Water Treatment for Food & Beverage Industry, Drinking Water and Industrial Processes

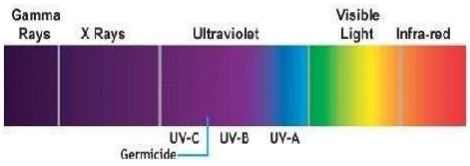
Written by : Sudarma Linggih, Ir.MBA

High quality water is critical for both human consumption and industrial processes. Bayern UV (Ultraviolet) Technologies leads the industry with innovative technologies to help you no matter your process water needs.

UV-C light is a type of electromagnetic radiation that lies between X-rays and visible light with a wavelength between 200 and 280 nanometers. When microorganisms or algae are exposed to UV-C light, the radiation penetrates their outer cell membrane and damages their DNA. This damage causes mutations and other changes in the DNA that prevent the microorganisms or algae from replicating or carrying out other essential biological functions, ultimately leading to their death [2].

Bayern UV systems:
The UV systems treat groundwater and drinking water featuring conventional UV disinfection solutions. Ultraviolet light alters the DNA of harmful organisms without the use of chemicals, rendering pathogens unable to reproduce and then destroyed.

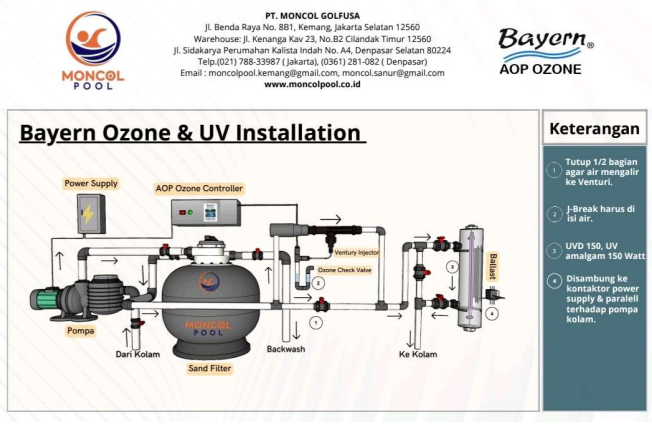
Figure1, Bayern Ultraviolet (UV) Sterilizer



As the water passes through the UV-C lamp, microorganisms and algae present in the water are exposed to the UV-C radiation and died. This process is highly effective and does not introduce any chemical into the water, making it a popular alternative to traditional water treatment methods.

Advanced Oxidation Process:
Bayern UV systems can be packaged with other oxidant generators, such as ozone, for advanced oxidation process (AOP) treatment to tackle complex applications and contaminants of emerging concern. Advanced Oxidation Process produces highly energetic free hydroxyl radicals.

These hydroxyl radicals (*OH) react with the organic and inorganic contaminants in the water, breaking them down into smaller molecules and eventually into harmless substances such as carbon dioxide and water. The process is highly effective at removing a wide range of contaminants, including pesticides, volatile organic compounds (VOCs), and pharmaceuticals [4].



In water treatment and swimming pool applications, UV-C lamp is often used in conjunction with ozone and filtration systems — using granular filter media such as **manganese greensands, granular active carbon (GAC)** and silica sands — to eliminate harmful microorganisms and algae from the water.

Figure 2, Advanced Oxidation Process Installation.

Manganese Greensand :

Manganese greensand is an effective filter media used to decrease high levels of iron, manganese, and hydrogen sulfide in well water. The manganese dioxide coating on the greensand acts as a catalyst in the oxidation-reduction reaction of iron and manganese, which allows for these contaminants to be trapped inside the filter medium.

The media requires periodic backwashing and regeneration to remove the contaminants and maintain its effectiveness. However, the use of manganese greensand for water treatment should be recommended by a water treatment professional based on the specific characteristics of your well water [6].

