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The Histological Analysis Of Goldfish Gills (*Cyprinus Carpio*)Treated Withliquid Waste From Hospital Wastewater Treatment Plant

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Abstract: *This study purposes to determine the effect of wastewater from hospital wastewater treatment plant (WWTP) on goldfish gill tissue. The research conducted in December 2018 used an experimental method with 6 treatments andused the formula percentage of organ damage to analyze the data. The results showed that the cell damage in gill tissue was only found in the treatment of 95% and 100% of the wastewater from hospital WWTP with the level of damage categorized as light damage. Meanwhile, in the treatment of 80%, 85% and 90% of the wastewater from hospital WWAL, the goldfish gills structural did not change. This research concluded that epithelial cell damage in goldfish gill tissue only occurs in the treatment of 95% and 100% of wastewater fromhospital WWTP.*

Keywords: *Histology, Fish Gills, Hospital Wastewater*

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I. Introduction

A hospital is one of the health service facilities with an effort of improving the health of the general public. Every hospital has service units such as operating rooms, laboratories, pharmaceuticals, waste treatment, waste management, and education and training centers. Hospitals have positive and negative impacts on society. The positive impact is that the hospital can provide health services to the community, while the negative impact is the pollution from all the activities carried out when the waste does not manage properly (Prakoso et al., 2010)

The negative effects that may emerge as a result of imperfect wastewater treatment can result in the presence of pathogenic bacteria. Therefore, the construction of the hospital must be accompanied by supervision, monitoring, and attention to the waste produced, especially the liquid waste to not pollute the environment when discharged into the water (Prakoso et al., 2010)

Every hospital has a Waste Water Treatment Plant (WWTP) which aims to minimize the danger of environmental pollution caused by hospital waste. The basic principle of wastewater treatment is the overall management of the operational processes of the hospital, both medical and non-medical. The waste from wastewater-producing units is treated at the hospital wastewater treatment facility. The processes are the organic materials cleaned physically, then cleaned microbiologicallyby bacteria and finally get rid of germs through chlorination (Siregar, 2005).

Wastewater Treatment Plant is a hospital wastewater treatment system that is designed based on the characteristics of liquid waste-producing from several sources of waste expenditure. Wastewater from various units is transferred gravity to the bar screening then pumped to be treated using a diffuser system (Siregar, 2005). However, not all results from WWTP are following the quality standards set by the government andsome pollutants contained in wastewater from WWTP cannot be tolerated by marine biota. Thus, it is needed to research to see the effect of wastewater from hospital WWTP on aquatic biota.

The negative result of hospital liquid waste can have an impact on the aquatic habitat and the physiological conditions of animals. One of the affected aquatic biotas is fish. Fish is one of the aquatic organisms that is the most easily affected by water conditions that contaminated by sewage or pollutants either from industry or other waste. Besides, fish that live in limited habitats, such as rivers, lakes, and bays, is difficult to avoid the effects of pollution. Many elements of pollution enter the fish body. Mangkoedihardjo (2005, in Andriani et al., 2017), stated that to find out the pollutants causing disruption of biota life and the effect it has on existing biota, it can be seen from the results of biological tests using test animals. Based on the explanation above, the researcher realized that water pollution is very detrimental to the life of aquatic biota.

Therefore, the researcher would like to investigate the effect of wastewater from hospital WWTP on goldfish gills.

II. Materials And Methods

Experimental Method

The method used in this study is experimental method consisting of 6 treatments;they are not given wastewater from WWTP (PO), given 80% of wastewater from WWTP (P1), given 85% wastewater from WWTP (P2), given 90% wastewater from WWTP (P3), given 95% wastewater from WWTP (P4) and, given 100% wastewater from WWTP (P5).

Research Parameter

The parameter measured in this study is the size of the cells in the gills that have changed in structure or damaged parts.

Research procedure

The first step carried out in this study is the preparation of tools and materials, such as aquariums, fish, aerators and other needs. The second step is doing the adaption in the storage tank for 14 days before the exposure of the effluents from hospital WWTP. The exposure is done for 144 hours. The next step is the tabulation of the data for the manufacture of gills hepatology which is done by following the steps taken from Silalabat (2014). These steps are; Tissue retrieval, Dehydration, Clearing, Impregnation, Embedding, Blocking, Cutting, Mounting and Staining.

