Analysis of Ammonia in Kali Lamong River Estuary Surabaya during Pandemic Covid-19

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Abstract. Water quality monitoring is an important instrument in the management of freshwater resources because they offer essential information about the physical, chemical, and biological water resources status, determining patterns and changes over time, and identifying emerging water quality issues especially in a specific situation. This study investigates the ammonia concentration in Kali Lamong river estuaries Surabaya to comprehensive the level of pollution that occurs during pandemic Covid-19. This research was conducted in the river downstream of Kali Lamong in the dry season. Sampling has occurred in 3 stations. Each station has 3 sampling sites that were ¼ of the left side, ½ from the side of the left, and ¼ of the right side. The measurement ammonia in water was measured by SNI 06-6989.30-2005 method. The laboratory result depicted the highest of ammonia concentration (0.765 mg/L) at B1 site. The ammonia concentration in water was <0.02 to 0.13 mg/L in another site. The water sampling result was classified based on PP number 22 of 2021 implementation of protection and management of environment in sixth appendix about national water quality standard with third-class purpose.

1. Introduction
Water is a vital natural resource for human survival as well as the survival of other lifeforms. Preserving the function of water is necessary for the management and control of water pollution in the interests of future generations as well as the ecological balance [1]. Changes in water quality can have a detrimental effect on rivers. For example, higher than natural levels of nutrients can tolerate algae to grow to nuisance levels, producing algal blooms. [2]

Kali Lamong has upstream in the Kendang Lamongan district and the downstream or the estuary of the river located in the Strait of Madura. Kali Lamong has a length of ± 89 km and has 7 tributaries provide to the important role of Kali Lamong as a supplier of freshwater source for the community in the District of Lamongan and Gresik. In daily activities, the waters of the Kali Lamong be used for agricultural purposes, industrial and domestic activities. The diversity of the community activities around the Kali Lamong has provided a big enough impact to change the quality of the waters of the Kali Lamong river [3]

Ammonia is an inorganic compound composed of a single nitrogen atom covalently bonded to three hydrogen atoms. Ammonia is contained in the water derived from the fertilizer that dissolves, animal waste, and others. Ammonia serves as a nutrient or fertilizer to water plants. High content ammonia in the water will increase the growth and activity of plant water so that the oxygen content in the water decreases and causes the water animals difficult to develop even die [4]. Ammonia can be toxic in humans when the amount that enters the body exceeds the amount that can be detoxified by
the body. In humans, the biggest risk is from inhalation of ammonia vapor which resulted in several effects including irritation of the skin, eyes, and respiratory tract.

Agriculture, industrial, and domestic activities are the potential to have an impact on pollutant sources in the marine [5][6]. The Estuary of Kali Lamong River is vulnerable to pollution due to industrial wastewater or domestic activity that goes into the river. One of the parameters of water pollution is ammonia (NH$_3$). The existence of ammonia in river water exceeded the threshold can disrupt aquatic ecosystems and organisms. Ammonia is highly toxic to almost all organisms. If dissolved in the waters will increase the concentration of ammonia that causes poisoning for almost all aquatic organisms [7]. Assessment and monitoring of river water quality have an important role. To find out river water quality, an analysis of ammonia in Kali Lamong was investigated in this study.

2. Materials dan methods

2.1 Study area and selection of sites

The study was undertaken downstream of Kali Lamong River. Sampling was carried out during pandemic Covid-19 in June 2021 (The imposition of restrictions on community activities (PPKM)) and also including in dry season. Kali Lamong water depth fluctuates from 0.5 to 2.05 meters during sampling time. A downstream site, within industrial, urban, and tourism areas. The determination of sampling sites considering the ease of access, cost, and time so specified the sites that represent the quality of the water of the river under the influence of the activities of Industry and TPI Romokalisari. The sampling area occurred at 3 stations namely the area of the side of the river (one-third of the width of the river) to the right and the left and middle areas of the river [8]. Sampling was carried out at 3 stations at each location parallel to the width of the river. Sampling was conducted for 14 days with one-week intervals.

Water samples are taken at a minimum of six sites each at a distance of $\frac{1}{4}$, $\frac{1}{2}$, dan $\frac{3}{4}$ and of the width of the river at a depth of 0.2 and 0.8 times the depth from the surface so that water samples are obtained from the surface to the bottom evenly and then mixed. This research was conducted in the estuary area of Kali Lamong [9]

Figure 1. Sampling location (a) 1, (b) 2, (c) 3
Table 1. Map of the estuary of the river Kali Lamong area and sampling sites

