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Submission date: 05-Jun-2023 10:34AM (UTC+0700)

Submission ID: 2109093950

File name: INT_2_Treatment_of_hospital_waste_water_by_ozone_technology.pdf (468.77K)

Word count: 1654

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To cite this article: Rina Indah Dianawati *et al* 2018 *J. Phys.: Conf. Ser.* **1025** 012013

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Treatment of hospital waste water by ozone technology

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Abstract. Conventional treatment hospital wastewater need high cost, large area, long time and the final result leaves a new waste known as sludge. Alternative to more efficient and new technologies for treated hospital wastewaters was ozonation.. Ozonation is able to oxidized pollutant materials in wastewater. This research is to know the decrease of COD and TDS levels with ozone . Waste water samples used by dr. Adhyatma, MPH Hospitals Semarang. Kruskal-Wallis test for COD and TDS with variation of concentration p-value = 0,029 and 0,001 ($p \leq 0,05$) or there is significantly difference between COD and TDS with level of concentration but there were no different between levels of COD, and TDS with reactions time variations p-value = 0,735, and 0,870 ($p \geq 0.05$). Ozone effeciently reduction of COD and TDS at a concentration of 100 mg/liter, the lowest mean value at COD 17.47 mg/liter and TDS 409.75 mg/liter.

Keywords: Ozone, COD, TDS

1. Introduction

The hospital becomes a "home" of all kinds of diseases, it can even be a source of disease distribution because it is always inhabited, used, and visited by people who are vulnerable and weak to disease. In this place there can be either cross infection, through the contamination of objects or through insects (vector borne infection) or air so as to threaten the health of the general public. Hospital waste water in the form of organic and inorganic compounds derived from laundry, kitchen, operating room, laboratories, clinics and others.^[1]

COD content is quite high from the operating room also contains phenol and Hg. While the medical service and maintenance activities generate waste water from bathrooms, laundry and pantry. Sometimes this unit also produces medicines waste water.^[2] COD is a measure for water pollution by organic substances which can naturally be oxidized through chemical processes.^[3]

The dissolved solid is the concentration of the number of cationic ions (positively charged) and the anion (negatively charged) in the water. The soluble substances are substances that pass filters on the analysis of suspended solids so that the analysis of dissolved solids can be a continuation of the analysis of suspended solids. Solution containing dissolved substances that passed the 10 μ m filter, then evaporated and dried at 105^oC.^[4]

Chemical oxidation, especially ozonation, has been shown to be an effective means of removing hazardous and / or hazardous chemicals from water and wastewater.^[5] Ozone will dissolve in air to produce radical hydroxyl (-OH), a free radical that has a very high oxidation potential. Hydroxyl radicals are oxidizing agents that can oxidize various organic compounds (phenol, pesticides, atrazine, TNT, and so on).^[6]



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2. Method

2.1. Material

Material used in this research is ozone generator, stopwatch, beakerglass, erlenmeyer, steam, porselen cup, oven, desikator, scale of weights, filter paper whatman, pipet and waste water HgSO_4 , KI 10%, KmnO_4 , $\text{Na}_2\text{S}_2\text{O}_3$ standard, amylum 1%, $\text{K}_2\text{Cr}_2\text{O}_7$.

The working principle of this research is air or oxygen (O_2) pumped with air pump, passing through cylindrical cavity, where the cavity is made of stainless steel which is enclosed by glass tube, glass tube called as dielectric material.⁽⁷⁾ Gas that comes out of the discharge tube that is ozone gas directly accommodated with beaker glass containing 1500 ml of waste water. Gas flow rate is limited to 7 liters / minute. The processing time is recorded from the time the ozone generator turns on until the tool is turned off, where the processing time is varied: 30, 60, 90, and 120 minutes. Medium for the concentration of ozone also made stratified ranging from 100 mg / liter, 200 mg/liter and 300 mg/liter. Measured COD, and TDS, then compared with COD, and TDS of ozone-treated waste samples.

