JURNAL ILMU LINGKUNGAN
Volume 24 Issue 3 (2026) : 743 - 750 ISSN 1829-8907

Assessment of Physical, Chemical, and Heavy Metal Parameters of Drinking Water in Specific Locations in The Ciledug Area, Tangerang City

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ABSTRAK

Air minum merupakan kebutuhan pokok bagi kehidupan manusia; namun, kualitasnya seringkali terancam oleh meningkatnya aktivitas industri, urbanisasi, dan pencemaran lingkungan. Untuk mendukung pencapaian Tujuan Pembangunan Berkelanjutan (SDG) 6, yang bertujuan untuk memastikan ketersediaan dan pengelolaan air bersih yang berkelanjutan, evaluasi kualitas air minum dilakukan di beberapa daerah di wilayah Ciledug, Kota Tangerang. Studi ini bertujuan untuk menilai kesesuaian kualitas air minum dengan standar kualitas air minum yang berlaku berdasarkan parameter fisik, kimia, dan logam berat. Studi ini melibatkan pengukuran pH, suhu, kekeruhan, oksigen terlarut (DO), total padatan terlarut (TDS), konduktivitas listrik (EC), dan salinitas, diikuti dengan analisis laboratorium amonia menggunakan metode fenat, fosfat menggunakan metode asam askorbat, dan Fe dan Mn menggunakan Spektrometri Serapan Atom (AAS). Hasil penelitian menunjukkan bahwa enam sampel air minum memenuhi standar mutu air minum yang ditetapkan dalam Peraturan Menteri Kesehatan Indonesia Nomor 2 Tahun 2023, sedangkan dua sampel (F dan H) gagal memenuhi standar karena kekeruhan tinggi (17,9 NTU) dan pH rendah (5,6). Konsentrasi amonia berada di bawah batas yang diperbolehkan yaitu 0,5 mg/L, sementara satu sampel melebihi batas dengan konsentrasi 1.690 mg/L. Konsentrasi fosfat pada semua sampel berada di bawah batas yang diperbolehkan yaitu 0,2 mg/L, sedangkan Fe dan Mn tidak terdeteksi. Secara keseluruhan, sebagian besar sampel air minum memenuhi standar mutu. Pemantauan berkelanjutan terhadap parameter yang menyimpang dari standar mutu diperlukan untuk memastikan penyediaan air minum yang aman dan untuk mendukung implementasi SDG 6 di tingkat lokal.

***Kata kunci**:* Mutu air minum, Amonia, Fosfat, Logam berat, SDG 6

ABSTRACT

Drinking water is an essential necessity for human life; however, its quality is often threatened by increasing industrial activities, urbanization, and environmental pollution. To support the achievement of *Sustainable Development Goal* (SDG) 6, which aims to ensure the availability and sustainable management of clean water, an evaluation of drinking water quality was conducted in some areas in Ciledug area, Tangerang City. This study aimed to assess the compliance of drinking water quality with the applicable drinking water quality standards based on physical, chemical, and heavy metal parameters. The study involved the measurement of pH, temperature, turbidity, dissolved oxygen (DO), total dissolved solids (TDS), electrical conductivity (EC), and salinity, followed by laboratory analyses of ammonia using the phenate method, phosphate using the ascorbic acid method, and Fe and Mn using *Atomic Absorption Spectrometry* (AAS). The results showed that six drinking water samples complied with the drinking water quality standards stipulated in the Indonesian Minister of Health Regulation No. 2 of 2023, whereas two samples (F and H) failed to comply due to high turbidity (17.9 NTU) and low pH (5.6). Ammonia concentrations were below the permissible limit of 0.5 mg/L, while one sample exceeded the limit with a concentration of 1.690 mg/L. Phosphate concentrations in all samples were below the permissible limit of 0.2 mg/L, whereas Fe and Mn were not detected. Overall, most drinking water samples complied with the quality standards. Continuous monitoring of parameters that deviate from the quality standards is necessary to ensure the provision of safe drinking water and to support the implementation of SDG 6 at the local level.