Figure 3, Manganese Greensands

Granular Active Carbon (GAC) :

The quality of drinking water is ensured by hygienic barriers and filtration steps, such as ozonation and activated carbon filtration. Granular activated carbon is a highly effective water treatment technology that can remove a wide range of contaminants from water, including organic and inorganic compounds.

Activated carbon is commonly used to remove chlorine, which is added to municipal water supplies for disinfection purposes, but it can also remove a variety of other pollutants, such as pesticides, volatile organic compounds (VOCs), industrial chemicals, pharmaceuticals, and heavy metals. The effectiveness of GAC in removing chlorine will depend on factors such as the contact time between the water and the carbon, the pH of the water, and the type of chlorine present in the water.

These contaminants can enter water sources through a variety of means, such as agricultural runoff, industrial discharges, and improper disposal of household chemicals. Active Carbon works by adsorbing the contaminants onto its surface, thereby removing them from the water. The result is water that is cleaner and safer for human consumption and other uses 7). In addition to that, silica sands are commonly used as filtration media for decreasing dissolved solids in water.

Figure 4, Granular Activated Carbon

Water Treatment Projects:
Since 15 years ago, our experts made the initial discovery of the effectiveness of UV light for treating pathogen microorganisms and protozoa, including Cryptosporidum parvum and Giardia lamblia. Today, there have been many projects of water treatment for commercial water and food & beverage industry installed and treated by Bayern UV disinfection systems.

For example, UV reactors and AOP treatment have been installed at our following projects :

1. Well water treatment for the birdnest industry in Medan, North Sumatra.
2. Process water treatment for the companies of exporting birdnest in Jakarta, 4 projects.
3. Process water treatment for the lobster hatchery in Lampung, Sumatra
4. Process water treatment for the Lobster hatchery in Situbondo in East Java
5. Groundwater and brine water treatment for the export oriented tuna industry in Bitung, North Sulawesi
6. Well water treatment for the export oriented tuna industry in Ambon, Maluku, Indonesia.
7. Drinking water treatment for a mineral water industry in Bali.
8. Process water treated with UV and Ozone for the shrimp export company in Jakarta, Indonesia.
9. Sea water treated with AOP Ozone (UV and ozone) in Lampung, Sumatra. etc.

How are the steps to decide what kind of water treatment to be used ?

In order to get a suitable result you wish to see, we need to do the following procedures :

1. Take a water sample of 1,5 to 2 liters and then put it in a container, and seal it tightly so that there is no air from outside of the container coming in contact with the water sample.
2. Send the water sample to a water testing laboratory and get it tested based on the standard of Indonesian Department of Health, No.492/PERMENKES/2010 or PERMENKES/2017. For example, table 1 consists of parameters for water testing.
3. From the result of water testing, ***enclosed table 1***, then we can analyze which kind of water treatment should be used for it.
4. Furthermore, our water expert will propose the solution and make the quotation for a water treatment plant to solve the problem. The water target quality is to pursue the above standard imposed by the government of Indonesia.

Conclusion :

There are many water treatments which can be applied for human consumption and industrial process water. In order to get a suitable and satisfied result you wish to achieve related to its usage, there are some procedures we need to take. First, we need to test the physical, microbial and chemical characteristics of the water source, whether it is from groundwater, surface and municipal water in reference to the Indonesian Standard.

Then, based on its test result, we can analyze it and decide what kind of treatment train we should use. Most of the times, the combination process of advanced oxidation process (AOP) coupled with filtration system using manganese greensands and/or activated carbon media would be enough to be applied for a superb result, in which the AOP is generated in situ through a combined of ozone generator and UV Sterilizer.

References :

1.WHO's Conference in Geneva, ***Nutrients in Drinking Water : Water, Sanitation and Health Protection and the Human Environment ,*** World Health Organization (WHO) , Geneva, Switzerland.

2.U.S. Environmental Protection Agency (U.S.EPA), ***Ultraviolet Disinfection Guidance Manual for The Final Long Term 2 Enhanced Surface Water Treatment Rule***, Washington D.C., USA, 2010.

