J. Pijar MIPA, Vol. 18 No. 4, July 2023: 608-613 ISSN 1907-1744 (Print)
DOI: 10.29303/jpm.v18i4.5104 ISSN 2460-1500 (Online)

BACTERIOLOGICAL ANALYSIS OF AIR QUALITY IN THE COMMUNITY SETTLEMENT AROUND WASTE DISPOSAL SITES KEBON KONGOK, WEST LOMBOK

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Received: May 31, 2023. Accepted: June 27, 2023. Published: July 31, 2023

Abstract: This study aimed to determine the air quality in the community settlements around the Kebon Kongok Dusun Landfill, Suka Makmur Village, West Lombok Regency. The type of research used was an experiment using NA media as a growth medium for bacteria at 3 points passed by garbage trucks in community settlements and 1 point not passed by garbage trucks in the Kebon Kongok landfill area, Suka Makmur Village. Air quality in residential communities around the waste disposal sites (WDS) Suka Makmur Village does not meet the requirements based on the Minister of Health Regulation number 1077 of 2011 concerning the requirements for biological contaminants, namely the germ count of less than 700 CFU/m3. The air quality index is lower than the other points, namely at Point I of 3,779 CFU/m3, because Point I is a sampling location far from garbage trucks going to the WDS. The highest results in this study were obtained at Point IV, which was 6,933 CFU/m3; this was estimated because the sampling location was in a community settlement which was less than 50 meters from the Kebon Kongok WDS gate with active trucks and heavy equipment activity in the WDS. Microscopic observation obtained gram-positive bacteria at all points.

Keywords: *Air Quality, Bacteriology, Settlement*

INTRODUCTION

Air is one of the most important needs to sustain the life of every living thing. Metabolism in the bodies of living things cannot occur without air oxygen. Problems that can interfere with the quality of the surrounding air can be caused by several things, such as lack of air ventilation, dust, the condition of the equipment inside the building, the condition of the building, and living things. Components derived from living things can be from the activities of humans, animals, plants, and microorganisms. Microorganisms, such as soil, dust, air, and water, are found everywhere. Microorganism cells are so small and light that they are easily blown away by air currents [1]. Along with current developments, air pollution is increasing in closed and open areas (outdoor air pollution) [2]. Air pollution in open places can come from natural sources or natural phenomena, such as volcanic eruptions [3].

Pollution caused by volcanoes is toxic because it contains dust particles which cause health problems in the respiratory tract and eyes. Meanwhile, anthropogenic sources come from all kinds of human activities that produce exhaust emissions, especially due to transportation activities. These gas emissions have toxic properties that bind to hemoglobin, interfering with blood circulation in the body [4]. In addition to gas emissions from the transportation of waste carriers, air pollution is also caused by gases produced from the decomposition of transported waste, such as H_2S gas and methane gas, as well as decomposing microorganisms that live in the waste, even though the air is not the original habitat of microorganisms, such as bacteria. Still, its presence can cause disease in humans. A study found that indoor air pollution killed 3.5 million people, while outdoor air pollution killed 3.3 million people worldwide in 2010 [5].

