Jurnal Inovasi Akuntansi dan Keuangan

https://journalversa.com/s/index.php/jiak Vol.7, No.3, September 2025

SYSTEMATIC REVIEW : INFLUENCE BIOTRANSFORMATION COPPER (Cu)TO ENVIRONMENT AND ALSO CREATURE LIFE WHICH EXISTS IN AROUND

Naura Ramadhona Aulia[1], Abdul Rohim Tulaeka[2], Juliana Jalaludin[3], Syamsir S. Russeng[4], Ahsan[5], Pudji Rahmawati[6]

[1,2]Universitas Airlangga, [3]Universitas Sebelas Maret, [4]Universitas Hasanudin Makassar, [5]Universitas Brawijaya Malang, [6]Universitas Sunan Ampel

Email: naura.ramadhona.aulia-2019@fkm.unair.ac.id[1], abdul-r-t@fkm.unair.ac.id[2], juliana@upm.edu.my[3], syamsiarsr@unhas.ac.id[4], ahsanfkub@yahoo.com[5], pudji.rahmawati@uinsby.ac.id[6]

Abstract

Copper or Copper is a metallic element in the form of crystals with a reddish color with the chemical name cuprum denoted by Cu. Copper is a transition metal group IB which has an atomic number of 29 and an atomic weight of 63.55 g/mol. Copper in nature found in the form of compounds or as solid compounds in the form of mineral. Copper Cu is one of the most toxic forms of copper in the form copper dust which can cause death at a dose of 3.5 mg/kg. Study This literature review aims to find out how the impact of biotransformation is copper Cu on the environment and also living things around it / inclusion criteriaused is the year of publication of articles from the last 5 years, discussing the effect or impact of copper biotransformation on the environment and living things is around. Experimental research methods and full text journals that can be accessed withoutpaid. The data source comes from the Google Scholar and Pubmed databases. Article writing The review starts from June to July 2022. Based on the results of 4 literature articles The review found that there was an effect of the biotransformation of copper Cu for environment and living things that there is surrounding.

Keywords: *Copper Cu, Influence Biotransformation Copper, Environment, Creature Life.*

Abstrak

Tembaga atau Copper merupakan unsur logam berbentuk kristal dengan warna kemerahan dengan nama kimia cuprum dilambangkan dengan Cu. Tembaga merupakan logam transisi golongan IB yang memiliki nomor atom 29 dan berat atom 63,55 g/mol. Tembaga di alam ditemukan dalam bentuk senyawa maupun sebagai senyawa padat dalam bentuk mineral. Tembaga Cu merupakan salah satu bentuk tembaga yang paling beracun berupa debu tembaga yang dapat menyebabkan kematian pada dosis 3,5 mg/kg. Kajian Tinjauan pustaka ini bertujuan untuk mengetahui bagaimana dampak biotransformasi tembaga Cu terhadap lingkungan dan juga makhluk hidup di sekitarnya / Kriteria inklusi yang digunakan adalah tahun terbit artikel dari 5 tahun terakhir, membahas pengaruh atau dampak biotransformasi tembaga terhadap lingkungan dan makhluk hidup di sekitarnya. Metode penelitian eksperimental dan jurnal full text yang dapat diakses tanpa berbayar. Sumber data berasal dari database Google Scholar dan Pubmed. Penulisan artikel Tinjauan ini dimulai dari bulan Juni hingga Juli 2022. Berdasarkan

hasil 4 artikel literatur, tinjauan ini menemukan bahwa terdapat pengaruh biotransformasi tembaga-Cu terhadap lingkungan dan makhluk hidup di sekitarnya.
Kata Kunci: Tembaga-Cu, Pengaruh Biotransformasi Tembaga, Lingkungan, Makhluk Hidup.