Analysis of Damage on Goldfish Tissue

There are six fish doing dissection. For the level of tissue damage, it is accumulated with the formula for percentage of organ damage based on the method used by Kim (2006, in Alifia, 2013), with the following formulation:

$$Tissues\ Damage = \frac{Damage\ surface\ area}{total\ surface\ of\ tissue}\ x\ 100\%$$

The level of organ damage is classified based on Mitchel's method (Oktavianti, 2005, in Alifia, 2013): which modified as follows;

(-) = No damage occurred
(+) = Light damage if it reaches 25% in one fieldpoint of view
(++) = Moderate damage if it reaches 50% in one fieldpoint of view
(+++) = Very severe damage if it reaches 75% in onefield of view
(++++) = Very severe damage if it reaches 100% in onefield of view

III. Results And Discussion

The Damage of Epithelial Tissue Cells of Goldfish GillsTreated with Hospital Wastewater Treatment Plant

Based on the results of microscopic observations made in the Biology laboratory of the Faculty of Mathematics and Natural Sciences, Syiah Kuala University, it can be seen that in the treatment given wastewater of hospital WWTP with levels of 80%, 85%, 90%, the goldfish gills structural did not change or there is no damage on the goldfish gill tissue. It is the same as the control group that also there is no change in the goldfish gill tissue. This happens because the effluents from hospital WWTP with levels of 80-90% still can be tolerated by goldfish tissue and did not damage the cell. Meanwhile, in the treatment of 95% and 100% of wastewater, the gill tissue of goldfish suffers necrosis damage in epithelial cells as can be seen in Figure 1.

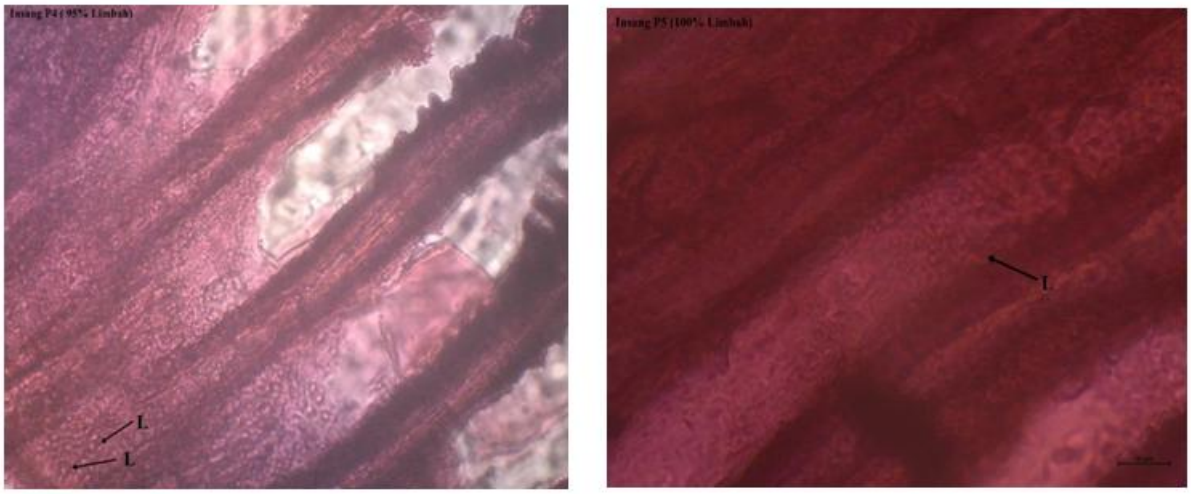

Figure 1.The Gill Tissue Structure of Goldfish on P4 (95% WWTP Waste) and P5 (100% WWTP Waste) having damaged,(L = Lysis).

Based on Figure 1, it can be seen that at a concentration of 95% and 100% waste, some cells undergo lysis which will progress to cell necrosis. Lysis is one phase of tissue damage where the cell will break and the cell nucleus disappears. This phase is followed by necrosis, which is the death of cells or tissue that accompanies cell degeneration in every animal life and is the final phase of irreversible degeneration. Necrosis can be caused by trauma, biological agents (viruses, bacteria, fungi, and parasites), and the entry of chemicals or disruption of blood supply in certain areas. Tissues that undergo the necrosis have several characteristics including having a paler color than normal color, loss of tensile power (the tissue becomes brittle and easily torn), or has poor or pale consistency (such as pulp) (Plumb, 1994, in Sulastri, et al., 2018).