3. Result

In figure 1, variations of ozone concentration 100; 200 and 300 mg/l for Chemical Oxygen Demand. At 100 mg/l ozone concentrations, COD levels reduce 43% from start. In the second sample COD reduce until 65%. COD levels reduce 44% at third sample.

In figure 2, variations of ozone concentration 100; 200 and 300 mg/l for Total Dissolved Solid. At 100 mg/l ozone concentrations, TDS levels reduce until 7,6%. TDS levels reduce 5% and for ozone concentrations 300 mg/l, level of TDS reduce until 4,9%.

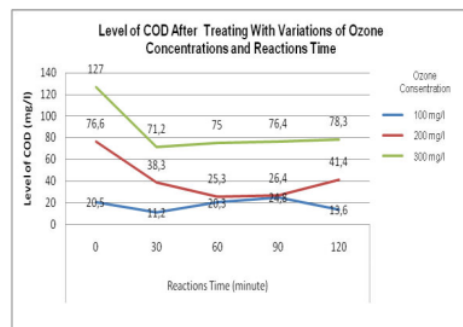


Figure 1. Level of Chemical Oxygen Demand before and after treated with variations of Ozone Concentrations 100; 200; 300 mg/liter dan reactions time 30;60;90;120 minutes

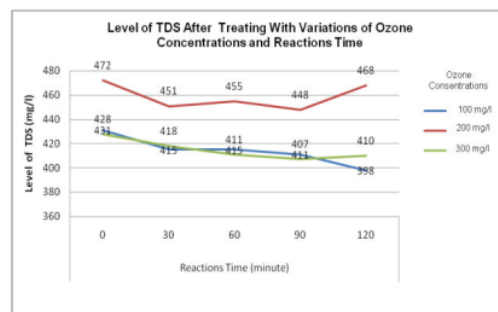


Figure 2. Level of Total Dissolved Solid before and after treated with variations of Ozone Concentrations 100; 200; 300 mg/liter dan reactions time 30;60;90;120 minutes

Table 1 showed significantly less than 0,05, there is differences between before and after being treated of variations ozone concentration 100; 200; 300 mg/liter. In table 2 Total Dissolved Solid less than 0,05, so there is differences between before and after being treated of variations ozone concentration 100; 200; 300 mg/liter.

There was no difference of COD and TDS levels between variation of reaction times. Significancy of COD 0,748 and TDS 0,870 more than 0,05.

Table 1. Statistics Chemical Oxygen Demand between before and after being treated of variations of ozone concentrations 100; 200; 300 mg/liter

Ozone Concentrations (mg/liter)	N	Mean	Median	Sig
0	3	74,70	76,60	
100	4	17,47	16,95	
200	4	32,4	32,45	
300	4	21,00	19,25	
				,002

Table 2. Statistics Total Dissolved Solid between before and after being treated of variations of ozone concentrations 100; 200; 300 mg/liter

Ozone Concentrations (mg/liter)	N	Mean	Sig
0	3	443,66	
100	4	409,75	
200	4	455,50	
300	4	411,50	
			.001

4. Discussion

The overall COD removal is fluctuating, because ozone is unstable and decomposes rapidly. When ozone decomposes, free radicals form and begin advanced oxidation. A typical general reduction of waste COD can be divided into two stages. First, the phase of rapid decline where there is a decrease with high speed, after that the second stage there is a turning point where the reaction velocity decreases as a result of the formation of organic carbon as a temporary result of the process.^[8]

Ozonation removes very small solids by combining them into larger particles (flocs), filterable particles, and by direct reaction through chemical oxidation.. Soluble volatile solids are strongly affected by ozonation. The smaller material is lost to foam. In line with Rueter and Johnson's (1995) suggests that ozone has a coagulant / flocculant effect.^[9]

Dissolved solids of size (<30 µm) account for more than 50% of TSS, 81 to 86% of volatile non-volatile solids (FDS), and only 6-14% reduction in levels by ozone treatment. TDS were not greatly reduced because of their large fixed fraction.^[10]

5. Conclusion

In conclusion, there were significant different between COD and TDS with level of concentration but there were no different between levels of COD, and TDS with reactions time variations.

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