14. DETERMINATION OF TOXICITY WASTE WATER TO NILAFISH (ORECHROMIS NILOTICUS)

by Naniek Ratni Juliardi A.r

Submission date: 24-Oct-2022 11:12AM (UTC+0700)
Submission ID: 1933620845
File name: on_Of_Toxicity_Waste_Water_To_Nilafish_Orechromis_Niloticus.pdf (228.5K)
Word count: 2688
Character count: 14369

ARTICLES BALI INTERNATIONAL SEMINAR ON SCIENCE AND TECHNOLOGY 2011
" Strengthening Basic Sciences and Technology for Industrial Sustainability""
July 22-23 , 2011, BALI-INDONESIA

ISBN 978 – 979-98623-1-0

DETERMINATION OF TOXICITY WASTE WATER TO NILAFISH (ORECHROMIS NILOTICUS)

Naniek Ratni JAR and Anas Zubair
Department of Environmental Engineering FTSP-UPN "Veteran"East Java
E-mail: naniktlupn@yahoo.com

Abstract

Waste water of Tofu industry is known containing organic matter and suspended particles that were relatively high and directy discharged into receiving water bodies that it is a potential caouse of pollution. Direct disposal of this waste can cause a decrease in dissolved oxygen, increasing turbidity and temperature and lowering the pH and even causing death of aquatic. Biota. The indicator of water pollution is the death of fish in the water bodies. Death can occur because of the damage to the fish gills coused by highly suspended particles in the wastewater of tofu industry. The emergence of environmetal pollution is sometimes difficult to identify but there are models of how to get warning of polluted water environment, by determining the level of toxicity of waste, known as Lethal Concentration (LC_{50}). The benefit of knowing LC_{50} can used the maximum limit toxicant standard for environmetal conservation of river water.

The purposes of this study were to determine the level of acute toxicity or Lethal Concetration (LC_{50}) of industrial liquid waste to the biota of the river, nila fish (Oreachromis Niloticus), and the effects of suspended particles in a liquid industrial waste on the structure of Nila fish (Oreochromis Niloticus) gills toxicity test with 4 day exposure time using tilapia. The variation of concentrage on the toxicity test results was obtained through a test range of toxicant volume percentage of 16%,17%,18% and 19%.

Results was obtained with LC_{50} volues of COD 1020 mg/l and TSS 1280 mg/I is 17%. With the volue of LC_{50} it is known that untreated effluent is acutely toxic. Through the test of histopathology of fish gills, it is known that liquid waste is processed do not know which cause changes in the structure of fish gills in the form of hyperplasia.

Keywords : *Toxicity, Waste water of Tofu industry , Nila fish.*

1. Introduction

Background Tofu is a food product that has been widely known in the community. This is because the idea is one of the foods that have high nutritional value at affordable prices. Therefore, knowing the industry became one of the small industries that grow and develop in society (Arianti R, 2000) Like other industries industry know also produces waste in the form of solid waste and liquid waste. This solid waste has been used submarines such as the manufacture oncom, fertilizer and animal feed. However, liquid waste has not been used and directly discharged into water bodies without being processed first. Only a small portion of the industry knew that already has a wastewater treatment unit. waste water industry know that containing organic matter and suspended particles (TSS) is relatively high and directly discharged into receiving water bodies is a potential cause of pollution. Direct disposal of this waste can cause a decrease in dissolved oxygen, turbidity increases and the temperature, lowering the pH, can even cause death of aquatic biota. Therefore it is necessary to conduct biological tests on industrial wastes know, namely through toxicity test using fish as one of the aquatic biota. In a toxicity test will know the impact of industrial liquid waste out through the percentage of test fish mortality. Fish deaths that occur because of damage caused by fish gills particle suspended high in the wastewater industry to know. For that also tests the fish gill histopathology test to see how much damage the fish gill structure occurs.

Objective :

1. Determining the environmental pollution detection model with the level of acute toxicity Consetration Lethal (LC50) of industrial liquid waste that has not been processed from the biota of the river nile tilapia (Oreochromis niloticus).