INTRODUCTION

River water is often polluted by inorganic components, di including various heavy metals which dangerous. Heavy metals often pollute the environment, especially mercury (Hg), lead (Pb), copper (Cu), cadmium ((CD), arsenic (Ar), chromium (Cr), nickel (Ni), and iron (Fe). Heavy metal can cause special effects on living things such as Minamata disease, cleft lip, nervous system damage, defects in infants, carcinogenicity and impaired immune function so that it can it is said that all heavy metals can Becomes poison if accumulated in inbody creature life if accumulated in in body in time which long. Several types of metal are usually used for growth biological life plant, for example in the growth of algae or other aquatic plants, but the number excessive will mem influence use because emergence power poisonpossessing, therefore, existencethis substance needs to be monitored the amount in water waste

Milkfish ponds located in Dukuh Tapak is part of the estuaryThe footprint that flows from the upstream located in Catfish Park and Beji River (Martuti, 2012). Main source of water supply The pond in Dukuh Tapak comes from water river mixed with sea waterwhen plugged in. It is very allows the carrying of contaminantsinto the pond environment that comes from from the river water and the Tapak estuary.

Indication the most conspicuous pollution occurs on season rain which be marked with a change in the color of the river water Becomes black concentrated and accompanied smell which sting. In that season, pond cultivators must do effort for withhold water river so that noenter the pond because you can threaten the survival of fish milkfish which maintained.

Research conducted by Marthana at Rawapening Lake in 2014 got the results that the content heavy metal Cu in water has exceeded PPRI quality standards No. 81 of 2001, namely of 2.032 mg/, while the quality standard Cu content for class II waters at Government Regulation of the Republic of Indonesia Number 82 of 2001 is 0.02 mg/l.2,3 After measurement on the level of copper (Cu) in water Lake Rawapening on 10 – 13 March 2018, the results were obtained that occurred enhancement content metal heavy copper (Cu) in Lake Rawapening from measurements that have been made previously. Research conducted by

Soeprobowati on year 2011 getthe result of the content of copper (Cu) in water Rawapening Lake 0.049 mg/l Becomes 0.063 mg/l.4.

The electroplating industry is one of the industries that produce hazardous liquid waste because contain heavy metal compounds. Metalweight can cause poisoning if accumulated in body creature live and in the long term can cause death if exceed threshold limit (Putranto, 2011).

Kotagede is wrong one area whichis a center for silver and processing using process electropleting. Electropleting industry in Kotagede produces liquid waste which contain metal heavy copper (Cu) and waste treatment is still very simple. Based on Sekarwati et al (2015) electroplating waste in Kotagede contain heavy metal copper (Cu) as big as 84,9350 mg L-1 which has exceedindustrial wastewater quality standard electroplating for copper is 0.6 mg L-1 . One of the efforts to reduce concentration of pollutants in the water before being discharged into the environment by taking advantage of natural processes is phytoremediation. Phytoremediation is use plant for remove pollutants from the soil or contaminated waters (Rodonuwu, 2014). Phytoremediation techniques are considered technology which innovative, economical, and relatively safe for the environment (Sidauruk and Patricius, 2015).

RESEARCH METHOD

The research method used is a *systematic literature review.* Writerusing data from various articles as well as references that can support study. Article search was performed onmonth June 2022 via *Google Scholar.*

Say key which used in searchThe article is Copper Cu biotransformation, effect of copper biotransformation, environment, living things after article collected the next step is carry out screening with the method PRISM. The result is 4 articles national and international reputation. The article was selected with several Inclusion criteria include: year of publication for the last 5 years from 2017-2022, use method experiment, discuss the influence or impact biotransformation copper Cu for environment and also living things in surroundings.

RESULTS AND DISCUSSION

From the search results via google scholar, obtained 4 standard journals National which in accordance with criteria inclusion.Of the 4 journals, there are 2 journals which discuss the

impact copper biotransformation in the environment waters and 2 other journals discuss related with effect of biotransformation copper on creature life.

1. Water Waste Wastewater is not disposed of continuously continuously, when thesolution water or water already deemed not feasible anymore then it is necessaryconducted disposal.

   The results of testing the wastewater parameters can beshowed on table 1.

