

## Use of ozoniser to kill bacteria in the beverage industry and water wells revile population

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**Abstract.** Refill beverage product that is widely available throughout the city in Indonesia feared contain contaminants that can damage the health. While industrial activity in Indonesia does not understand the nature of the ecosystem around it, which can cause environmental contamination. Ozone technology is a technology that has the ability to suppress bacteria, carried out at low temperature (20-25° C), do not turn off the eye grows, the process is simple, low operating cost, environmentally friendly and clean work area. Plasma ozonizer used to capacity: PLN 220 V source voltage and 50 Hz, input voltage 25 kV dielectric (no load), frequency of 4 kHz high voltage, 3L/minute Air Flow Rate, Power type ozonizer tube coaxial with the surface area of 60 cm<sup>2</sup> and dielectric materials of glass, ozone production rate of 0.01 mg/sec. From the results of research on a number of drinking water refill in Yogyakarta area showed bacteria E. Coli between 20-36 MPN/100 mL. While some area residents Yogyakarta wells producing bacteria E. Coli between 150-460 MPN/100 mL, with the ozonation process of the bacteria are all dead. From the research it can be used for Plasma Ozonizer beverage and health care industries.

### 1. Introduction

Today many refill drinks industry based populist experiencing problems associated with the product [1][2]. Small industrial refill drinks and beverages is growing in all cities in Indonesia, this development is very beneficial for ailing businesses in Indonesia. However, for the health and safety of the beverage products must be monitored in accordance with the values of the existing health on product yield. With the ozone technology to kill bacteria that exist in the beverage or beverage products refill that can be accepted by the market as a health and safety [3][4][5].

Industries in Indonesia do not understand the nature of the existing ecosystem at about the industry, so as to result in contamination of the environment caused by their activities. In this case would be very detrimental to society now and our children and grandchildren that will come due to damage to the environment which cannot be utilized instead to pose a danger to the community. To overcome this problem, we need a better system for processing, in order to obtain quality mineral water that meets the quality standard requirements, one of the alternatives that can be applied is the ozonation process using ozone generator device that is in BATAN [6][7][8][9].

Ozone is a triatomic allotrope of oxygen gas that can be formed by the recombination of oxygen atoms. Ozone is a colorless gas with nearly a distinctive odor that can be detected by the olfactory senses to a concentration of 0,001 ppm (parts per million). Maximum ozone concentrations in open space is about 0.01 ppm, whereas concentrations as high as 1.00 ppm can still be considered harmless inhaled origin in the respiratory tract to more than 10 minutes [3]. After ozone reacts with other elements will produce oxygen (O<sub>2</sub>) that are environmentally friendly ozone technology or ozone is often said to be the future of green chemistry. Ozone gas (O<sub>3</sub>) can serve as a cleaning, deodorizing as well as disinfecting materials capable of killing all microorganisms such as bacteria, viruses, fungi, and so on. Ozone is a powerful oxidizing materials fourth after fluorine, and when compared to chlorine, ozone power as a disinfectant power can reach 3250 times faster and 50% stronger force oxidation [10][11][12][13]. Given the usefulness and advantages of ozone it is not surprising that up to now still used ozone for sterilization of water, air, and food items as well as materials that can be durable though also safer to be consumed. Ozone benefits are [3] :

- a. Ozone can kill bacteria 3100 times faster than chlorine.

- b. Ozone to eliminate the use of hot water.
- c. Ozone virtually eliminates the use of all chemicals.
- d. Ozone is not toxic.
- e. Ozone is an environmentally friendly substance as by-product is oxygen.
- f. Ozone is very effective as pesticides at low concentrations.
- g. Ozone is very inexpensive to produce.
- h. Ozone is a substance that is not harmful chemicals than other conventional.
- i. Ozone can reduce BOD.

Ozone has strong oxidizing properties. This is shown in Table 1 below:

Table 1. Potential oxidation of various elements [8]

Elements	Potential Oxidation (V)
Fluorine (F)	2,87
Radikal Hidroksil (OH) *	2,86
Oxygen Atom (O)	2,42
Ozone (O <sub>3</sub> )	2,07
Hydrogen Peroxide (H <sub>2</sub> O <sub>2</sub> )	1,78
Chlorine (Cl)	1,36
Chlorine Oxide (ClO <sub>2</sub> )	1,27
Oxygen (O <sub>2</sub> )	1,23

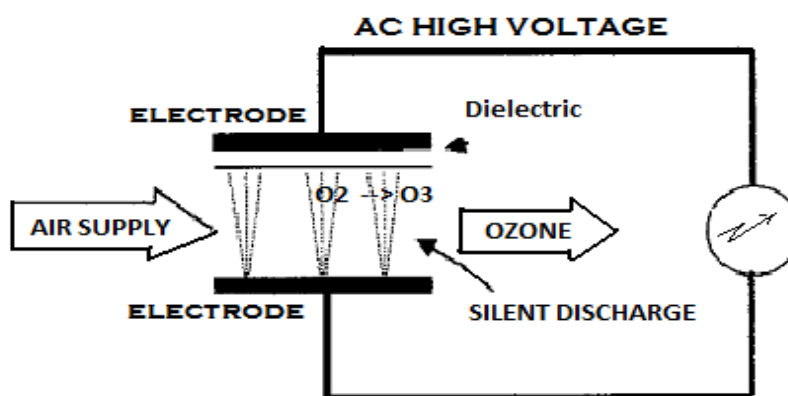


Figure 1. Ozone Generator (Ozonizer)

Ozonizer as shown in figure 1. Using external voltage is high voltage AC is charged at the electrode discharge tube ozonizer silent so there is a gap in the discharge area of the dielectric layer with electrode discharge will occur that are micro-electrical discharge as a whole can be described by the mean quantity [14][15]. In this case the use of ozone-making technology is hindered by the method of dielectric or plasma discharge due to a barely audible lucutannya then this method is often said to be silent discharge plasma method as shown in Figure 1. To support the improvement of the application, the method is designed ozone generator with a power output of 100 watts. Silent discharge technology advantages compared with UV technology is the efficiency of ozone produced greater [3].