Determine the effect of particles generated in industrial waste water that has not been processed from the structure of the gills of tilapia (Oreochromis niloticus)

2. BASIC THEORY

The basic theory will be discussed on the theory that became the basis of the research consisted of: factors affecting toxicity, toxicity test, and manual methods estimate LC50. Factors Affecting the Toxicity

2.1..The factors that affect toxicity by Mangkoediharjo (1999) are:

1. Related to toxicant own.
2. Related to toxicant exposure, consisting of: a) Type toxicant b) The period of exposure (exposure to short-term and long term) c) Frequency of exposure d) Concentration of exposure

ISBN 978 – 979-98623-1-0

3. In connection with the environment
4. A biota associated with toxicant can affect living organisms in two ways (Rand and Petrocelli, 1985), namely: a. By default, toxicant directly into the body through channels in the body of organisms that cause disruption in biochemical processes. b. Indirectly, toxicant not directly cause disruption of the organism by altering chemical and physical environmental conditions that lead to endangerment of living organisms.

2.2. Toxicity test.

Toxicity was necessary to assess the water quality resulting from the chemical and physical testing is not sufficient to assess the potential impact on aquatic biota. E.g. toxic chemical interactions and effects of sophisticated components that cannot be determined from the test chemical alone. Organisms with each other will be different reactions to the same toxic substances, even for organisms with the same type is it possible to provide answers to various toxic substances. To determine the level of poison or toxic substances or substances chemical toxicity tests. The APHA (1998), toxicity tests are useful for many purposes, among other things to know: 1. fitness level environmental conditions for aquatic biota. 2. There is no water Or environmental factors, such as DO, pH, temperature, salinity, turbidity. 3. effects of environmental factors on the toxicity of waste. 4. Toxic wastes in biota. 5. Relative sensitivity of aquatic organisms to the effluent or toxicant. 6. The number and type of waste treatment are required to obtain the desired quality yanh waste. 7. The effectiveness of wastewater treatment systems. 8. The level / rate of waste is allowed. 9. Monitoring the quality of waste, both in accordance with the standards of quality and the level permitted.

Toxicity test can be classified according to APhA (1998): 1. Exposure time exposure time) the short term is usually 48 hours or 96 hours. Used to monitor the activities, in accordance with basic licensing policy making waste disposal as well as for research, useful for estimating the overall toxicity. Observations can be either death or other observations to determine the effect toxicant. b) Medium term really no real boundaries between short, medium and long. Usually 11-90 days. Used to determine the impact on various stages toxicant living organisms. c) Long-term pemeparannya time covering the early stages of life, some life cycle and during the test organism's life cycle, so as to only 7 days to months. Toxicity test is useful for determining the acute-chronic ratio, the effect on growth, reproduction, to find the resistance of larvae, growth and survival of each stage of life, behavior, bioaccumulation of the test organism.

2.3. Exposure method

a. static techniques (static) test organisms are placed on the environmental conditions / solutions for stationary and test solution is not replaced or added.
b. Mechanical recirculation (recirculation) Solution or test media that is not replaced during the test, but recirculated from one vessel to another vessel and returned to the test vessel for the purpose of providing aeration, filtration or recirculation. This technique requires a high prudence in toxicant recirculation mechanism to maintain concentration.
c. Technical update (renewal) as a static technique, but replaced with a new solution periodically during the test. Usually every 24 hours.
d. Techniques to flow (flow through) the solution is to move in and out of the test vessel, where there is a test organism. Streaming can be done periodically or continuously. All toxicity tests require control tests to ensure that negative impacts related to the real test is only toxicant (Mangkoedihardjo, 1999).

According Mangkoedihardjo (1999), the control test can be divided into 3 main types, namely:

a. negative control (not treated): consists of a group of biota that originated from the same source with biota samples with the same diluent (without test toxicant or solvent) with the same conditions and procedures of this type of control used to determine the internal impact of biota such as health, diluent material quality.
b. Solvent Control: used when toxicant test does not dissolve in water. In principle, solvent control similar to negative controls, except the maximum volume of solvent used to prepare test toxicant.
c. Positive control (reference): material that has been known from the test results already exist to produce certain effects to biota. Ideal positive control is toxic at low concentration condition, quick to give effect, stable, nonselective and can be detected analytically.
d. Because the control test is an integral part of toxicity testing, control testing should be evaluated for validity. Buikema et al (1982) in Mangkoedihardjo (1999) considers the experience of the control test is valid when the amount of control the effects of biota exposed to no more than 10% of the number of organisms used. As the number of organisms in the control test the effect of more than 10% of the biota, then the test should be repeated again.