| Sampling sites | Coordinate X;Y | Description of the area |
|----------------|----------------|--------------------------|
| Station 1 site 1 (A1) | 683862.27 ; 9203975.42 | Station 1 site 1 is located at ¼ the width of the river from the right side of station 1 large estuary of Kali Lamong |
| Station 1 site 2 (A2) | 683872.8 ; 9203984.2 | Station 1 site 2 is located at ½ the width of the river from the right side of station 1 large estuary Kali of Lamong |
| Station 1 site 3 (A3) | 683886.17 ; 9204004.74 | Station 1 site 3 is located at ¼ the width of the river from the left side of the station 1 large estuary of Kali Lamong |
| Station 2 site 1 (B1) | 683603.26 ; 9204545.08 | Station 2 site 1 is located at ¼ the width of the river from the right side of the station 2 is located at the junction between the big river and small river |
| Station 2 site 2 (B2) | 683604.95 ; 9204561.63 | Station 2 site 2 is located at ½ the width of the river from the left side of the station 2 is located at the junction between the big river and small river |
| Station 2 site 3 (B3) | 683605.6 ; 9204577.87 | Station 2 site 3 is located at ¼ the width of the river from the right side of station 2 is located at the junction between the big river and small river |
| Station 3 site 1 (C1) | 683897.36 ; 9204728.37 | Station 3 site 1 is located at ¼ the width of the river from the left side of station 3, located in the estuary of a small river |
| Station 3 site 2 (C2) | 683893.94 ; 9204730.36 | Station 3 site 2 is located at ½ the width of the river from the left side of station 3, located in the estuary of a small river |
| Station 3 site 3 (C3) | 683892.1 ; 9204734.35 | Station 3 site 3 is located at ¼ the width of the river from the left side of station 3, located in the estuary of a small river |

2.2 Materials and Equipment
Equipment was used in this study among others 1L jerry cans as a river water container, an icebox as a temporary refrigerator for river water samples, a global positioning system (GPS), a thermometer, pH meter, salinometer. Ammonia was analyzed by SNI 06-6989.30-2005 method.

2.3 Data Analysis
Data analysis of ammonia concentration was performed after sampling at several sites in Kali Lamong river estuary. Furthermore, the concentration of ammonia in Kali Lamong was plotted using Surfer.

3. Results and Discussion
Geographically, the estuary of the river Kali Lamong is located in the border region between Gresik and Surabaya city. Physicochemical properties samples in experiments in Kali Lamong river estuary during water sampling namely as below:
Table 2. Physicochemical properties in Kali Lamong river estuary

| Temperature | pH     | Salinity  | DO          |
|-------------|--------|-----------|-------------|
| 31 to 32 °C, | 5.6 to 7.8 | 3 to 3.3 ‰, | 4.36-4.81 mg/L |

According to the laboratory results, the average concentration of ammonia in the estuary of the river Kali Lamong are among the <0.02 to of 0.765 mg/L, thus still eligible in PP No. 22 Year 2021 implementation of protection and management of environment in sixth appendix about national water quality standard with the third-class purpose. The terms of the third-class purpose whose are water that designation can be used for the fisheries, water to irrigate crops, and or other uses that require the same water quality as those uses.

The levels of ammonia estuary of the river Kali Lamong at site B1 have the highest concentration (Table 2). The high concentration of ammonia in water is due to the high organic matter that can come from agricultural, domestic waste, and industrial waste around the river. Ammonia dissolved in water is known to be unfavorable and even toxic in waters. According to [10] the concentration of ammonia which high levels in water can cause a decrease in dissolved oxygen which can cause disturbances in physiological and metabolic functions such as respiration.

Figure 2. Ammonia levels of Kali Lamong river estuary

Ammonia in water comes from urine and feces, microbiological oxidation of organic substances as well as from industrial wastewater and community activities. Fertilizer runoff from agriculture which is located upstream and carried away towards the estuary as one of the sources of nitrogen in the river. In addition. Domestic wastewater and industrial waste are discharge into the estuary of the river also affect the concentration of ammonia in the river. There are various activities such as agriculture in upstream, fisheries, residential, tourist areas and industrial areas along the Kali Lamong river. The potential discharge from their activities such as wastewater can influence ammonia concentration in the river. Moreover, coal barges have been found in Kali Lamong.

According to Indonesia Government, PPKM is considered the most effective measure to control COVID-19. PPKM can decrease the curve, which has been an unexpected positive to the environment. It has been noticed that during PPKM, air and water pollution have been potential to declined. According to the result, the range of ammonia in Kali Lamong river estuary is <0.02 – of 0.765 mg/L so it still qualifies in PP No. 22 Year 2021 with the third-class purpose. On the existing conditions in Kali Lamong river estuary, the activity of aquacultures such as Mujair, milkfish, and crab is managing by the surrounding community or fisherman.
The water temperature in Kali Lamong river estuary area is 31 – 32 °C. The ammonia oxidation rate increased significantly with the increase in the temperature from 10 to 30 °C [11]. The pH is one of the most important factors in nitrification both in freshwater and marine systems [12]. The pH range from 5.6 to 7.8 in Kali Lamong river estuary. The maximum nitrification rate occurs at pH 7.5 over a range pH of 5.9 to 8.7 in the freshwater sediment [12].

The distribution of ammonia concentration in Kali Lamong river estuary is shown in Figure 3. Ammonia concentration can vary throughout the year which is influenced by temperature, pH, and dissolved oxygen. The higher the pH and temperature values, the ammonia concentration will also increase, while at high oxygen, ammonia is rarely found, but on the contrary, in low oxygen areas, ammonia levels are relatively increased [13].

4. Conclusions
This study concluded that the concentration of ammonia in Kali Lamong river estuary is still classified as third-purpose in PP. 22 year 2021. The criteria of the third-class purpose whose classification is water that can be utilized for fisheries, irrigating crops, or other activities that require the same water quality as all those uses.

5. References
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