Keywords: Drinking water quality, Ammonia, Phosphate, Heavy metals, SDG 6

Citation: Wulandari, M., Safitri, E. N., Fajra, S. A., Zahratussaadah, Setyowati, W. A. E., and Herlinawati. (2026). Assessment of Physical, Chemical, and Heavy Metal Parameters of Drinking Water in Specific Locations in The Ciledug Area, Tangerang City. Jurnal Ilmu Lingkungan, 24(3), 743-750, doi:10.14710/jil.24.3.743-750

1. BACKGROUND

Water is one of the primary needs of living things and the environment. Humans require water not only for drinking but also for various daily activities such as bathing, cooking, washing clothes, and cleaning household appliances (Chaudhary et al., 2023). Familiar water sources include surface water, rainwater, and groundwater (Katili et al., 2023). Drinking water plays a vital role in sustaining life and improving human well-being. However, global climate change, rapid urbanization, technological advances, and increased industrial activity have posed serious threats to drinking water quality. Continuous population growth also increases the need for clean water, while its availability tends to decrease, thus creating potential losses for consumers (Ali & Ghareeb, 2023).

Water quality measurement parameters include physical, chemical, heavy metal, organic, bacteriological, biological, and radioactive elements (Roy, 2018). Temperature, color, taste, turbidity, pH, conductivity, and total dissolved solids are physical parameters. Meanwhile, chemical parameters include measuring phosphate, sulfate, and nitrate levels. According to Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2023 concerning Drinking Water Quality Requirements, all drinking water consumed by the public must meet physical, chemical, and microbiological standards. Ammonia in high concentrations not only poses a health risk but can also react with chlorine, the primary disinfectant in drinking water treatment, thereby reducing the effectiveness of disinfection and producing byproducts that are harmful to consumers (Yuniarto & Hamonangan, 2022).

Population growth and human activity can worsen drinking water quality due to the potential for increased phosphate contamination from domestic waste and fertilizers. Continuous use of fertilizers on crops increases the levels of nitrogen and phosphorus in the environment. In the United States, damage due to eutrophication causes losses of up to USD 2.2 billion per year. Another study showed that every 1 mg/L of nitrate added to water can increase stunting in children aged 5 years by up to 19% ("Water Qual. Agric. Risks Risk Mitig.," 2023). Furthermore, phosphate levels exceeding the threshold can disrupt calcium metabolism in the body and trigger deficiencies in bones and teeth (Rumhayati et al., 2012).

Heavy metal measurement parameters focus on analyzing Fe and Mn concentration. The body needs Fe in small amounts for hemoglobin formation, while Mn plays a role in enzyme systems and metabolism. Fe and Mn in drinking water have thresholds of 0.3 mg/L and 0.1 mg/L, respectively. If levels exceed these limits, they can have adverse health effects, such as an increased risk of infection, nervous system disorders, and even degenerative diseases (Nisah & Nadhifa, 2020).

The Sustainable Development Goals (SDGs) aim to ensure equitable resource availability across generations, encompassing 17 missions (Setyawan et al., 2024), one of which is Ensure availability and sustainable management of water and sanitation for all (SDG 6) (Bain et al., 2020). To implement SDG 6.1: Universal access to safe and affordable drinking water in the Ciledug area, Tangerang City, this paper aims to present the results of water quality measurements. The Ciledug area of Tangerang City has experienced substantial urban development and population growth in recent years. While these changes may increase the vulnerability of drinking water systems to quality deterioration, limited data are available regarding the current status of drinking water quality in this area based on the latest Indonesian Ministry of Health Regulation No. 2 of 2023. Moreover, previous studies have primarily focused on selected water quality parameters or different geographical locations, leaving a need for updated baseline information on drinking water quality in Ciledug.

Ciledug City was chosen because it is a densely populated area with high development activity. Almost every year, road and drainage excavation projects are carried out, which not only cause traffic congestion but also have the potential to increase environmental pollution. For example, recently, residents complained about cable excavation projects in Ciledug, which made road access difficult and disrupted daily mobility (Subchan, 2025). Construction activities and motor vehicle emissions stuck in traffic can be sources of metal pollutants entering the surrounding environment, including into the community's drinking water sources. Considering the potential for pollution and the high level of community dependence on refilled drinking water and drinking water from restaurants, monitoring the quality of drinking water in this area is very important. In addition, no comprehensive assessment has been reported for drinking water collected from the Ciledug area using the current national drinking water quality standards. Consequently, updated baseline information describing the present status of drinking water quality in this rapidly developing urban area remains unavailable.