2. Wastewater quality analysis on the quality standards of Liquid waste Regulation governor nur DIY No. 7 Year 2010. Wastewater Data measurement water waste in industrysilver craft show Cu content of 84,9350 mg/l. Where rate it but exceeds the quality standard DIY Governor Regulation No. 7 Year 2010 with rate maximum 0.6 mg/l. Water waste in dustri still contain residue log am weight can cause pollution and seep into soil layer so that contaminating well water residents, when used humans will cause a disease or disorder health. Production process done by traditional al with simple facilities. Silver craft production process includes the gilding process, coating, and flushing untilbecome a thing (Anonymous, 1990). These processes will generate waste the one with no amount a little. One of them is liquid waste containing One of the metals is copper (Cu), and Silver (Ag).
3. Water Well a. Analysis quality waterwells on water quality standards based on Permenkes No. 416/ Men.Kes/PER/IX/1990 regarding Condition condition supervision Quality Water. Based on right water quality requirements list in the attachment, test results laboratory of water quality well physically and chemically analyzed based on raw Water Quality as follows: 1. pH Table 2 shows the results testing from well which be measured show bah wa pHthe highest is shown from the water well E(50 m) with pH= 7.3, and Lowest showed on well water location well M(2 m) with pH = 5.5. Analysis result laboratory in table 2 shows that the pH level in each well water sample is stillaccording to the standard thresholdquality water Clean Permenkes No. 416/Menkes/PER/IX/1990.

No	Parameter	Satuan	HasilPengujian	Baku Mutu (PerGub DIY No. 7 Ta-hun 2010)
1.	Suhu	° C	26,4	± 3°C drsuhuudara
2.	Ph	-	2,3	6.0 – 9.0
3.	Kekeruhan	NTU	1	-
4.	TDS	mg/l	8	1000
5.	TSS	mg/l	31	20
6.	Ag	mg/l	< 0,0059	0,1
7.	Cu	mg/l	84,9350	0,6

Parameter	Sampel air sumur (m)	Nilai	Permenkes No. 416/ Men.Kes/PER/IX/1990
pH	Sumur A(10)	6,8	6,5 – 9,0
	Sumur B(20)	6,8	
	Sumur C(30)	6,8	
	Sumur D(40)	7,1	
	Sumur E(50)	7,3	
	Sumur F(60)	6,7	
	Sumur G(70)	6,5	
	Sumur H(80)	6,7	
	Sumur I(90)	6,6	
	Sumur J(100)	6,7	
	Sumur K(5)	6,7	
	Sumur L(10)	6,7	
	Sumur M(2)	5,5	

Score FK obtained based on results calculation of the concentration of heavy metals in water and sediment. Pb . metal measurement in water at each station shows results which varied that is reach 0.0093 ± 0.0107 mg/l while metal content Cu is in the range of 0.0480 ± 0.0733 mg/l. Heavy metal content in sediment at each pond station, respectively was in the range of 55.90 ± 81.34 mg/kg for Pb metal and 55.76 ± 66.09 mg/kg for metal Cu. Average content metalPb in water and sediment is 0.0099± 0.0013 mg/l and 66.52± 25.46 mg/kg while the average metal content of Cu in water and sediment is 0.0629±0.014 mg/l and 60.36±8.56 mg/kg. Data measurement of heavy metals in water and sediment pond could seen on Table

Stasiun Tambak	Air (mg/l)		Sedimen (mg/kg)	
	Pb	Cu	Pb	Cu
Stasiun I	0.0097± 0.0021	0.0673± 0.0055	62.32± 15.69	59.23± 9.84
Stasiun II	0.0093± 0.0006	0.0480± 0.0115	55.90± 5.57	55.76± 3.77
Stasiun III	0.0107± 0.0006	0.0733± 0.0087	81.34± 42.32	66.09± 9.97
Rata-rata ± SD	0.0099± 0.0013	0.0629± 0.014	66.52± 25.46	60.36± 8.56

The entry of heavy metal contamination into thein pond environment could lead to an accumulation process in water, sediment and commodity bodieswhich cultivated. Thing the because fish can absorb contaminants heavy metals into the body actively and passive. Ridhowati (2013) stated that passive uptake is done with 2 (two) ways, namely by ion exchange which replaced by heavy metals and second is the formation of complex compounds between ions between heavy metals and functional compound fast.