Gills are organs that contact directly with the water. Thus, if the surrounding waters contain heavy metal pollutants, it will cause damage to the gills and other organs. In the treatment of 95% and 100% wastewater from hospital WWTP, the gills undergo anatomic structure changes, such as hyperplasia, lamella fusion, hemorrhage, atrophy. According to Tandjung (1982 in Suparjo, 2010), gill damage caused by polluted substances is divided into several levels starting from edema, hyperplasia of basal cells, lamella fusion, a fusion of all secondary lamellae, loss of secondary lamella structures, and reducing filament.

A further explanation of the gill's damage will be explained below. First, hyperplasia can reduce the surface area of lamella secondary to gas exchange carried out by erythrocytes (Naparin, 1993 in Suparjo, 2010). Second, lamella fusion occurs by the presence of widespread hyperplasia in the basal cells and epithelium leading to coalesce of the secondary lamellae. This occurrence obstructs the process of the respiration and expiration of respiratory gas entering and leaving the fish body.Third, hemorrhage (bleeding) in lamella happens due to direct contact with heavy metals during respiration. The occurrence of irritation causes increased osmotic power of blood vessels so that the fluid in the blood capillaries out and then enters the surrounding tissue which causes the cells to grow bigger. (Kurniasih, 1999 in Suparjo, 2010). Finally, the damage of the lamella can disrupt the process of exchange of respiratory gases which causes the fish difficult to breathe and at last leading to the chronic death of goldfish.

Based on the percentage calculation results of cell damage using the formula by Kim (2006, in Alifiani, 2013) showed that the gill tissue of goldfishwasdamage when given 95% and 100% of wastewater treatment. In goldfish treated with a concentration of 95% of wastewater, the total damage of thegill tissuefrom the entire surface when it was seen using a microscope was 0.28% of the total area of 220000 µm². Whereas, in goldfish treated with a concentration of 100% of wastewater, the damaged surface area was 11.36% of the total surface area of 220000 µm². It can be concluded that at the 100% concentration of wastewater there are more damaged cells in the epithelial tissue of the goldfish gills than at the 95% concentration of wastewater. This showed that wastewater from hospital WWTP can damage the epithelial cells of the goldfish gills if the exposure time is longer. The level of damage to goldfish cells treated 95% and 100% of wastewater can be seen in table 1.

Table 1. The Cell Damage Percentage of Goldfish Gills Exposed to Wastewaterof Hospital WWTP

No	Treatment	Score	Level of Damage	Damage
1	P1 0% Waste	-	Not Damaged	-
2	P2 80% Waste	-	Not Damaged	-
3	P3 85% Waste	-	Not Damaged	-
4	P4 90% Waste	-	Not Damaged	-

5	P5 95% Waste	+	Light Damaged	Lysis
6	P6 100% Waste	+	Light Damaged	Lysis

Note: (+) = light damage; (-) = do not have damage

The table above illustrated that the level of cell damage in the treatment of 95% and 100% of wastewater is categorized into the level of light damage based on the criteria used by Oktavianti (2005, in Alifiani, 2013).

During the treatment period with various wastewater concentrations from hospital WWTP, there is no mortality in goldfish in the treatment of 80% to 100% of wastewater. This happens becausethe goldfish can neutralize the metal content contained in the wastewater from hospital WWTP during the treatment period with a total treatment time of 144 hours.

The characteristic of the waste used in this study is inorganic chemical waste, which generally contains heavy metals. Domestic and non-domestic wastewater has several characteristics according to the source, where liquid waste characteristics can be classified as physical, chemical, and biological characteristics. Three chemical characteristics that need to be identified areorganic, inorganic, and gas. (Eddy, 2008).

IV. Conclusion

Based on the results of research conducted on Study of Hospital Liquid Waste on the Existence of Goldfish, it can be concluded that the epithelial cell on gill tissue having damaged in the treatment of 95% and 100% of the wastewater from the hospital WWTP, whereas in the treatment of 80% to 90% of the wastewater from the hospital WWAL did not have the damage of the epithelial cell of goldfish gill tissue. The percentage of epithelial cell damage in the goldfish gill tissue in the treatment of 95% wastewater was 0.28% µm out of a total area of 220000 µm% whereas, in the goldfish treated with 100% concentration of wastewater of hospital WWTP, the surface area damaged was 11, 36% µm of the total surface area of 220000% µm.

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