Navigation Physics: Journal of Physics Education
Vol. 7, No. 1, June 2025
E-ISSN: 2722-5593

Analysis of the Influence of River Water Quality on Public Health in Kolohipo, Laloeha Village, Kolaka District, Kolaka Regency

Rina Sardiana Sari [1*], Nurfitria Ningsi [2], Muhammad Fajri Ramadhan[3]
[1]Pendidikan Fisika, FKIP Universitas Sembilanbelas November Kolaka, Indonesia
[2]Sistem Informasi, FTI Universitas Sembilanbelas November Kolaka, Indonesia
[3]SMKN 7 Kolaka, Kolaka, Indonesia
* E-mail: rinasardian4@gmail.com

Abstract

As the main water source for the surrounding environment, the Kolohipo River is very important. The river, a freshwater ecosystem, provides water for local industries, agriculture, and daily needs. However, the water quality of the Kolohipo River has declined drastically due to increasing human activities including intensive agriculture, domestic waste disposal, and deforestation throughout the river basin. Public health, environmental sustainability, and agricultural yields may be compromised by this decline in water quality. By monitoring physical, chemical, and biological parameters such as pH, dissolved oxygen, BOD (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand), and heavy metal concentrations, this study attempts to assess the water quality of the Kolohipo River. heavy metals. This study also assesses the relationship between local water quality decline and human activities. The findings of this study are expected to assist initiatives to protect the river as an important resource for the Kolohipo community's way of life and offer suggestions to the community and authorities to manage and resolve water pollution issues. Kolohipo community.

Keywords: *Water quality, public health, Kolohipo River.*

Corresponding Author:
Rina Sardiana Sari
Department of Physics Education, Universitas Sembilanbelas November, Indonesia
Jalan Pemuda No 339 Kelurahan Tahoa, Kecamatan Kolaka, Kabupaten Kolaka, Sulawesi Tenggara 93517
Email: rinasardian4@gmail.com

1. INTRODUCTION

The basis of all biological and human activities is water. Water is considered a natural resource that can be accessed continuously and will never run out. However, the hydrological cycle of water which is basically continuous limits its availability as a natural resource, so its supply is limited. Afiatun et al. (2018) claim that because there is no significant increase in water over time, the amount of water on Earth is uneven. As long as the water meets the requirements and is boiled before consumption, it can be used for daily needs, according to Aronggear, T. E., Supit, C. J., and Mamoto, J. D. (2019).

Rivers are natural features that are important for human daily life and offer significant ecological benefits. For example, from providing irrigation and clean water to serving as a home for various living things. As stated by Nibras (2020), rivers have several types. Water sources, discharge or volume of flow, rock layer structure, flow direction, and flow location can all be used to distinguish different types of rivers. Wells and rivers are often sources of clean water for communities. In the River Basin Area (DAS), where most of the river water is used to support the lives of local residents, the presence of residential land causes a number of problems, including flooding, reduced water availability due to reduced river width, and water pollution that reduces river water quality.

The usefulness, efficiency, productivity, capacity, and capacity of water resources will decrease due to the decline in water quality, which will ultimately result in a decrease in its value. Water pollution must be managed and controlled carefully to maintain water quality and keep it in its natural

state. Household wastewater, sediment from garbage dumped into rivers, bathroom washing water, and feces are some sources of river pollution from cities. The amount of BOD, COD, and E. Coli bacteria in rivers will be affected by these four factors. D. S. Donoriyanto (2011).

Water quality testing for public health related to the disposal of garbage and agricultural waste by local residents in river basins is very important to solve this problem. In the Regulation of the Minister of Health No. 416 of 1990 concerning: Water Quality Requirements and Supervision, water is defined as drinking water, clean water, swimming pool water, and public bathing water. While clean water is explained as water that is safe to drink after being boiled and meets health requirements for daily use. Law Number 32 of 2017 states that in order for water quality to be considered clean, the water must meet health criteria, which include physical, chemical, radioactive, and microbiological norms.