Based on this, this study aims to analyze the levels of ammonia (phenate method), phosphate (ascorbic acid method), Fe, and Mn using an *atomic absorption spectrometer* (AAS), as well as physical parameters in drinking water samples in the Ciledug area. The measurement results are expected to provide an overview of the quality of drinking water circulating in the community and ensure its compliance with government-set quality standards.

2. METHODOLOGY

2.1. Chemicals and Instrumentation

The materials used in this study were purchased from Merck, Germany. The materials for phosphate determination include sulfuric acid 5 N (H_2SO_4), potassium antimonyl tartrate, ammonium molybdate, ascorbic acid, and 500 mg/L phosphate stock solution. Meanwhile, the materials used for ammonia analysis include phenol, sodium nitroprusside ($C_6FeN_6Na_2O$) 0.5%, alkali citrate ($C_6H_5Na_3O_7$), sodium hypochlorite (NaOCl), 1000 mg/L ammonia standard solution. The levels of Fe and Mn metals were tested using materials such as nitric acid p.a., hydrochloric acid, 1000 mg/L Fe solution, 1000 mg/L Mn metal solution. The equipment used in this study is glassware commonly used in Chemistry laboratories, sample testing was carried out using a pH meter (METTLER TOLEDO), DO meter (Lutron), Turbidimeter (2100Q Portable Turbidimeter), and sample bottles. The instruments used were a UV-Vis spectrophotometer (Perkin Elmer), *atomic absorption spectrometer* (Agilent 200 Series AA).

2.2. Water Sampling and Parameter Measurement

Samples were collected from the location at coordinates -6.2311782, 106.7265103 (Figure 1). Water sampling was carried out using two plastic bottles. Bottle 1 was used for parameter measurements (pH, dissolved oxygen (DO), total dissolved solids (TDS), electrical conductivity, and salinity). The parameter measurements were conducted in the laboratory. Bottle 2 was added with two drops of concentrated HNO_3.

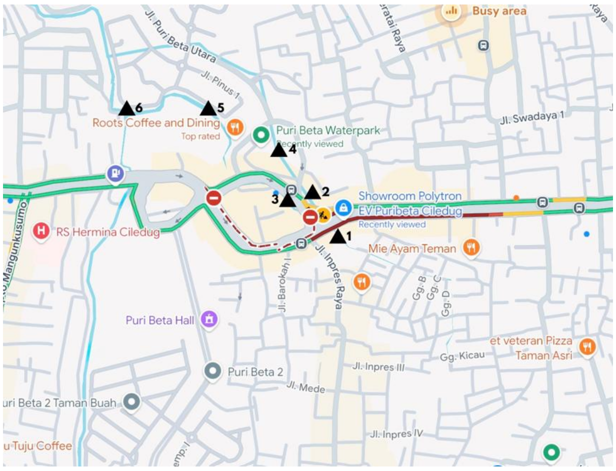


Figure 1. Sampling Location

2.3. Ammonia Determination Method

A series of standard ammonia solutions with concentrations of 0, 0.1, 0.2, 0.3, 0.5, and 0.6 mg/L was prepared. To 25 mL of each standard solution, 1 mL of phenol solution, 1 mL of nitroprusside solution, and 25 mL of oxidizing solution (a mixture of 100 mL of alkali citrate and 25 mL of hypochlorite solution) were added, respectively. The mixture was then incubated for 1 hour to allow all reactants to react completely. Then, each solution was placed in a cuvette and measured at a wavelength of 640 nm. The sample solutions were prepared in the same manner as the standard solutions (Park et al., 2009).

2.4. Phosphate Determination Method

A 25 mL standard phosphate solution was prepared with concentrations of 0.0, 0.01, 0.1, 0.4, 0.8, and 1.0 mg/L. Then, one drop of phenolphthalein indicator was added to each solution. If a pink color formed, 5N sulfuric acid was added dropwise until the color disappeared. This was followed by the addition of 4 mL of a mixed solution (50 mL of 5N H_2SO_4, 5 mL of potassium antimonyl tartrate solution, 15 mL of ammonium molybdate solution, and 30 mL of ascorbic acid). The mixture was then incubated for 10-30 minutes to allow all reactants to react completely. Each solution was then placed in a cuvette and measured at a wavelength of 880 nm. Similarly, the preparation of the sample solution followed the same procedure as for the standard solution (Lufiana et al., 2021).