Resources alternating voltage with a frequency of the order of kilo Hertz (kHz) is a very important component in supporting the circuit ozonizer unit. The supporting components consist of a series of insulators, power amplifier and voltage amplifier circuit. At first circuit isolator provides a signal (pulse) back and forth, then power is enhanced by the power amplifier circuit further by folding circuit voltage (high voltage transformer) output voltage of the power amplifier circuit was increased to a high voltage [3][9].

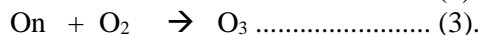
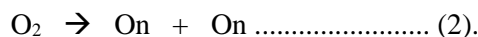
Presence of dielectric cover one of the electrodes is a key function of the perks of silent discharge source in which a dielectric can function filament currents containing energetic electrons (1-10 eV).

The magnitude of this force is an ideal region for the excitation energy of the particles of atoms, molecules that are able to separate the particles of chemical bonds [9].

Ozone production rate can be determined by the absorbance (absorption) on the basis of the nature of ozone that absorbs radiation capable of short wavelength (high energy) that is in the area of spectrum ultraviolet (UV). If the early-powered beam of UV radiation pass P0 radiasi solution then most power will be absorbed by the solution and the rest of the power will be forwarded. Comparison between the transmitted radiation power (P) of the initial radiation (P0) is called transmittance (T) which can be formulated :

$$\text{Transmittance, } T = P/P_0 \dots\dots\dots (1)$$

Ozonnizer made by PTAPB BATAN Yogyakarta can generate ozone gas was 0.02 mg/sec. The working principle of Ozonnizer is air or oxygen (O<sub>2</sub>) is pumped with air compressor, entered through a cylindrical cavity, where the cavity is made of Aluminum material that shrouded the glass tube, glass tube called a dielectric material. The entire surface of the tube was energized high voltage is referred to as whip's end voltage of 25 kV. Air or oxygen (O<sub>2</sub>) that comes out of Ozonnizer will form ozone gas. Formation of ozone gas is affected by the whip's end voltage break down molecules into oxygen radical O<sub>2</sub> (On) Oxygen radicals react with oxygen (O<sub>2</sub>) to form ozone gas (O<sub>3</sub>). Ozone gas is formed by this reaction is only temporary and will split again into oxygen molecules<sup>3</sup>. Zon gas-forming reaction can be seen below<sup>3</sup>:



## 2. Methods

The method of parameters determining for the flexible rotary machine and lines. Procedure and the Drinks Industry Research For Health.

Refill Beverage industry and specific product

1. Sampling was carried out with equipment for the analysis of bacterial
2. Performed on 5 products and 1 product refill existing drinking
3. Do ozonation variation of 10, 15, 30, 45, 60 minutes

Population wells

1. Sampling was carried out with equipment for the analysis of bacterial
2. Performed on 5 wells residents
3. Do ozonation variation of 10, 15, 30, 45, 60 minutes.

## 3. Results

### Refill Beverage industry and specific product

Table 2. Ozonation treatment on some products around Yogyakarta refill drinks and beverage products (X).

No	0 (Minutes)	10 (Minutes)	20 (Minutes)	30 (Minutes)	40 (Minutes)	50 (Minutes)	60 (Minutes)
Refill 1	20	0	0	0	0	0	0
Refill 2	20	0	0	0	0	0	0
Refill 3	36	7	0	0	0	0	0
Refill 4	20	0	0	0	0	0	0
Refill 5	36	0	0	0	0	0	0
Product X	20	0	0	0	0	0	0

From the results of the research can be seen that the product refill beverages and certain beverage products in Yogyakarta still contains E. Coli that is troubling for consumers in the Yogyakarta area that can cause diarrhea and dysentery. After ozonation process with less than 10 minutes the bacteria contained in the beverage product is dead (no longer) that can be consumed safely.

### Population wells.

Table 3. Ozonation treatment on several wells residents of Yogyakarta

No	0 (Minutes)	10 (Minutes)	20 (Minutes)	30 (Minutes)	40 (Minutes)	50 (Minutes)	60 (Minutes)
Well 1	460	360	150	93	20	0	0
Well 2	460	300	150	93	23	0	0
Well 3	150	93	20	0	0	0	0
Well 4	150	36	20	0	0	0	0
Well 5	93	7	0	0	0	0	0

From the results of the research can be seen that the well population with dense housing in Yogyakarta still contains E. Coli that is troubling for residents in the Yogyakarta area that can cause diarrhea and dysentery. After ozonation process with less than 50 minutes the bacteria contained in the beverage product is dead (no longer) so that the population can be consumed safely.

### 4. Conclusion

The content of the bacteria E. Coli on drinks revil in Yogyakarta area is between 20-36 MPN/100 mL and the content of the well population between 150-460 MPN/100 mL with Ozonice process will kill the bacteria E. Coli that can be consumed by the public. The content of E coli bacteria after ozonation 50-60 minutes have died all.

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