Simulation Of Bod And Cod Pollutants Distribution In Tello River Makassar City

Ika Apriyani¹, Louise Elizabeth Radjawane²
Civil Department, Faculty of Engineering, Universitas Kristen Indonesia Paulus Makassar

*apriyaniika01@gmail.com

Abstract Water quality management and water pollution are one of the natural resources that have a very important function for human life that must be managed and secured from the conditions of pollution, therefore efforts are needed to monitor and monitor river water quality. In connection with that, a study was conducted aimed at assessing changes in water quality in the Tallo River through the distribution of pollutant concentrations of BOD (Biological Oxygen Demand), DO (Dissolved Oxygen) and COD (Chemical Oxygen Demand) by analyzing the mathematical model approach in the form of Surface Software Water Modeling System (SMS 8.1) integrated with RMA2 and RMA4. The research method carried explanation was a field survey in the form of data collection of water as many as 5 points in the drainage along the Tallo River. Simulation results show that based on water content requirements in the Republic of Indonesia Government Regulation No. 82/2001 regarding water quality standards it is known that for existing conditions and simulation results it is known that the classification of estuary river water conditions based on Dissolved Oxygen (DO) content is classified as Class 4 and the content of Biochemical Oxygen Demand (BOD) is classified as class I and the content of Chemical Oxygen Demand (COD) is categorized as class IV.

1. Introduction

The increase in population and the development of a city results in a pattern of changes in consumption of the community that is quite high from year to year, with a fixed area of land that will cause pressure on the environment heavier. Human activities in meeting their daily needs derived from agriculture, industry and household activities will produce waste which contributes to the decline in river water quality. The river is one of the natural water resources that must be maintained and secured from the cause of pollution. Therefore, efforts are needed to monitor and monitor river water quality with the relationship of the spread of pollutants with water quality with BOD (Biological Oxygen Demand) and DO (Dissolved Oxygen) parameters in the waters (Hudaya, 2009). In this study the aim is to determine changes in water quality in the Tallo River through the distribution of pollutant concentrations of BOD, DO and COD by analyzing the mathematical model approach in the form of analysis using the Surface Water Modeling Software System (SMS 8.1) integrated with RMA2 and RMA4 which is expected to provide information or an overview of the spread of pollutants and also do tests on the level of water quality of the Tallo River whether it can be used as an appropriate source of raw water or not feasible. Location The study was conducted in the Tallo River by taking test samples at the point of pollutant source locations which included 5 sample points, namely: 1. Muara, 2. S. Pampang, 3. Daya, 4. Bring Romang and BTN Hamzy. This type of research is a computing method...
using SMS software (Surface Water Modeling System version 8.1). For the RMA2 simulation, the mainstay discharge data is used while for the spread of BOD and COD pollutants the RMA4 simulation model is used.

2. Research Method
2.1 Data Collection Implementation
The sampling time was carried out on November 7, 2019 at 5 sampling points which is the location of a tributary meeting point that entered the Tallo River in the Makassar City administration area. Sampling locations are presented in Figure 1.

2.2 Research Implementation Procedure
The research method is a scientific way to collect data with specific purposes and uses. So that the research can be carried out properly and the research objectives can be achieved, the research will be carried out in several stages, namely: the preparatory stage, the stage of the field survey in the form of water sampling at 5 points of the observation station originating from channels that are good sources of disposal from industrial waste and households that dump their waste into the Tallo River. The results of the research carried out in the form of pollutant distribution patterns in the Tallo River. The stages of research that will be done and can be illustrated in the flow chart in Figure 2.

![Research flow chart](image-url)
The data processing flow chart with SMS 8.1 software can be seen in Figure 8.

![Flow Chart Modeling RMA 2 and RMA 4](image)

**Figure 3** Flow Chart Modeling RMA 2 and RMA 4

### 2.3 Classification and Water Quality Criteria

Based on the Republic of Indonesia Government Regulation No. 82 of 2001 Concerning Water Quality Management and Water Pollution Control The President of the Republic of Indonesia concerning Water Quality Classification is set to be 4 (four) classes:
a. First class, water whose designation can be used as raw water for drinking water, and/or other designation that requires the same water quality as the purpose;

b. Class two, water whose designation can be used for water recreation infrastructure/facilities, freshwater fish farming, animal husbandry, water for irrigating crops, and/or other designation that requires the same water quality as the use;

c. Class three, water whose designation can be used for the cultivation of freshwater fish, animal husbandry, water for irrigating crops, and/or other designation that requires the same water quality as the use;

d. Class four, water whose designation can be used to irrigate crops and/or other uses that require the same water quality as the purpose.