2.5. Determination of Total Fe and Mn

The calibration curve for the Fe standard solution ranged in concentrations of 1.0, 2.0, 3.0, 4.0, 5.0, and 6.0 mg/L. The Mn standard solution had concentrations of 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, and 3.0 mg/L. Each solution was then placed in a cuvette and measured at wavelengths of 248.3 nm (Fe) and 279.5 nm (Mn). The preserved sample solutions were measured in the same manner as the standard solutions (Dutra et al., 2018).

3. RESULTS AND DISCUSSION

3.1. Parameter Analysis and pH

The results of water sample measurements, including pH, temperature, electrical conductivity (DHL), total dissolved solids (TDS), dissolved oxygen (DO), turbidity, and salinity, are shown in Table 1. The pH value of water indicates the concentration of H+ ions, which play a crucial role in various chemical reactions in the aquatic environment, and reflects the balance between acids and bases. The ideal pH range for water is usually between 6 and 8. In this study, water samples were collected from four locations, utilizing two different types of water sources: refilled water (codes A-D) and drinking water from restaurants (codes E-H). The results of the pH measurements showed that water samples code A-D had the highest pH value, at 6.9, which meets the drinking water quality standards according to Minister of Health Regulation No. 2 of 2023, specifically the range of 6-8. Meanwhile, water samples code E, F and H had a low pH in code F and H, at 5.6, which did not meet the standards.

Water with a pH below 6 is generally considered polluted because it indicates the presence of harmful ions or compounds, such as sulfate, phosphorus, and heavy metals (like lead and copper), that have been dissolved due to corrosion in the water infrastructure. This acidic condition disrupts aquatic ecosystems by reducing the survival of marine life, disrupting the reproductive cycles of organisms, and reducing biodiversity. For drinking water, a low pH (<6.5) can cause health problems, including tooth corrosion, gastrointestinal irritation, and increased absorption of toxic heavy metals through food consumption.

On the other hand, water with a pH above 8 (alkaline) also indicates contamination. This is due to high dissolved solids (TDS) or alkaline contaminants. This condition reduces the effectiveness of water disinfection, disrupts irrigation systems by causing mineral deposits in channels, and damages industrial equipment such as steam tanks and food processing machines due to scaling. The ideal pH range for most water uses is 6-8, with deviations outside this range potentially posing threats to human health, ecosystems, and technical applications.

3.2. Temperature Determination

Temperature is one of the physical parameters used to determine water quality (Cincotta et al., 2024). This is because temperature can affect various physical, chemical, and biological processes in water. Water temperature and dissolved oxygen concentration in water have direct and indirect effects on the environment. High water temperatures can increase the bioaccumulation of pollutants, characterized by increased metabolic processes and influence the behavior of pathogens in the environment (Hutchings et al., 2024). The results of temperature measurements showed that the water samples were coded A-F, with the highest temperature value in code F at 30.5°C. The results of this sample measurement still meet the drinking water quality standards based on Minister of Health Regulation No. 2 of 2023 (28°C ± 3°C).

3.3. Water Turbidity Measurement

Turbidity is a physical property of water that reduces transparency due to the presence of suspended materials that block light transmission. Causes of turbidity include industrial waste, pesticides, and microplastics. Water with high turbidity levels can prevent aquatic plants and algae from photosynthesizing. Water turbidity can be used as an indicator of contaminants and microbes in the water. Therefore, measuring this turbidity parameter is crucial (Matos et al., 2024). The greater the number of suspended particles, the greater the scattering of light. This results in decreased water transparency and increased turbidity.

The interaction of light and suspended particles in water can be measured using nephelometry, backscattering, and turbidimetry. Nephelometry involves measuring suspended particles at a 90° angle. Nephelometry is generally accurate for measuring water with low turbidity. Backscattering, on the other hand, is used to measure light scattered directly by incident light. This research focuses on turbidimetry (transmisometry), which is the measurement of suspended particles based on the decrease in emitted light intensity. When light passes through particles dispersed in water, it undergoes scattering and absorption. As a result, the emitted light intensity is reduced.

Turbidity is usually measured using a turbidimeter and expressed in Nephelometric Turbidity Units (NTU). This value reflects the intensity of light scattered by particles. The measurement results showed that the turbidity level of water samples coded A-E and G was 0.0 NTU, where this value meets the drinking water quality standards according to Minister of Health Regulation No. 2 of 2023 of <3 NTU indicating a good level of water clarity. Meanwhile, water samples coded F and H showed a high turbidity level of 17.9 NTU. This is due to community activities that result in soil erosion that carries mud, clay, and fine sand.

