it is found that up to population of 3000 people community UV treatment is cheaper than chlorine disinfection in potable water.

**Keywords: -** Water disinfection, Ultraviolet light, Chlorine, E-coli.

### I. INTRODUCTION

Conventional methods of disinfection of water are not so effective and there are problems associated with the usage of very expensive instruments. The reuse of wastewater after adequate treatment constitutes a potential water resource which could be of great interest to several sectors, especially in countries suffering from a deficiency in water resource. Ultraviolet light has been shown to be very effective for the disinfection of drinking water and wastewater. Ultraviolet disinfection is a well established technology for disinfecting water effluents. UV light, specifically around the germicidal wavelengths (200-300 nm), inactivates microorganisms by penetrating through the cell wall and altering the microorganism's DNA. This is widely believed to be the main mechanism for the UV disinfection of water. It has been reported that UV light can also cause disinfection through the production of highly oxidative species such as hydroxyl radicals in the presence of certain photo-catalysts and photoactive species. [1,2]

The other disinfection methods like chlorination, reverse osmosis are effective against most pathogens but are too costly to implement. Chlorine and chlorine-containing compounds are widely used as bleaches and disinfectants, providing consumers with more vivid whites from their laundry, cleaner swimming pools and spas, and brighter pulps for the high grade paper they use. In addition, these products are used to disinfect and sanitize food and household surfaces, disinfect hard surfaces and medical instruments in health care settings, and provide the public with safe drinking water. Consumers prefer them in many applications where chlorine-free materials or processes are available because of their performance and cost advantages. [2, 3]

Disinfection is always carried out on public water supplies in the UK to protect public health, by killing or inactivating harmful microorganisms, including bacteria and viruses, which may be present in drinking water.

Worldwide, many thousands of people continue to die each year from waterborne diseases. Sickness and diarrhea and diseases including cholera and typhoid are spread by drinking water which is contaminated with human excrement. [4, 6]

Disinfection of surface water is carried out by a two stage process of physical removal of pathogens followed by inactivation with an oxidizing agent. For water stored in underground aquifers the first stage is carried out by filtering through the ground. There are several ways of disinfecting water supplies, and the main methods are listed below.

1. Physical removal of bacteria and viruses.
2. Chlorine
3. Ultraviolet light
4. Ozone

Chlorination is commonly used in the UK because it is very effective at disinfecting the water, is harmless to humans at the concentrations used and is relatively cheap. It also provides protection for the water after it leaves the treatment works and as it travels through the network of pipes and reservoir into people's homes. Chlorine gas or liquid sodium hypochlorite is injected into the water during treatment and allowed contact time for the disinfection process to work. In some areas chloramine is the preferred agent to provide a residual disinfection in the network. Dissolved organic matter can react with chlorine to form harmful by products, and therefore organic matter may need removing before disinfection with chlorine. [9,10]

Other disinfection methods have different advantages, and can be used in conjunction with chlorine or as a substitute, depending on the specific circumstances. In rural locations for private water supplies the most effective option may be disinfection with a small ultraviolet light unit. [14, 15]

In US paper it is reviewed that the comparative cost of UV disinfection with ozonation and chlorination for a range of system sizes (from 9-7000 cubic meter/day) and concluded that UV disinfection is effective and affordable relative to conventional disinfectants assuming US labor cost and infrastructure. UV is slightly more expensive than chlorine disinfection for a plant which produces 3785 cubic meter per day. [8]

## **II. METHODOLOGY**

Usually there are many disinfection processes for the removal of micro-organism from water such as TiO<sub>2</sub>, Chlorine, Ozone, Ultraviolet light, SODIS, Ultrasound. The TiO<sub>2</sub>, Ozone, Ultrasound methods are expensive methods, but chlorine and ultraviolet light methods are cheaper and SODIS is use only such place where the availability of sunlight is maximum. It is found that chlorine produced their by-products in water; therefore ultraviolet light for water disinfection is use because it not produces any by-products in water. In this paper I have performing on ultraviolet lights as compared with chlorine. The experiment was set-up in environmental laboratory. Firstly, the set-up was made in plastic box, but it does not sustain and get melted due to the high temperature of UV lights. Therefore, it can be replaced by glass box of size 25cm X 25cm X 25cm and consist of two(6watt) germicidal UV light of size 15cm . The experiment was performed by taking 1 liter of lake water from three different points. The physicochemical characteristics of raw water are analyzed. Microbial contamination is analyzed for raw water in autoclave, and then raw water is treated with chlorine, after it would be again analysis for microbial contamination. Similarly, same procedure is done for UV lights. Then the tested results of chlorine and UV lights will be compared with raw water results. The water will be exposed in UV lights for different time of interval for disinfection and then microbial contamination is checked for the same. Further, chlorine is added into the water with different dosage and exposed with UV lights in different time of interval.

### **III. OBJECTIVE**

1. To conduct feasibility batch studies to evaluate performance of UV-lamp through analysis of influent and effluent samples.
2. To design the experimental set-up for UV-lamp.
3. To do physic-chemical and bacteriological characterization.
4. The efficacy of UV-radiation disinfection will be compared by chlorine disinfection.
5. To suggest on best methods and practices that can be recommended for disinfection of contaminated water for water treatment plant

### **IV. RESULT AND DISCUSSION**

From all the papers it is found that ultraviolet lights is more effective than chlorine for small scale treatment process and it does not produce any by-products when react with water. Also the other disinfectant products were costlier than UV and chlorine. Chlorine is easily available and cheap product therefore it can be used widely as compared to UV. But in western country UV light is used for disinfection of water as single or with chlorine because chlorine produce their by-products when react with water if use in excess which is harmful for human health as well as for environment. In UV light there is no use of chemicals.

### **V. CONCLUSION**

From this paper it is concluded that other product is highly costlier. UV is useful for disinfectant of water as compared to chlorine for small scale purposes. And it is also found that UV is cheaper than chlorine for the same.

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