ISBN 978 – 979-98623-1-0

2.4.LC50 Calculation Method

According to Peltier (1978) in Mangkoedihardjo (1999), the method can be used used to calculate the LC50 is: 1. Straight - line graphic interpolation (Graphic Calculation Method) This method can provide a quick overview of the influence of the concentration distribution data, to see any positive correlation between concentration and effect toxicant acute. The calculation procedure includes: a) Preparing the data tabulation b) Data plotted on the y-axis graph semilogaritma with valuable logs to get a correlation line with the axis of the equation. c) Enter the equation x = 50 at the axis, the value of y obtained toxicant concentration that resulted in the death of fish by 50%.

3. RESEARCH METHODS

Materials Research Materials used in this study are: 1. Factory waste water plant was taken out of the area know Kedung Asem, Surabaya. 2. Biota water rivers namely tilapia (Oreochromis Niloticus). 3. solvent water taken from rivers Jagir , precisely in the area as a place of disposal of liquid waste Panjang Jiwo Surabaya. 3.2 Equipment Research Equipment that will be used in this study are: 1. Reactor where the fish (pail / plastic tub) capacity of 10 liters. 2. Equipment aeration (aerator, hose, porous stone). 3. Analysis of existing equipment in Environmental Engineering Research Laboratorium UPN "Veteran" East Java. 4. Digital Microscope.

Variables of this study as follows: 1. Exposure time (hours): 24 hours, 48 hours, 72 hours, 96 hours. 2. Toxicant Concentration (%): 0%, 25%, 50%, 75%, 100%. With certain conditions, among others: 1. The number of tilapia fish in each box: 10 head 2. The volume of each bucket of water: 10 liters 3. Tilapia Length: 4-6 cm

Procedure Research: In the research procedure will discuss the procedures to be performed in this study, namely: a preliminary analysis, acclimatization, test range finding, acute toxicity test, and test fish gills hispatologi.

4. RESULT AND DISCUSSION

Before being used as a diluent water, river water quality should be analyzed first to determine whether the water meets the criteria as a diluent water or not. Analysis results was:

Table 4.1 Criteria for analysis of water diluent diluent water parameters

Water parameters	Water diluted criteria(*)	Water River (**)
Total hardness	50-250 mg CaCO3 / L	198 mg CaCO3/lL
PH	6.0 to 8.5	7.68

Sources: (*) in Mangkoedihardjo (1999); (**) Results Analysis

Table 4.2 Results of analysis of untreated sewage plants

Parameter	Unit	Standard Quality (*)	Measurement (**)
Temperatur	° C	-	38
PH	-	6 – 9	4,97
COD	mg / L	200	1020
TSS	mg / L	50	1280

Source: (*) waste water quality standards the industry
(**) Results Analysis

Acclimatization stage is the first step before the toxicity test. Acclimatization of fish tests done in order to adapt to the diluent water used, so that the fish kill that occurred during the test not because of the inability of fish in adapting to new environments. Acclimatization conducted for 7 days, if within 2 days of death of fish less than 5% of fish and water diluent used for toxicity tests feasible (Mangkoedihardjo, 1999). During this phase, measurement of temperature, pH, DO performed every day to ensure that the environment in accordance with environmental acclimation of fish. The number of fish used is 100 individuals.

Table analysis of fish acclimatization stage

Parameters	Satuan	days						
		1	2	3	4	5	6	7
Temp	°C	27	27	27	27	26	27	26
PH	-	7,72	7,85	7,84	7,91	7,88	7,83	7,79
DO	mg/L	6,68	6,51	6,34	6,34	6,16	6,16	5,98
Death fish	Ekor	2	2	3	5	3	4	4
	%/ day	2	2	3	5	3	4	4
	%accummulated	2	4	7	12	15	19	23

Toxicity Test
In the toxicity tests will be two stages, namely Range Finding Test and Acute Toxicity Test.

Range Finding Test
Initial concentration effects used in 100% test rangefinder, 75%, 50%, 25% and 0%. During tests conducted by aeration to prevent loss of fish due to lack of oxygen. At this point is 10 fish in each concentration toxicant (with replication) and during monitoring dead fish were recorded and removed from the container. After 24 hours after contact, 100% loss of fish due to a concentration of 100%, 75%, 50% and 25%, whereas in concentrations ranging from 0% mortality rate of fish. Because they haven't found the right concentration toxicant, Rangefinder test was repeated with lower concentrations and less toxicant range, namely 25%, 20%, 15%, 5% and 0%. Monitoring deaths of fish in this test can be seen in table 4.