3.4. Dissolved Oxygen (DO) Measurement

Dissolved oxygen (DO) is oxygen in the form of free molecules dissolved in water. It is essential for supporting aquatic ecosystems (fish, invertebrates, and microorganisms) and aiding the natural decomposition of organic matter. The primary source of dissolved oxygen comes from the diffusion of atmospheric air into the water and the photosynthesis of aquatic plants and algae. Adequate DO levels maintain ecosystem health, support the growth of aquatic biota, and maintain a balanced nutrient cycle. Conversely, low DO levels (<5%) can lead to the death of aquatic organisms and indicate pollution or disturbance of the aquatic environment (Wei et al., 2019).

Table 1. Results of Water Sample Quality Measurements

Parameter	Sampel							
	A	B	C	D	E	F	G	H
pH	6.8	6.1	6.9	6.8	5.8	5.6	6.2	5.6
Temperature (°C)	29	27	28.1	29	29	30.5	27.8	30.5
Turbidity (NTU)	0	0	0	0	0	17.9	0	17.9
DO (ppm)	4.0	4.0	4.7	4.0	5.3	3.8	4.6	3.8
TDS (ppm)	60	60	76	60	160	144	183	144
Conductivity (µS/cm)	120	120	152	120	321	291	365	291
Salinity (%)	0	0	0	0	0	0	0	0
NH3 (ppm)	0.047	0.118	0	1.690	0	0	0	0
PO_4^{3-} (ppm)	0.081	0.033	0.073	0.081	0.092	0.060	0.047	0.065
Fe (ppm)	0	0	0	0	0	0	0	0
Mn (ppm)	0	0	0	0	0	0	0	0

The DO measurement results showed that water samples coded C-E and G had the highest DO value of 4,7: 5.3: and 4,6 ppm. This value is still within the DO threshold for drinking water (4.0-6.0 ppm). It indicates that the water in these samples is of good enough quality for consumption. Meanwhile, water samples coded F and H had a DO value of 3.8, which does not meet quality standards. It is likely due to the low amount of dissolved oxygen in the aquatic environment, which can lead to the death of aquatic organisms such as fish.

3.5. Total Dissolved Solid (TDS) Measurement

TDS is an important parameter in measuring water quality. TDS is defined as the total concentration of dissolved substances in water, including minerals, salts, and organic matter. These dissolved substances originate from various sources, including domestic activities, industrial processes, and natural processes in aquatic environments. High TDS levels in water can affect its taste, safety, and suitability for various uses (Zukhruf et al., 2024).

TDS measurement can be performed simultaneously with Total Suspended Solids (TSS) determination using the gravimetric method. The principle of TDS analysis is to evaporate the filtrate from filtering the air sample at a temperature of around 105 °C in an oven until all the air has evaporated and only the dissolved solids residue remains. This residue is then weighed, and the result is expressed in mg/L as the TDS value. Before evaporation, the air sample is first filtered to obtain two parts: the filtrate containing dissolved solids (TDS) and the residue retained on the filter, which is then used for TSS analysis. In TSS analysis, the residue is dried at a temperature of 103-105ºC until its weight is constant, so that the increase in filter weight represents the total suspended solids content in the air sample. The results of TDS measurements show that water samples code A-H with the smallest TDS value in codes A, B, and D of 60 ppm meet the water quality standard requirements according to Minister of Health Regulation No. 2 of 2023, which is <300 ppm. The higher the TDS value, the more dissolved substances it contains, causing turbidity. The standard quality of TDS value specifically for water for bathing and sanitation hygiene is a maximum of 1000 mg/L (based on the Regulation of the Minister of Health of the Republic of Indonesia No. 32 of 2017). At the same time, the standard quality of TDS value specifically for drinking water is a maximum of 500 mg/L (based on the Regulation of the Minister of Health of the Republic of Indonesia No. 492 of 2010). It can be concluded that the TDS value for the sample is below the quality standard threshold and is declared safe.