2. METHODS

The research method used is using physical methods (temperature, color, total dissolved solid (TDS), Total Suspensed Solid (TSS) and PH), chemical methods (Dissolved Oxygen (DO), Biologycal Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Hexavalent Chromium (Cr-VI), Total Nitrogen, Sulfide (H2S), Fluoride (F), Chloride (Cl), Nitrite (NO2), Nitrate (NO3), Phosphate (PO4), Sulfate (SO4), Copper (Cu), Zinc (Zn), Arsenic (As), Lead (Tb), Nickel (Ni) and Cadmium (Cd)) and biological methods (face caliform and total cliform).

This study uses a laboratory-based descriptive method. Sampling of this study was carried out in the Kolohipo River, Laloeha Village, Kolaka District, Kolaka Regency, Southeast Sulawesi. The location of data analysis was carried out at the Regency Environmental Service Office. Where the parameters to be measured consist of physical parameters, chemical parameters and biological parameters. The stages of the research are:

1) Sampling
   This stage is the initial stage, namely river water samples will be taken at the Kolohipo River location, Laloeha Village, Kolaka District, Kolaka Regency.
2) Sample Testing
   At this stage, the samples will be tested at the Environmental Service Office to test physical parameters, chemical parameters and biological parameters.
3) Data Analysis and Reporting
   Data after the parameters are measured are then analyzed using qualitative and quantitative methods. For physical parameters and biological parameters, qualitative methods will be used, while chemical parameters will use quantitative methods because in addition to the content of the river water that will be tested, testing will also be carried out on the metal content contained in the river water.

3. RESULT AND DISCUSSION

The research began by taking water samples from the Kolohipo River, Laoeha Village, Kolaka District, Kolaka Regency, Southeast Sulawesi.

Figure 1. Kolohipo River Water Sampling

Then, a water quality analysis test was carried out on the river at the Kolaka Regency Environmental Service Laboratory, which is shown in Table 1.

Table 1. river water test analysis with parameters (physics, chemistry and biology)

No.	Parameter	Result	Unit	Class 1 Quality Standard
A.	Physics			
1.	Temperature*	30	°C	Deviation 3
	Color	0	Pt-Co Unit	15
	Dissolved Residue	150	mg/L	1000
B	Chemistry			
	Acidity (pH) *	7,57		6-Jan
	Dissolved Oxygen (DO) *	6,04	mg/ L	>4
	Biological Oxygen Demand (BOD)	1,21	mg/ L	2
	Chloride (Cl)	59,99	mg/ L	300
	Total detergent	0,022	mg/ L	0,2
	Sulfur as H_2S	< 0,002	mg/ L	0,002
	Chemical Oxygen Demand (COD) *	3,942	mg/ L	10
	Nitrite ($N0_2$-N) *	0,003	mg/ L	0,06
	Nitrate ($N0_3$-N)	< 0,122	mg/ L	10
	Dissolved Copper (Cu) *	0,036	mg/ L	0,02
	Dissolved Zinc (Zn) *	0.11	mg/ L	0,05
	Dissolved Lead (Pb)	0.149	mg/L	0,03
	Dissolved Cadmium (Cd)	0.014	mg/L	0,01
	Dissolved Nickel (Ni) *	(),034	mg/L	0,05
	Dissolved Arsenic (As)	0,016	mg/L	0,05
	Dissolved Iron (Fe) *	0,090	mg/L	0,3
C	Biology			
	Coliform Total	240	MPN/ 100 mL	1000
	Fecal Coliform	1,8	MPN/ 100 mL	100

a. Physics Parameter

The physical parameters measured include the level of water turbidity (dissolved residue (TDS) and suspended residue (TSS), temperature, and odor. Based on the test results, the temperature of the river water is 30 oC which is a class 1 quality standard that is included in the deviation 3, or temperature variation from the norm. Therefore, the Class Two (II) Temperature quality standard is a deviation 3, and the Class II criteria limit the T of water in the range of 22°C to 28°C, then this temperature condition is still within the threshold of water quality standards based on Government Regulation Number 82 of 2001 (Hanisa Estu, et al. 2017). Meanwhile, in this study, T = 30 oC was obtained, this is influenced by the temperature conditions at the sampling site. However, it is still within the reasonable threshold. Thus, it means that the temperature of the Kolohipo River water still has life in the waters. For the aroma and color of the water, the test results show a number of 0 while the maximum class 1 quality standard is 15 and the water is odorless, meaning that the water is suitable for consumption by the wider community.