Furthermore, active uptake is a mechanism entry metan essential through system transport membrane. Presence of heavy metals in the water column too can be life threatening phytoplankton due to metal accumulation effects weight that settles in the water.

Metal the weight that settles will be difficult released into the water so that the content heavy metals in the bottom of the water is bigger compared to the water column. Source heavy metals in the environment Tapak ponds are thought to have originated from the activities of anthropogenic such as industry, settlement as well as agriculture. wood, medicine industry and cosmetics, food industry, and industry baby soap. Therefore, the potential accumulation on environment cultivation verymight happen. The picture that inform how many times higher deposited heavy metal content and accumulated in the sediment as a result of the process heavy metal transport from the water column calculated using the concentration factor. In this study, the value of the factor heavy metal concentration in sediment varies at each station with a range of 6010.43- 7602.15 for Pb and 880.09 - 1161.73 for Cu. Average score FK metal Pb in sediment 6679.003 ± 825.83 which show that Pb metal content in sediment reach 6679 times higher compared to the Pb metal content in water column. Furthermore, the FK value of Cu . metal in the sediment has reached the average 981.14±156.77 which means that Cu metal content in sediment reach 1001 times higher compared to the Cu metal content in water column. FK . value calculation results sediment and water in pond could seen onTable.

Stasiun Tambak	Logam Berat	
	Pb	Cu
Stasiun I	6424.43	880.09
Stasiun II	6010.43	1161.73
Stasiun III	7602.15	901.59
Rata-rata ± SD	6679.003 ± 825.83	981.14 ± 156.77

Metal content measurement results copper in Lake Rawapening shows that the copper content in Lake Rawapening water ranges from0.02 mg/l – 0.11 mg/l, average content The copper in the lake water is of 0.063 mg/l and the median value as big as 0.06 mg/l exceed raw quality whichhas been stipulated in a Government RegulationRepublic of Indonesia Number 82 of 2001 that is of 0.02 mg/l.

Stasiun	Kadar Cu
Inlet Sungai Tuntang	0,02 mg/l
Outlet Sungai Panjang	0,11 mg/l
Desa Bejalen	0,06 mg/l

Results measurement content metal copper in tilapia fish (Oreochromis mossambicus) in Lake Rawapening shows that the copper content in tilapia fish (Oreochromis mossambicus) on the lake Rawapening ranged from 0.002 to 1.57 mg/kg. Only there is three tail fish which no exceed copper quality standard in food according to SNI which as big as 0.3 mg/kg.

Flat flat content copper on fish mujair (Oreochromis mossambicus) lakethe is as big as 0.6 mg/kg and scorethe median was 0.61 mg/kg over raw quality which determined by SNI.

The high content of copper in Rawapening Lake water is caused by several factors, namely: pollution from household laundry waste comes from detergent soap, laundry soap dishes, bleach and softener dumped directly into the lake; waste plantations in the form of residual pesticides; waste livestock that comes from manure, feedand livestock drinks that use Cuto meet the needs of Cu in animalscattle; wood industrial waste use ingredient preservative wood; wastehuman waste; and use of fertilizers NPK in farms around Lake Rawapening is thought to be a factor the main cause of fluctuating copper content in water Rawapening Lake.

	Kadar Cu
Min	0,002 mg/kg
Max	1,57 mg/kg
Mean	0,6 mg/kg
Median	0,61 mg/kg

The concentration of Cu metal that will used in phytoremediation is whenplant damage above 80% at the time RFT. The percentage is obtained from physical condition of aquatic plants. RFT done for 7 days with 2 times observation i.e. beginning and end.