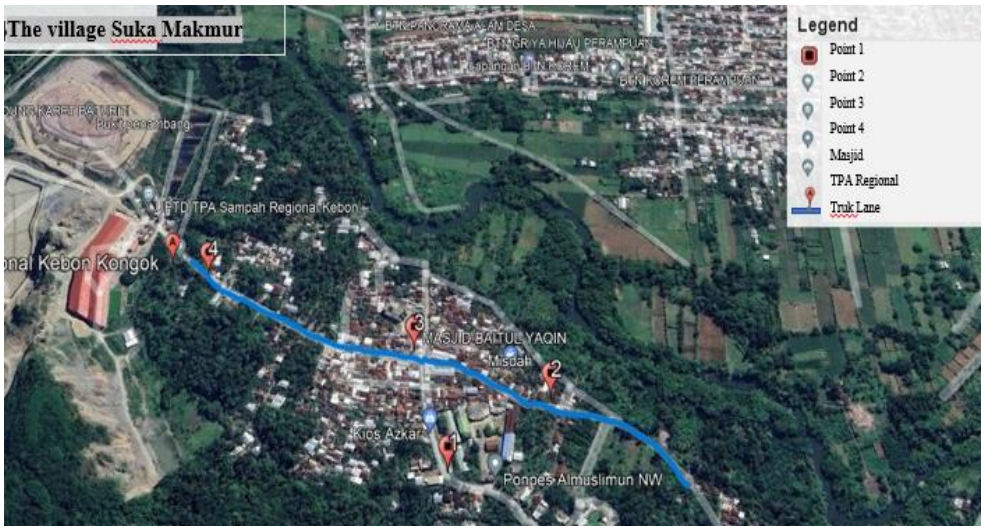
Based on this, air tests were carried out in densely populated residential areas, as well as in areas where the activity of trucks transporting waste to the final processing site was intense, which so far had never been tested for biological parameters because, in general, they focused on chemistry and physics, so after knowing the results of this test can be information for the public, as well as policymakers, regarding air quality in biological parameters, an alternative that can be done is to add green open spaces to roads so that microorganisms in the air that are spread along with particulates can be filtered by plants. Based on this background, it is necessary to research air quality in the Community Settlements Around the Kebon Kongok Landfill, Suka Makmur Village, West Lombok Regency because air quality must be maintained to provide a carrying capacity for living things to live optimally.

RESEARCH METHODS

The type of research used was an experiment using NA media as a growth medium for bacteria at 3 points passed by garbage trucks in residential areas and 1 point not passed by garbage trucks in the WDS Kebon Kongok, Suka Makmur Village. This research was conducted in March 2022. The research location was in Suka Makmur Village as the sampling location. Then it was analyzed at the Mataram STTL Environmental Laboratory.

ISSN 1907-1744 (Print)
ISSN 2460-1500 (Online)

This study tested air bacteriology in Suka Makmur Village, with the first observation point in settlements where garbage trucks did not pass, points 2 and 3 in the residential center area where garbage trucks passed, and point 4, settlements at the entrance to landfills, such as in the following figure.



Research location map

The tools and materials used in this study were analytical balance, watch glass, Erlenmeyer flask, stir bar, autoclave, incubator, petri dish, round loop, electro microscope, ice flask, bunsen, funnel, glass preparation, cover glass, mask, gloves, distilled water, airborne bacteria in community settlements around the WDS, spirits, NA (Nutrient Agar), Crystal Violet, lugol iodine, Alcohol, Ethanol and Safranin.

Research procedure

1. Sampling
   Petri dishes containing NA media were placed and opened for 15-30 minutes in Suka Makmur Village at 4 points, point I at the village center T-junction, point II at the densely populated T-junction leading to the WDS, point III in front of the WDS door and point IV in front village offices that are not passed by garbage trucks to the WDS. At each point, 2 Petri dishes containing NA media were stored on the left and right sides of the road. Afterward, the petri dish was closed and stored in a cool box on the way to the laboratory.
2. Planting and Breeding
   The NA medium containing the study sample was incubated upside down at 37°C for 2 x 24 hours. The number of growing bacterial colonies was counted, followed by macroscopic and microscopic characteristics.
3. Counting the number of bacterial colonies
   Colonies that grew after being incubated for 2 x 24 hours at 37°C were counted manually by placing dots on the counted colonies. Colonies that grow after incubation are counted with the following requirements:
   a. Large, small, creeping colonies were counted as one colony because they were assumed to originate from one bacterium.
   b. According to the Minister of Health, the index of the number of germs obtained is given in units of CFU/m3.
   c. KEPMENKES standard No.1405/MENKES/SKXI/2004, germ rate 200-500 CFU/m3 Conversion: 1 colony CFU/m^3 = 35.32 CFU/m^3 [6] dan [7]

$$X = \frac{\sum fx}{\sum f} \quad \text{.....(1)}$$

$$\sum y = \text{CFU/m}^3 \text{ x } X \text{ ..... (2)}$$

   Information:
   X = Average yield in colonies
   ∑fx = number of colonies in a petri dish
   Σf = Number of Petri dishes
   ∑y = number of colonies in the room
   4. Macroscopic observation
4. After counting the number of bacterial colonies and incubating them from NA media, macroscopic identification of the shape, size, color, surface, and edges of the growing microorganism colonies was carried out. Colonies with different characteristics and shapes were taken and Gram stain.
5. Microscopic observation after macroscopic is looking at shape, color, size, surface, and edges. The object glass is cleaned with alcohol and passed several times on a Bunsen flame to free it from impurities. Then make a thin smear of the bacterial isolate with an ose needle aseptically, dry it, and fix it by passing it over a Bunsen flame. The smear was dripped with crystal violet (Gram A) until it covered the entire preparation, left for 1 minute, then washed in running water.