3. Ledy Afriani, Sulistyani, T., ***The Ultraviolet (UV) Technology as a Disinfection of Drinking Water***, International Journal of Health, Education and Social, June 2020.

4. Pandis, P. K.; Kalogirou, C., et al, ***Key Points of Advanced Oxidation Process (AOP) for Wastewater, Organic Pollutants and Pharmaceutical Waste Treatment: A Mini Review***, MDPI, Basel, Switzerland, 2021.

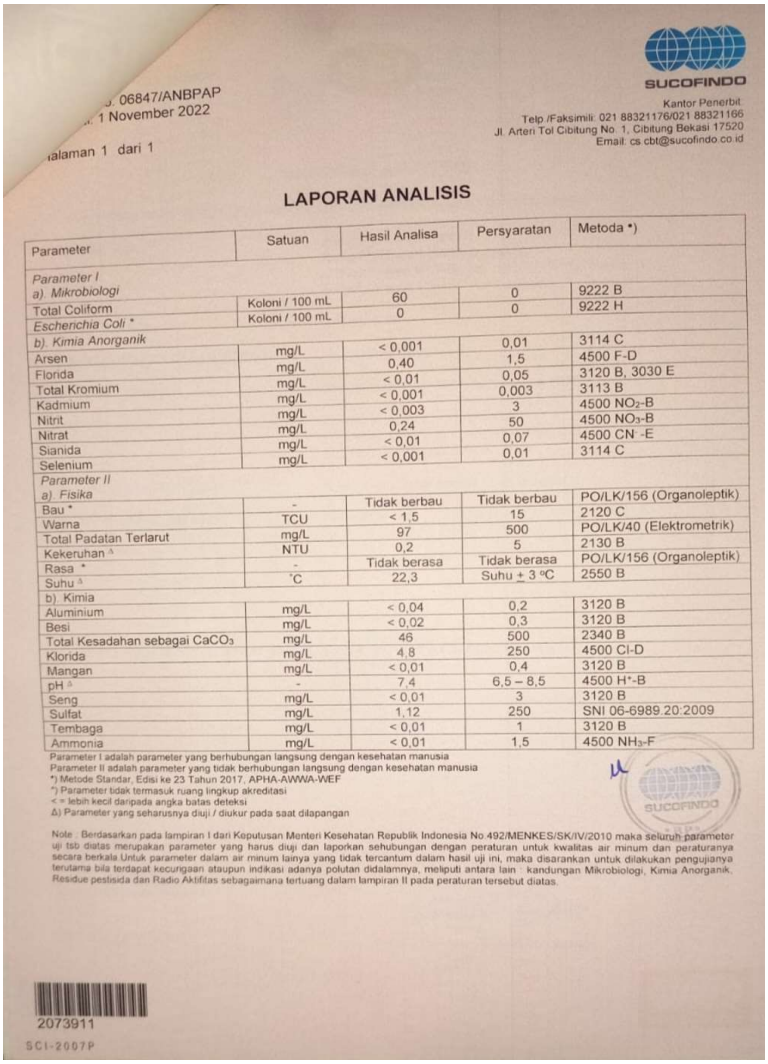
5. Lu,H.;Li,Q., et al, ***Application Progress of O3/UV Advanced Oxidation Technology in the Treatment of Organic Pollutants in Water***, MDPI, Basel, Switzerland, 2022.

6. Hungerford & Terry, ***Manganese Greensand Filter Removes Iron, Manganese, and Arsenic from Groundwater***, Wastewater Digest, USA, March 2003

7. da Silva-Medeiros, F.V., ***Evaluation of the Removal of Chlorine, THM and Natural Organic Matter from Drinking Water Using Microfiltration Membrane and Activated Carbon in a Gravitational System***, IntechOpen.

8. Kaleta, Jadwiga, et al., ***The use of Activated Carbons for Removing Organic Matter from Groundwater,*** Researchgate, January 2017.