3.6. Electrical Conductivity (EDC) Measurement

Water conductivity is a parameter used to measure water quality, indicating the number of dissolved ions capable of conducting an electric current. When water contains inorganic acids, alkalis, or salts, its conductivity increases. The higher the EDC value, the greater the number of ions present in the water, such as cations (Na^+, K^+, Ca^{2+}, Mg^{2+}) and anions (Cl^-, SO_4^{2-}, NO_3^-, PO_4^{3-}) (Yang et al., 2021). The level of pollution from domestic and industrial waste significantly influences EDC value. EDC measurement results indicate that water samples with codes A-F, with the highest EDC value of 321 µS/cm, still meet the drinking water quality standard of 1500 µS/cm (Solis-Castro et al., 2020). A high DHL value indicates a high mineral content. High mineral levels can cause the formation of dissolved solids in the water, making it complicated. Hard water can clog blood vessels and cause heart problems.

3.7. Salinity Measurement

Salinity is the amount or concentration of salt dissolved in water, expressed as a percentage (%). Negative effects such as increased systolic and diastolic blood pressure (BP) and hypertension are the effects of salt in drinking water (Rosinger et al., 2021). Based on measurement results, the salinity level in all samples was 0%. This indicates that the water is classified as freshwater without significant dissolved salt content. According to the classification of groundwater salinity levels based on salinity parameters, water is categorized as freshwater if its salinity level is below 20 mg/L (Crowther et al., 2025).

3.8. Ammonia Level Analysis Using the Indophenol Blue Method (Phenate Method)

Measuring ammonia levels is important in water analysis because ammonia is an indicator of water quality and excessive concentrations may adversely affect human health. The principle of measuring ammonia levels is based on the reaction of ammonia with hypochlorite and phenol, which will be catalyzed by sodium nitroprusside, producing a blue indophenol compound that is measured using a UV-Vis spectrophotometer at a wavelength of 630-655 nm (Utomo et al., 2023). The first step is that ammonia reacts with hypochlorite in an alkaline medium to produce monochloramine. Monochloramine is added to phenol to produce chloramine quinone, catalyzed by sodium nitroprusside. Chloramine quinone reacts with phenol to produce blue indophenol. The reaction for the formation of the indophenol compound is shown in Figure 2.

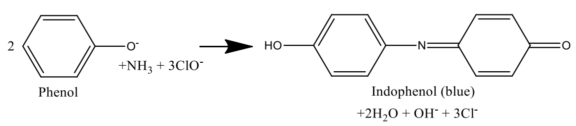
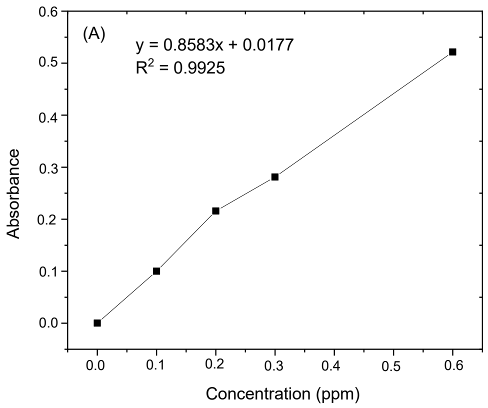


Figure 2. The Reaction of Indophenol Formation

The ammonia calibration curve is shown in Figure 3. The results of measuring ammonia levels in water samples coded A-C and E-H show that the lowest ammonia content is found in code H at 0.059 mg/L.

This indicates that water samples coded A-C and E-H meet the drinking water quality standards according to Government Regulation Number 22 of 2021 at 0.5 mg/L. Meanwhile, in water sample code D, the ammonia content is relatively high at 1.690 mg/L, which exceeds the threshold limit for drinking water quality standards. High ammonia content can cause health problems such as irritation, nausea, vomiting, and respiratory tract irritation. The presence of ammonia in water is an indicator of pollution from domestic, industrial, and agricultural waste.



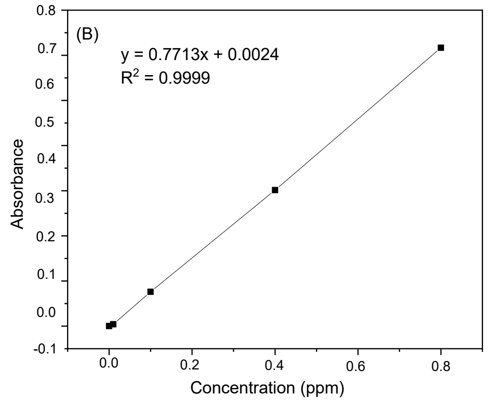


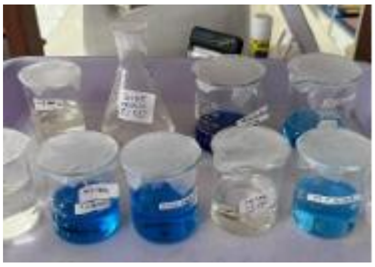
Figure 3. Calibration Curve of Ammonia (A) and Phosphate (B)