Based on the RFT results in Table 1 It is known that Salvinia molesta is capable of grows well at metal concentrationsCu weight of 3 ppm, 5 ppm, 10 ppm and 15 ppm. Only just on concentration 15 ppm of roots in Salvinia molesta visible break. But Salvinia's percentage of life molesta is still above the maximum damage limit allowed. The results of research by Yuliani et al. (2013) show that Salvinia molesta is able to survive on Heavy metal concentration of Cu is 20 ppm with the percentage of heavy metal absorption Cu by 90-94%.

Konsentrasi	Pengamatan awal	Pengamatan akhir	Keterangan	% hidup
3 ppm	Tanaman hijau segar akar tidak putus	Tanaman hijau segar akar tidak putus	Tanaman hidup	100
	Tanaman hijau segar akar tidak putus	Tanaman hijau segar akar tidak putus	Tanaman hidup	100
5 ppm	Daun hijau segar akar tidak putus	Daun hijau segar akar tidak putus	Tanaman hidup	100
	Daun hijau segar akar tidak putus	Daun hijau segar akar tidak putus	Tanaman hidup	100
10 ppm	Daun hijau segar akar tidak putus	Daun hijau segar akar tidak putus	Tanaman hidup	100
	Daun hijau segar akar tidak putus	Daun hijau segar akar tidak putus	Tanaman hidup	100
15 ppm	Daun hijau segar akar tidak putus	Daun hijau segar akar tidak putus	Tanaman hidup	100
	Daun hijau segar akar tidak putus	Daun hijau segar akar putus	Tanaman hidup	90

Pistia stratiotes is able to grow well at a concentration of 3 ppm, while at a concentration of 5 ppm This plant begins to damage, namely: in the form of yellowing leaves at the tips of the leaves with percentage damage 90% (Table 2).When heavy metal Cu is applied to concentration of 10 ppm there is significant damage worse, the leaves are dry and yellow with 70% damage percentage. On Cu metal application of 15 ppm Pistia stratiotes seen experience damage whichvery critical that is leaf yellow and rot with damage percentageas big as 60%.

Konsentrasi	Pengamatan awal	Pengamatan akhir	Keterangan	% hidup
3 ppm	Tanaman hijau segar	Tanaman hijau segar	Tanaman hidup	100
	Tanaman hijau segar	Tanaman hijau segar	Tanaman hidup	100
5 ppm	Tanaman hijau segar	Sedikit kuning di tepi	Tanaman hidup	90
	Tanaman hijau segar	Sedikit kuning di tepi	Tanaman hidup	90
10 ppm	Tanaman hijau segar	Kuning dan kering tepi	Tanaman hidup	70
	Tanaman hijau segar	Kuning dan kering tepi	Tanaman hidup	70
15 ppm	Tanaman hijau segar	Kuning dan kering hampir keseluruhan daun	Tanaman hidup	60
	Tanaman hijau segar	Kuning dan kering hampir keseluruhan daun	Tanaman hidup	60

CONCLUSION AND SUGGESTION

Conclusion

Based on the results of the analysis laboratory from well water samples taken in daer Ah study, obtained Cu levels (tem baga) and Ag (Silver) stillbelow the water quality standard limit value based on Kemen case No. 492/Menkes/IV/2010 that there is no impact of heavy metals Cu and Ag on wasteliquid silver industry on water quality wells and public health. Results craft industrial wastewater laboratory silver obtained Cu (copper) content has been exceeds the limit value of the liquid waste quality standard.

Impact to health Public good for the workforce and society around does not show a significant impact significant. Control with gu nakan watery goiter experiencethe average decrease on day 4 was 0.82 mg/l to 1.56 mg/l. Average decrease on day 8 decreased by 1.003 mg/l to 0.54 mg/l.