ISBN 978 – 979-98623-1-0

Table 4.4 Data accumulated mortality of tilapia in the range finding test II

toxicant volume concentration (%vol)	initial number of test fish	accumulated number of deaths of fish after exposure toxicant during			
		24 hours	48 hours	72 hours	96 hours
25	10	8	10	-	-
20	10	3	5	8	10
15	10	0	0	2	3
10	10	0	1	1	1
0	10	0	0	0	1

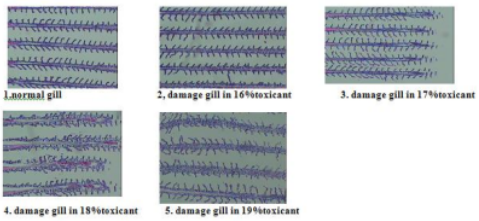
Acute Toxicity Test

Data accumulated mortality of tilapia in acute toxicity tests

toxicant volume concentration (%vol)	initial number of test fish	accumulated number of deaths of fish after exposure toxicant during			
		24 hours	48 hours	72 hours	96 hours
19	10	5	6	7	8
18	10	3	6	8	8
17	10	1	3	6	7
16	10	0	1	2	3
0	10	0	0	0	0

Gill damage.

Through the gills of fish histopathology test, can be seen the degree of influence caused by toxicant. Gill damage that occurs here is hyperplasia. Toxicant exposure to the content of 1020 mg COD / l and TSS 1280 mg / l cause damage to the gills of fish. This is because the internal organs of the external gills are the first direct contact to the polluted environment and as a means of respiration in fish, gills are the main target because of pollution (Rand and Petrocelli, 1985).
According to Rand and Petrocelli (1985), a very weak protection of fish gills. Gills only protected by some operculum made of cartilage, so that the gills are very easily damaged. One response to the gills of fish due to pollution of suspended particles of other irritants that cause hyperplasia in fish gills.



5. CONCLUSION

Conclusion after conducting toxicity tests are: 1. Consetration Lethal toxicity (LC50) of waste water from untreated plants was 17%, from the beginning - first, COD 1020 mg / l and TSS 1280 mg / l. 2. Histopathology of fish gills open trials for 96 hours with out water treatment plants have led to changes in the structure of fish gills in the form of hyperplasia.

6. BIBLIOGRAPHY

Alaerts, G. dan Sumestri, S., 1984 Metode Penelitian Air, Usaha Nasional, Surabaya.

Anonim, 1991, Petunjuk Teknis Budidaya Ikan Nila, Direktorat Jenderal Perikanan, Surabaya.

Anonim, 1994, Himpunan Peraturan Perundangan Lingkungan Hidup, BAPEDAL Propinsi Jawa Timur, Surabaya.

Anonim, 2007, Pengelolaan Limbah Industri Pangan, http://ikm.dprin.go.id/pelatihan/cp/modul3.doc

APHA, 1998, Standart Methods for the Examination of Water and Waste Water. 20th edition. Eds : Leonare S. and Arnold, Washington.

Arianty, R., 2000, Studi Evaluasi Kinerja Instalasi Pengolahan Pabrik Tahu Legowo Surabaya, Tugas Akhir, Jurusan Teknik Lingkungan ITS, Surabaya.

Lesmana, D.S., 2002, Kualitas Air Untuk Ikan Hias Air Tawar, PT Penebar Swadaya, Jakarta.

Mangkoediharjo, S., 1999, Ekotoksikologi Keteknikan, Jurusan Teknik Lingkungan ITS, Surabaya.

Makruf, F. H. , 2003, Uji Toksisitas Subletal Air Limbah Industri Menggunakan Ikan Nila Sebagai Alat Pemantauan Biologis, Tesis, Jurusan Teknik Lingkungan ITS, Surabaya.

14. DETERMINATION OF TOXICITY WASTE WATER TO NILAFISH (ORECHROMIS NILOTICUS)

ORIGINALITY REPORT

10%	10%	1%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Surabaya University Student Paper	5%
2	id.123dok.com Internet Source	4%
3	Sardi, Edy Sriyono, Tania Edna Bhakty, Ganang Azas Hayininda. "Chapter 21 The Effectiveness of the Use of Tripikon-S in Tofu İndustry Wastewater Treatment", Springer Science and Business Media LLC, 2021 Publication	<1%
4	www.oecd.org Internet Source	<1%
5	pasca.unila.ac.id Internet Source	<1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		