Purple crystals will stain the whole cell surface of Gram-positive and Gram-negative bacteria. Then it is dripped with iodine solution (Gram B), left for 1 minute, then washed in running water until the drop becomes clear. Decolorization is carried out by dropping 95% ethyl alcohol (Gram C) for 10-30 seconds until the color fades; immediately run over with water for a few seconds to stop the decolorization activity. Then the bacteria are dripped with safranin for 20-30 seconds and washed with running water for a few seconds to finish off the remaining paint until it is clean and dried. It was observed with a microscope to see the cells' shape and the bacteria's nature to the dye.

RESULTS AND DISCUSSION

Dirty and clean air can be distinguished by analyzing the air quality in the environment. Air quality according to KPI (Air Quality Index), which shows a value of air quality (good level) based on the properties of its constituent elements [8]

Table 1. Bacterial Number Index

Sample	Bacteria count (CFU/m^3)	Standard 200-700 CFU/m^3
Point I	3,779	TMS
Point II	5,969	TMS
Point III	6,154	TMS
Point IV	6,933	TMS

Source: Primary Data for 2022
Information: MS= Qualified, TMS= Not eligible

One of the factors that can reduce the quality or quality of air is microbes or bacteria. Based on the results of observations at 4 points in the residential community of Suka Makmur Village, it was found that the bacterial index did not meet the requirements based on the Minister of Health Regulation number 1077 of 2011 concerning the requirements for biological contaminants. It was determined that the maximum level of pathogenic bacteria is 0 CFU/m^3 and the maximum level of germ count is <700 CFU/m^3[9]. Point I obtained lower results than other points, namely 3,779 CFU/m3; this was because point I was a sampling location that was far from the activity of garbage trucks going to the WDS, namely in Egok Hamlet, while Points II and Point III were community settlement centers. In Kebon Kongok Hamlet, which is adjacent to the WDS location, truck activity started from 09 am to 05 pm, resulting in higher yields than point 1, ranging from 5,699 to 6,154 CFU/m^3. The highest result in this study was obtained at Point IV, which was 6,933 CFU/m^3; this was estimated because the sampling location was in a community settlement less than 50 meters from the Kebon Kongok WDS gate [10].

The highest number of colonies was found in the UAD Faculty area, with a 71 CFU/m2 colony count. The number of airborne bacterial colonies could be due to the presence of ditches around the UAD Faculty parking area, the in and out of vehicles in the parking area, the temperature, and the condition of the parking area close to the dump site. Rubbish [11].

The results of this study are in line with the results of research conducted by Naddafi et al., which exceeded the quality standards with the maximum bacterial contamination occurring at Imam Khomeini station with an average of 1073.16 CFU/m3 and a minimum at Sadeghiye station with an average of 242.58 CFU/m^3 [12] Metro stations in Cairo, Egypt, the average concentration of bacterial contamination ranges from 2.94103 CFU/m3 in the tunnel, at ground level stations of 2.81103 CFU/m3 [13], while in the underground concourse trains in Tokyo, it is around 150 –1380 CFU/m^3 [14]. The high concentration of bacterial contamination is due to the high population density of the stations located deeper underground, which results in poor ventilation.

More dynamic area conditions can cause a high concentration of various types of bacteria due to the presence of incoming and outgoing vehicles. In addition, the nature of vehicle mobility in Kebon Kongok Village is higher than human mobility in other areas, according to [15]. Several sources of air pollution include motorized vehicles, cigarette smoke, and various activities in the area [16].