b. Chemical Parameter

Analysis of Kolohipo River water test analyzed with chemical parameters consists of measuring the degree of acidity (PH), measuring elements in river water, mineral content, dissolved oxygen content (DO), biological oxygen demand (BOD) and total detergent because water is also used for washing in Kolohipo River. According to Government Regulation Number 82 of 2001, river water with a pH value between 7.5-8.4 can still be used for agriculture, livestock, recreation, and freshwater fish farming because the test results show the acidity level (pH) of the water is 7.57 which still meets

water quality standards. Yuliastuti (2011) emphasized that organic and inorganic waste dumped into rivers has an impact on increasing pH or acidity levels. Normal water that can meet human needs is water with a pH of 6.5-7.5 (Wardhana, 2004). The dissolved oxygen content in water is measured using the DO (Dissolved Oxygen/Oxygen Demand) test as a metric to assess water quality. Kolohipo River water meets the criteria for class II water quality, according to the DO test results, which show a figure of 6.04 mg/L with a standard of> 4 mg/L. According to the basic premise, aeration can occur as a result of natural water movement, which means that the more discharge produced, the more oxygen is dissolved in the water, accelerating the process of oxygen diffusion from the air into the water.

BOD (Biological Oxygen Demand) is the amount of dissolved oxygen needed by microorganisms to decompose organic matter in water. The results of the study shown in table 1 with a class I quality standard of 2 mg/L. The BOD quality standard in water is shown in table 2 below:

Table 2. BOD level in water

Levels	Nilai BOD (mg/L)	Water Quality
Green	1-2	Very Good
Yellow	3-5	Good
Orange	6-9	Polluted
Red	> 100	Very Bad and Polluted

This means that the water is normal with a normal number of microorganisms so that it is safe for use by the public. Based on the test results, the chloride content (Cl^-) in water is 59.99 mg/L. Where the limit in the class 1 quality standard is 300 mg/L, so the Cl^- content in water is normal. Chlorine or chloride (Cl) has several benefits in water, including: Purifying water: Chlorine can help purify water by removing small particles and microorganisms, Eradicating bacteria: Chlorine can inhibit growth and eradicate bacteria and other microbes. Chlorine is effective against bacteria such as Escherichia coli, Listeria, Salmonella, and amoeba such as the Naegleria species, Controlling taste and odor: Chlorine can be used to control the taste and odor of water, Removing iron and manganese: Chlorine can be used to remove iron and manganese, Stopping pest growth: Chlorine can be used to stop pest growth in wells, water pipes, storage facilities, and water channels.

Total detergent refers to the total amount of surface active substances in water, which come from chemicals in cleaning products that enter the water system. Detergents can function to reduce the surface tension of water, which helps remove dirt or grease. However, these compounds can also have detrimental effects on aquatic ecosystems if the concentration is too high. The test results in this study showed that the total detergent content shown in table 5.1 was 0.022 mg/L with a class 1 quality standard of 0.2 mg/L. The detergent content in the Kolohipo River water was tested using a methylene blue spectrophotometer. Based on the test results, the detergent content in the Kolohipo River was still normal, marked by a total detergent value of 0.022 mg/L, because it was supported by the sampling location located around the residents' plantations so that the use of detergent in the process of washing agricultural equipment or washing livestock can cause detergent waste to flow into the river which is still relatively normal. However, it remains under supervision and guarding so that the sustainability of river water is maintained from the agricultural activities of the Kolohipo community.