Environment pond fish milkfish in Dukuh Tapak, Tugurejo Village, Kota Semarang has accumulated heavy metals good on water, sediment as well as organs fish milkfish Metal accumulation ability the weight of the sediment is indicated by presence of heavy metal concentrations in sediment is higher thanheavy metal concentration in water. Heart is organ fish which most manyaccumulate metal heavy comparedwith organ milkfish other.

The results showed thatcopper (Cu) content in lake water Rawapening has an average score of 0.063 mg/l and a median value of 0.06 mg/l which has exceeded the quality standard Government Regulation of the Republic of Indonesia Number 82 year 2001 for waters class II which is used for fish farming. In addition, the copper (Cu) content in fish tilapia in Lake Rawapening also hasexceeds the quality standards set by SNI with an average value of 0.6 mg/kg and a median value of 0.61 mg/kg.Tilapia fish (Oreochromis mossambicus) in Rawapening Lake has a level low accumulation of copper (Cu), it can be seen from the value of copper bioconcentration in tilapia fish catch from Lake Rawapening which is equal to 10.26 which is included inlow bioconcentration level. Limit maximum consumption of fish meat tilapia caught from the lake Rawapening is 3,280 grams/day for adult women and 3,900 grams/day for adult men. Comsumption PatternPublic around Lake Rawapening against the tilapia fish from the lake Rawapening has an average value of218±37 grams/day and a median of 225±37 grams/day.

Aquatic plant Pistia stratiotes able to reduce heavy metal Cu at concentration 2 ppm as big as 94% and 5 ppm by 90% but the plant Pistia stratiotes damaged in the form of chlorosis and necrosis at both concentrations, whereas on the aquatic plant Salvinia molesta able to reduce heavy metal Cu by96% on concentration 2 ppm and 95% on 5 ppm without any damage. Water app post phytoremediation does not provide real influence to growthand Pakcoy crop yields. Pakcoy plantalso able to accumulate Cu . heavy metalin plant roots and shoots. Score heavy metal content of Cu in roots and header plant Pakcoy is at in on threshold limit Cu . metal in vegetables.

Suggestion

Government area could to confirm for make or designing wastewater treatment can reduce the Cu content in silver liquid waste, for example by the technique of phytore mediation. Monitoring needs to be donechecking the quality of wells and water waste so that it can be minimized the occurrence of pollution environment.

REFERENCES

Achmad R, 2004, Chemistry Environment, Andi offset,Yogyakarta

Anonymous, 2004, Effect of Silver Industry Waste Water in City big Yogyakarta on Solubge Soil Aluminum and Grown and Composition of Ki kuyu Grass. Plant Soil 45:531-542

Al Najare, Jaber, Talal, Hantoush, 2015. The Concentrations of heavy Metals (Copper, Nickel, Lead, cadmium, iron, manganese) in Tenualosa Ilisha (Hamilton, 1822) hunted from Iraqi Marine Water. J. mesop environment. 1(3), pp. 31-43

Amriani, Hendrarto B., Hadiyarto A., 2011. Bioaccumulation Metal Weight of Lead (Pb) and Zinc (Zn) on Blood Shells (Anadara granosa L.) and Shell Mangrove (Polymesoda bengalensis L.) di Kendari Bay waters. Science JournalEnvironment. 9(2), pp. 45-50.

Soeprobowati TR, Suedy SWA. Lake Rawapening Tropic Status and Solution Its management. ScienceMatt. 2010;18(4):158–69.

Marthana WSM, Soeprobowati TR, Izzati M. Bioaccumulation Lead (Pb) by Hydrilla verticillata Lf Royle at Lake Rawapening, Ambarawa Semarang. Vol. 22, Journal of Science andMathematics. 2014. p. 52–9

happy, A., Masyamsir, and Yayat D. 2012. Distribution of metal content weight of pb and cd in the water column and Watershed sediment Upper Citarum. Journal of Fisheries and marine 3(3): 175-182.

Hardiani, H. 2009. Potential of plantsin accumulating Cu . metal on contaminated soil media paper industry solid waste. Journal Cellulose 44 (1): 27-40