Poor air quality due to contamination by harmful substances is called air pollution. Air pollution has a more dangerous impact than pollution in general. Outdoor air pollution can sometimes be seen with the naked eye, such as black exhaust fumes from vehicles [17]. The activity of the garbage trucks will produce exhaust emissions into the air, both from the exhaust, from flying dust particles, and the decomposition of the transported waste. Air is a medium for transferring microbes from one place to another [18]. It is thought to cause air pollution, which can affect the number of microbes in it so that the bacterial index results are obtained far from the applicable quality standard threshold. The poor air quality will also affect the level of health and life of the population of living things around it, including humans [19].

Air pollution based on emission patterns consists of points, lines, and areas. In this study, sources of pollution are based on points, for example, originating from just 1 point, such as activities from a WDS, then including line patterns such as on highways with quite high vehicle volumes, such as motorized vehicles in this case sourced from garbage truck activities [20].

Table 2. Characteristics According to Colony Size

Sample	Size				
	Pinpoint	Small	Moderate	Large	count
Point I	80	50	39	45	214
Point II	145	108	59	26	338
Point III	64	215	80	33	392
Point IV	95	81	72	100	348

Source: Primary Data for 2022

Observation of bacterial morphology can be divided into two, namely macroscopic and microscopic observations. Macroscopic security is carried out by observing microorganisms in visible parts that can be seen with the naked eye, such as colony shape, colony margins, colony elevation, colony surface, and colony size [21].

The results from Table 2 above show that the most common size of bacteria is pinpointed at point I as many as 80 colonies, and II, as many as 145, while at point III is Small as many as 214 colonies, and point IV is large with a total of 100 colonies. The lowest colony of the four points is large, with 39 colonies at point III. The number of colonies and the size of the colonies that grow are influenced by several factors, including nutrient intake, temperature, pH, water, and oxygen. Changes in these factors can result in changes in the morphological properties of the shape and the physiological way of working [22].

Research conducted by Cahya in 2016 on the relationship between light, humidity, and temperature with air bacteria using Rank Spearman obtained a p-value of <0.05. This value indicates that there is a significant relationship between temperature and airborne bacteria [23]

Table 3. Gram Stain Results

Sample	Observation result			
	White	Yellow	Clear	Cream
Point I	+	+	+	+
Point II	+	+	+	+
Point III	+	+	+	+
Point IV	+	+	+	+

Source: Primary Data for 2022

Microscopic observation was carried out by gram staining; the results obtained in this study were gram-positive bacteria, both in Egok Hamlet or at Point I, which was far from the activity of garbage trucks going to the WDS, as well as in Kebon Kongok Hamlet, namely Points I, II, and III which is the center of truck activity and which is closer to the WDS, as shown in Table.3.

The results of this study align with the results of research on the Quran Recitation Education Park, namely the characterization shows that the average bacteria is gram-positive, and the characteristics according to the average colony are pinpoint size. The conclusion from research on air bacteriological quality in the Quran Recitation Education Park does not meet the requirements according to KEPMENKES RI No. 1204/MENKES/SK/X/2002 concerning classroom (200-500 CFU/m^3) [24].

The dyes used in gram staining are either acidic or basic. In basic dyes, the part that plays a role in giving color is called a chromophore and has a positive charge. Gram-positive bacteria have a relatively large or thick peptidoglycan layer compared to gram-negative bacteria, so they have more resistance to extreme environments, such as high temperatures. The inhibition response of gram-positive microbes was stronger than that of gram-negative microbes. Differences in cell wall components between gram-positive and gram-negative microbes cause this. Gram-positive microbial cell walls contain a lot of teicoronate and polysaccharide molecules. These chemical components protect cells from enzyme lysis activities, while other substances determine cell reactions in gram staining, and some attract and bind bacteriophages [25].

CONCLUSION

Air quality in residential communities around the WDS Suka Makmur Village does not meet the requirements based on the Minister of Health Regulation number 1077 of 2011 concerning the

requirements for biological contaminants, namely the germ count of less than 700 CFU/m3. The air quality index is lower than the other points, namely at Point I of 3,779 CFU/m3; this is because Point I is a sampling location far from garbage trucks going to the WDS. The highest results in this study were obtained at Point IV, which was 6,933 CFU/m3; this was estimated because the sampling location was in a community settlement which was less than 50 meters from the Kebon Kongok WDS gate with active trucks and heavy equipment activity in the WDS. Microscopic observation obtained gram-positive bacteria at all points.

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ISSN 1907-1744 (Print)
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