.



SUCOFINDO

Kantor Penerbit:
Telp./Faksimili: 021 88321176/021 88321166
Jl. Arteri Tol Cibitung No. 1, Cibitung Bekasi 17520
Email: cs.cbt@sucofindo.co.id

06847/ANBPAP
1 November 2022

Halaman 1 dari 1

LAPORAN ANALISIS

Parameter	Satuan	Hasil Analisa	Persyaratan	Metoda *)
Parameter I				
a). Mikrobiologi				
Total Coliform	Koloni / 100 mL	60	0	9222 B
Escherichia Coli *	Koloni / 100 mL	0	0	9222 H
b). Kimia Anorganik				
Arsen	mg/L	< 0,001	0,01	3114 C
Florida	mg/L	0,40	1,5	4500 F-D
Total Kromium	mg/L	< 0,01	0,05	3120 B, 3030 E
Kadmium	mg/L	< 0,001	0,003	3113 B
Nitrit	mg/L	< 0,003	3	4500 NO_2-B
Nitrat	mg/L	0,24	50	4500 NO_3-B
Sianida	mg/L	< 0,01	0,07	4500 CN^--E
Selenium	mg/L	< 0,001	0,01	3114 C
Parameter II				
a). Fisika				
Bau *	-	Tidak berbau	Tidak berbau	PO/LK/156 (Organoleptik)
Warna	TCU	< 1,5	15	2120 C
Total Padatan Terlarut	mg/L	97	500	PO/LK/40 (Elektrometrik)
Kekeruhan Δ	NTU	0,2	5	2130 B
Rasa *	-	Tidak berasa	Tidak berasa	PO/LK/156 (Organoleptik)
Suhu Δ	°C	22,3	Suhu ± 3 °C	2550 B
b). Kimia				
Aluminium	mg/L	< 0,04	0,2	3120 B
Besi	mg/L	< 0,02	0,3	3120 B
Total Kesadahan sebagai $CaCO_3$	mg/L	46	500	2340 B
Klorida	mg/L	4,8	250	4500 Cl-D
Mangan	mg/L	< 0,01	0,4	3120 B
pH Δ	-	7,4	6,5 – 8,5	4500 H^+-B
Seng	mg/L	< 0,01	3	3120 B
Sulfat	mg/L	1,12	250	SNI 06-6989.20:2009
Tembaga	mg/L	< 0,01	1	3120 B
Ammonia	mg/L	< 0,01	1,5	4500 NH_3-F

Parameter I adalah parameter yang berhubungan langsung dengan kesehatan manusia
Parameter II adalah parameter yang tidak berhubungan langsung dengan kesehatan manusia
*) Metode Standar, Edisi ke 23 Tahun 2017, APHA-AWWA-WEF
*) Parameter tidak termasuk ruang lingkup akreditasi
< = lebih kecil daripada angka batas deteksi
Δ) Parameter yang seharusnya diuji / diukur pada saat dilapangan

Note : Berdasarkan pada lampiran I dari Keputusan Menteri Kesehatan Republik Indonesia No.492/MENKES/SK/IV/2010 maka seluruh parameter uji tsb diatas merupakan parameter yang harus diuji dan laporkan sehubungan dengan peraturan untuk kwalitas air minum dan peraturanya secara berkala.Untuk parameter dalam air minum lainya yang tidak tercantum dalam hasil uji ini, maka disarankan untuk dilakukan pengujianya terutama bila terdapat kecurigaan ataupun indikasi adanya polutan didalamnya, meliputi antara lain : kandungan Mikrobiologi, Kimia Anorganik, Residue pestisida dan Radio Aktifitas sebagaimana tertuang dalam lampiran II pada peraturan tersebut diatas.

2073911

SCI-2007P

Table 1, Water testing result done by PT. Sucofindo.

Figure 5, Water treatment installation at the apartment in menteng, jakarta.