Sulfur is a chemical element with the symbol S and atomic number 16. Sulfur is included in the non-metal group and is usually found in the form of compounds such as sulfur dioxide (SO_2) or hydrogen sulfur (H_2S) in nature. Sulfur has a colorless nature, but is often found in the form of a distinctive yellow solid. Sulfur can be found in nature in the form of a free element (as a mineral deposit) or in compounds, such as in volcanic rocks, natural gas, and even in the bodies of some organisms. Sulfur also has an important role in various biochemical processes, such as the synthesis of sulfur-containing amino acids such as cysteine and methionine. In addition, sulfur is widely used in industry, for example in the manufacture of sulfuric acid, fertilizers, and as an additive in the manufacture of rubber. Table 1 shows that the H_2S content in the Kolohipo River water is <0.002 mg/L

while the class 1 quality standard is 0.002 mg/L. so it can be said that the Kolohipo River water does not contain H_2S.

COD (Chemical Oxygen Demand) test is the amount of chemical compound requirement for oxygen to decompose organic matter. The test results in this study showed a figure of 3.9 mg/L with a standard quality threshold of 10 mg/L, meaning that the amount of chemical compound to oxygen in this study is classified as normal and safe for use by the public. In addition, testing of river water for total nitrogen, nitrate, nitrite, phenol, ammonia (NH_3-N), cyanide (CN^-), and mercury (Hg) content showed that the nitrate concentration still meets government regulations on water quality. Classes I and II are allowed to have a nitrate value of 10 mg/l, while classes III and IV are allowed to have a value of 20 mg/l.

Pollution occurs when there is too much nitrogen in the water. Nitrate value Segment 2, or Number 82 of 2001. Classes I and II are allowed to have a nitrate value of 10 mg/l, while classes III and IV are allowed to have a value of 20 mg/l. Pollution occurs when there is too much nitrogen in the water. Nitrate value Segment 2, or Number 82 of 2001. Classes I and II are allowed to have a nitrate value of 10 mg/l, while classes III and IV are allowed to have a value of 20 mg/l. Pollution occurs when there is too much nitrogen in the water. Since agricultural land using fertilizers dominates in segment 2, which has the highest nitrate values, it is likely that nitrate concentrations in that segment will increase as a result. This is because, according to Casali (2010), the impact of agricultural activities will produce phosphate deposits, nitrates, and runoff. Furthermore, simple disposal also prevents rivers from naturally diluting the water, which can reduce nitrate levels in the area.

Copper is is a soft, ductile, and malleable metal with very high electrical and thermal conductivity. Pure copper has a reddish-orange surface when first exposed. In addition to being a building and construction material, copper is also a conductor of heat and electricity and is an ingredient in several metal alloys, such as sterling silver used to make jewelry, cupronickel used to make coins and marine instruments, and constantan used in thermocouples and strain gauges. Copper is an essential element for human health. Copper is involved in many biological processes, including red blood cell production, energy metabolism, and the immune system, although only very small amounts are needed. Although very small amounts of copper are necessary for human health, excessive exposure to the metal—either from drinking water contaminated with copper or from direct contact in the workplace—can result in poisoning. Copper poisoning can cause liver damage, nausea, vomiting, and diarrhea. Table 1 shows that the Kolohipo River water has a dissolved Cu content of 0.036 mg/L, while the standard quality is 0.02 mg/L. If ingested for a long period of time, the amount of 0.036 mg/L is more than the recommended quality and is harmful to health.

Zinc is the 24th most abundant element in the Earth's crust and has five stable isotopes. Excess zinc in the body can cause several health problems. Although zinc is an important mineral that supports various body functions, such as the immune system, metabolism, and wound healing, consuming too much of it can also cause side effects. Some of the weaknesses or negative impacts of excess zinc include: Digestive disorders, Interfering with the absorption of other minerals, Decreased immune function, Disorders of the nervous system, Kidney damage and Problems with taste and smell. Based on table 5.1, the Zn content in Kolohipo River water is 0.110 mg/L while the standard quality standard is 0.05 mg/L. The amount of 0.110 mg/L is greater than the standard so that the Zn content is excessive which could potentially be fatal if Kolohipo River water is consumed excessively.