3. Results and Discussion

As preliminary data, pollutant values were taken from 5 (five) points of the test sample location consisting of 1 (one) point of pollutants from the estuary (open sea) representing downstream boundary conditions and 4 (four) tributary points representing downstream boundary conditions. The test sample is then carried out laboratory analysis of the percentage content of Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), based on the results of laboratory testing the results are obtained as shown in the following table.

| No | Sample Code | Parameter |
|----|-------------|-----------|
|    |             | Dissolved Oxygen (DO) - ppm | Biochemical Oxygen Demand (BOD) - ppm | Chemical Oxygen Demand (COD) - ppm |
| 1  | Muara Sungai Tallo | 0,00 | 0,00 | 54,0 |
| 2  | Sungai Pampang | 0,00 | 0,00 | 136,0 |
| 3  | Daya | 6,72 | 6,08 | 38,0 |
| 4  | Biring Romang | 0,64 | 0,64 | 46,0 |
| 5  | BTN Hamzy | 2,24 | 1,28 | 46,0 |

Source: 2019 Test results Laboratory productivity and water quality UNHAS

The data is then used as preliminary data in the RMA4 product to determine the distribution of pollutant distribution that will accumulate at the Tallo River estuary in 360 hours (timestep). As a control point, one of the points taken in the estuary area is at coordinates X = 771504, Y = 9435601. From the observation point the following results were obtained:

1) The Dissolved Oxygen (DO) content in the estuary area on timestep > 120 has reached a stable point tendency with a content ranging from 1.2373-1.2659 ppm (Figure 4). If referring to DO Content Requirements in clean water based on GoI Regulations Number 82/2001 concerning water quality standards, the categories based on DO content are included in class IV.

2) The content of Biochemical Oxygen Demand (BOD) in the estuary area at timestep > 120 has reached a stable point tendency with a content ranging from 1.2169-1.2191 ppm (Figure 5). If referring to the BOD Content Requirements in clean water based on Republic of Indonesia Government Regulation Number 82/2001 regarding water quality standards, the categories based on BOD content are included in class I.

3) The Chemical Oxygen Demand (COD) content in the estuary area in timestep > 264 has reached a stable point tendency with content ranging from 80-84 ppm (Figure 6). If referring to the BOD Content Requirements in clean water based on the Republic of Indonesia Government Regulation Number 82/2001 concerning water quality standards, the categories based on BOD content are included in class IV.
Table 2 Government Regulation No. 82 of 2001 about Water Quality

| No | PH | Satuan | Class | Information |
|----|----|--------|-------|-------------|
|    |    |        | I     | II          | III         | IV          |
|    |    |        | 6 - 9 | 6 - 9       | 6 - 9       | 5 - 9       |
| 1  | BOD| ppm    | 2     | 3           | 6           | 9           |
| 2  | COD| ppm    | 10    | 25          | 50          | 100         |
| 3  | DO | ppm    | 6     | 4           | 3           | 0 Number limit minimum |

![Figure 4 Grafik laju perubahan kada DO pada muara S.Tallo](image1)

![Figure 5 Grafik laju perubahan kada BOD pada muara S.Tallo](image2)

![Figure 6 Grafik laju perubahan kada COD pada muara S.Tallo](image3)
In the following figure, the distribution patterns for each Dissolved Oxigen (DO), Biochemical Oxigen Demand (BOD) and Chemical Oxigen Demand (COD) distribution patterns are presented.

**Figure 7** Pattern of DO changes in the estuary S.Tallo condition time step 24 (A) and time step 360 (B)

**Figure 8** The pattern of distribution of changes in the BOD level in the estuary S.Tallo condition time step 24 (A) and time step 360 (B)
4. Conclusion

Content requirements in clean water based on Republic of Indonesia Government Regulation No. 82/2001 concerning water quality standards it is known that for existing conditions and simulation results it is known that the classification of estuary river water conditions based on Dissolved Oxygen (DO) content is classified as class 4 and the content of Biochemical Oxygen Demand (BOD) is classified as class I and the content of Chemical Oxygen Demand (COD) is classified as class IV.

References

1) Harry D et al. (2005). Tutorial on Surface Water Modeling System http://Report-Prak-SMS.htm.
2) Hudaya, Ahsan. (2009). Water quality modeling with BOD and DO parameters in Ciliwung River segment 2. Journal of Environmental Engineering, Jakarta.
3) Karnaningroem, Nieke. (2006). Hydrodynamic Model Spread of Pollutants in the River (http://digilib.its.ac.id) (accessed 28 September 2012).
4) Mahfudz, Hernawan et al., (2009). Hydraulics Analysis of Water Gate Use in DKI Jakarta's North Coast Reclamation Project with SMS Software 8.1.
5) Nicarahua, Carolus. (2009). Analysis of Organic Waste Pollution on the Determination of Spatial of Floating Cage Fish Cultivation in Ambon Bay Waters. (http://digilib.its.ac.id).
6) Government Regulation No. 82/2001 concerning Management of Water Quality and Water Pollution Control.
7) Wahyuni, et al (2011). River discharge characteristics in the upper Tallo watershed (Jenepangkalung sub watershed and Jenetalinggoa sub watershed). Thesis. Hasanuddin University, Makassar.