Lead is a group IVA (14) metal that is relatively inert or non-reactive. This metal is amphoteric, meaning that acids and bases easily react with lead and its oxide derivatives. Lead rarely undergoes the +4 oxidation state which is characteristic of the group IVA elements above it; instead, lead usually has an oxidation number of +2. However, organoleic compounds often have an oxidation number of +4. Excess lead in the body can be dangerous and cause various health problems. Lead is a toxic heavy metal, and high or long-term exposure can damage organs and the nervous system. Here are some of the dangers that can be caused by excess lead: Damage to the nervous system, Kidney damage, Digestive system problems, Heart disease and high blood pressure, Reproductive disorders, Damage to the immune system and Toxicity to the brain. The results of the Pb dissolved in the Kolohipo River water test were 0.149 mg/L while the standard quality standard was 0.03 mg/L. This can cause health problems if consumed over a long period of time.

Nickel metal is silvery white with a hint of gold. Hard and flexible, nickel is a transition metal. The iron-cobalt group of metals, which includes nickel, can create valuable alloys. Large particles of pure nickel react slowly with air under normal conditions because an oxidized layer accumulates on the surface, preventing further corrosion (passivation). Pure nickel is powdered to optimize its reactive surface area and has substantial chemical activity. Pure nickel, on the other hand, is found only in trace amounts in the Earth's crust, often in ultramafic rocks and iron meteorites or siderites that are not exposed to oxygen when outside the atmosphere. Nickel plays a role in several biological processes, including the formation of certain enzymes that are essential for metabolism. However, consuming small amounts, such as those found in food, can help the body function. However, excess nickel can actually cause allergic reactions or poisoning, so it is important to maintain proper levels. The results of the Ni test on the Kolohipo River water shown in table 5.1 are <0.034 mg/L while the standard quality standard is 0.05 mg/L, levels <0.034 mg/L will have a good effect on public health because the levels are below the standard.

Arsenic (chemical symbol As) is a chemical element belonging to group 15 (or group V-A) of the periodic table. Arsenic has atomic number 33 and is a semi-metallic element that can be found in the form of compounds or in pure form as element. Uses: Arsenic and its compounds are used in a variety of applications, such as semiconductor materials, pesticides, and certain drugs. However, arsenic is highly toxic and hazardous to human health. Toxicity: Arsenic is a highly toxic element, especially in the form of its inorganic compounds such as arsenic trichloro ($AsCl_3$) and arsenic pentoxide (As_2O_5). High exposure to arsenic can cause poisoning, organ damage, and even cancer. Arsenic is often found in the form of compounds with other elements, such as in galena ore or as a contaminant in groundwater and food. Due to its toxic nature, the presence of arsenic in the environment and food is a serious concern for public health. Table 5.1 shows the level of Arsenic (As) dissolved in Kolohipo River water of <0.016 mg/L. This As level is lower than the class I quality standard of 0.05 mg/L. So the As level in Kolohipo River water is considered safe. Iron is a chemical element with atomic number 26 and belongs to the transition metal group. Iron is one of the most abundant elements in the Earth's crust and has very important mechanical properties, such as high tensile strength and resistance to deformation. Iron has various uses, especially in the steel and iron manufacturing industry, because steel made from iron has many applications, such as in construction, vehicles, machinery, and industrial equipment. Iron is also found in the human body, where it plays an important role in the formation of hemoglobin in the blood that transports oxygen throughout the body. Iron deficiency can cause anemia. The results of the test of Fe levels dissolved in Kolohipo River water were <0.090 mg/L, while the class 1 quality standard was 0.3 mg/L so that levels <0.090 mg/L were considered safe for consumption.

c. Biological Parameter

River water biological parameter testing is a testing process to determine the presence and number of pathogenic microorganisms (such as bacteria, viruses, or parasites) that can contaminate river water. This test aims to assess water quality based on health and safety standards, because microorganisms in water can potentially cause disease to humans and other living things. In this study, a microbiological test was carried out consisting of total coliform and fecal coliform. The method of river water microbiology testing usually includes the technique of planting samples on agar media to count the number of microorganism colonies or molecular techniques such as PCR (Polymerase Chain Reaction) to detect the presence of certain pathogens. The results of this microbiology test are very important to ensure the quality of river water and its suitability for aquatic and human life, as well as to determine whether the water meets the quality standards set by the government or related health agencies. The results of the Kolohipo River water biological parameter test obtained a total coli form of 240 MPN / 100 mL with the SNI 1000 standard, while the fecal coliform of 1.8 MPN / 100 mL is still in the standard category with a standard of 100 MPN / 100 mL. This shows that the water of the Kolohipo River is considered safe.

4. CONCLUSION

The results of the Kolohipo river water test analysis reviewed from the physical parameters and biological parameters are classified as safe because they have met the quality standards set by the government. Meanwhile, in the chemical parameters there are still several elements that are classified as less safe, namely the elements Pb, Cu and Zn which are above average. This is due to the agricultural activities of the community whose waste is dumped into the river so that the levels are higher than the standard.

REFERENCES

Afiatun, E., Wahyuni, S., Hamdan, F., (2018). Perbandingan Komposisi Koagulan Biji Kelor (Moringan Oleifera), Biji Asam Jawa (Tamarindus Indica L) dan Aluminium Sulfat (Al2(SO4)3) untuk menurunkan Kekeruhan Air Sungai Citarum Atas, Ciparay, Kabupaten Bandung. *Journal of Community Based Environmental Engineering and Management*, vol. 2, no. 1, pp. 21-30. DOI: http://dx.doi.org/10.23969/jcbeem.v2i1. 1453

Aronggear, T. E., Supit, C. J., dan Mamoto, J. D. 2019. Analisis Kualitas dan Kuantitas Penggunaan Air Bersih PT. Air Manado Kecamatan Wenang. Vol. 7 No. 12 *Jurnal Sipil Statik*.

Casali, J. R. Gimenez, J. Diez, J. ÁlvarezMozos, J. D.V. de Lersundi, M. Goni, M.A. Campo, Y. Chahor, R. Gastesi, J. Lopez. 2010. Sediment production and water quality of watersheds with contrasting land use in Navarre (Spain).Agricultural Water Management 97 pp. 1683–1694.

Christiana, R., Anggraini, I. M., & Syahwanti, H. (2020). Analisis Kualitas Air dan Status Mutu Serta Beban Pencemaran Sungai Mahap di Kabupaten Sekadau Kalimantan Barat. *Jurnal Serambi Engineering*, 5(2).

Donoriyanto, D. S. (2011). Analisis dampak lahan permukiman terhadap kualitas air sungai bengawan solo kabupaten lamongan. Prosiding Konferensi Nasional "Inovasi Dalam Desain Dan Teknologi"-*IDeaTech*, 331-340.

Hanisa, E., Nugraha, W. D., & Sarminingsih, A. (2017). Penentuan Status Mutu Air Sungai Berdasarkan Metode Indekskualitas Air–National Sanitation Foundation (IKA-NSF) Sebagai Pengendalian Kualitas Lingkungan (Studi Kasus: Sungai Gelis, Kabupaten Kudus, Jawa Tengah). *Jurnal Teknik Lingkungan*, 6(1), 1-15.

Kota Semarang, Dinas Lingkungan Hidup. (2020). https://dlh.semarangkota.go.id/pengertian-dan-manfaat-reboisasi-yang-wajib-andaketahui/#:~:text=Reboisasi%20adalah%20melakukan%20penghijauan%20kembali,manusia%20dan%20juga%20aneka%20satwa. Diakses Via Browser pada 21 maret 2024.

Lestari, I. L., Singkam, A. R., Agustin, F., Miftahussalimah, P. L., Maharani, A. Y., & Lingga, R. (2021). Perbandingan Kualitas Air Sumur Galian dan Bor Berdasarkan Parameter Kimia dan Parameter Fisika. BIOEDUSAINS: *Jurnal Pendidikan Biologi Dan Sains*, 4(2), 155-165.

Mutiara Septiana Liska (2021). Pengelolaan Limbah Pertanian Genap 2020/2021 https://vclass.unila.ac.id/course/info.php?id=6290#:~:text=Limbah%20pertanian%20merupakan%20bahan%20yang,bagian%20tanaman%20yang%20tidak%20terpakai). Diakses via browser pada 21 maret 2024

Nada Nailufar Nibras. (2020) "Pengertian dan Jenis-jenis Sungai", Klik untuk baca: https://www.kompas.com/skola/read/2020/04/10/200000969/pengertian-dan-jenis-jenis-sungai. Diakses pada 21 maret 2024

Nur, F. (2013). Analisis Kualitas Air Tanah Di Sekitar TPA Tamangapa Dengan parameter Biologi. *Jurnal Teknik Lingkungan*, 2(2), 1-8.

Nursaini, D., & Harahap, A. (2022). Kualitas air sungai. BIOEDUSAINS: *Jurnal Pendidikan Biologi dan Sains*, 5(1), 312-321.

Peraturan Perundang-undangan. (2017). Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air Untuk Keperluan Higiene Sanitasi, Kolam Renang, Solus Per Aqua, dan Pemandian Umum. Permenkes No. 32 Tahun 2017 (bpk.go.id). diakses pada 21 maret 2024.

Rosarina, D., & Laksanawati, E. K. (2018). Studi Kualitas Air Sungai Cisadane Kota Tangerang Ditinjau Dari Parameter Fisika. Jurnal Redoks, 3(2), 38-43.

Situmorang, R., & Lubis, J. (2017). Analisis Kualitas Air Sumur Bor Berdasarkan Parameter Fisika dan Parameter Kimia di Desa Bagan Deli Kecamatan Medan Belawan. *Einstein E-Journal*, 5(1), 17-23. https://doi.org/10.24114/einstein.v5i1.7226

Wardhana, Wisnu Arya. 2004. Dampak Pencemaran Lingkungan. Penerbit ANDI. Yogyakarta

Yudo, S., & Said, N. I. (2019). Kondisi kualitas air Sungai Surabaya studi kasus: peningkatan kualitas air baku PDAM Surabaya. *Jurnal Teknologi Lingkungan*, 20(1), 19-28.

Yuliastuti, E. 2011. Kajian Kualitas Air Sungai Ngringo Karangannyar Dalam Upaya Pengendalian Pencemaran Air. Tesis. Universitas Dipenogoro, Semarang.

Yuniarti, Y., & Biyatmoko, D. (2019). Analisis Kualitas Air Dengan Penentuan Status Mutu Air Sungai Jaing Kabupaten Tabalong. *Jukung (Jurnal Teknik Lingkungan)*, 5(2).

BIOGRAPHIES OF AUTHORS

Autothor 1	
	**Rina Sardiana Sari, S.Pd., M.Sc** He is a lecturer in Physics Education at the Faculty of Teacher Training and Education, Sembilanbelas November Kolaka University. His research focuses on the fields of material physics and physics education. She can be contacted at email: rinasardian4@gmail.com
Author 2	
	**Nurfitria Ningsi, S.Pd., M.Kom** is a lecturer in the Information Systems Study Program on Faculty of Information Technology, Universitas Sembilanbelas November Kolaka. Her research focuses on Information Systems Specialization, especially in the field of SI Audit, Information Systems Development and Smart Village. She can be contacted via email nurfitrianingsi35@gmail.com
Author 3	
	**Muhammad Fajri Ramadhan, S.Pd., M.Sc**. is a vocational high school teacher who teaches in kolaka wundulako sub-district. his research focus is on chemical education, natural material chemistry and material chemistry. He can be connected at email: jirinramdhan@mail.ugm.ac.id