3.9. Phosphate Analysis Using Ascorbic Acid

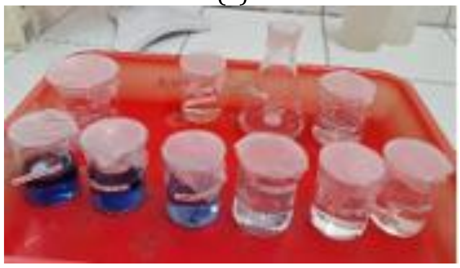
Phosphate is used to stimulate the growth of plankton and aquatic plants, which serve as food for fish. However, excessive concentration can lead to excessive algae growth and reduced dissolved oxygen levels in the water, a process known as eutrophication. The most significant contributor of phosphate to aquatic environments is detergents (Habibah et al., 2018).

$$PO_4^{3-} + 12\ MoO_4^{2-} + 27\ H^+ \rightarrow \underset{\text{phosphomolybdic acid}}{H_3[PMo_{12}O_{40}]} + 12\ H_2O$$

$$H3[PMo_{12}O_{40}] + \text{ascorbic acid} \rightarrow [PMo_{12}O_{40}]^{n-} + \text{ascorbic acid oxidation product}$$



(a)



(b)

Figure 4. Ammonium and Phosphate Standard Solution

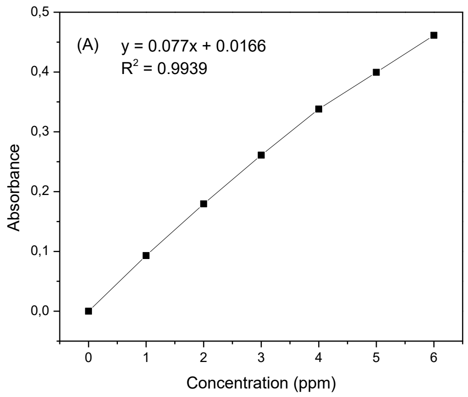
Phosphate is measured under acidic conditions, where orthophosphate reacts with ammonium molybdate and potassium antimonyl tartrate to form yellow phosphomolybdic acid. This compound is then reduced by ascorbic acid, producing a molybdenum blue complex that can be measured using a UV-Vis spectrophotometer.

The molybdenum blue complex was then analyzed using a spectrophotometer at a wavelength of 880 nm, as this is the wavelength at which the compound exhibits maximum absorbance (λmax), making it suitable for quantification. The results of measuring phosphate levels in drinking water showed that all water sample codes had the lowest phosphate level at 0.033 mg/L, which meets the drinking water quality standards according to the Minister of Health Regulation No. 2 of 2023, which is a maximum of 0.2 mg/L.

3.10. Analysis of Fe and Mn Concentration

Analysis of iron (Fe) metal content was carried out using the *atomic absorption spectrophotometry* (AAS) method. The sample solution was sprayed into a flame and then atomized. The metal atoms in the ground state were irradiated by a Hollow Cathode Lamp (HCL) and absorbed light energy at a specific wavelength, so that the atoms were excited to a higher energy level. The number of atoms that absorbed light was directly proportional to the energy absorbed by the sample. The amount of radiation absorption was measured at a wavelength of 248.3 nm—determination of the maximum wavelength aimed to determine the highest absorption point in the sample being tested. Based on the experimental results, the linear region of Fe was obtained at 1, 2, 3, 4, 5, and 6 mg/L. The sample solution was added with 1% HNO_3 to preserve the sample and prevent the formation of precipitation in the sample and dissolve the metal completely.

Based on the Fe calibration curve graph, it can be concluded that the greater the standard concentration, the greater the absorbance. Based on Figure 3, a linear regression equation is obtained: y = 0.007x + 0.0166 with a coefficient of determination R^2 = 0.9939. The R^2 value meets the requirements of 0.90 <r <1, so that R^2 shows a linear and perfect relationship between intensity and concentration (Wulandari et al., 2024). Based on the measurement results (Table 1), the Fe concentration in the A-G water code sample was 0 mg/L. This indicates that the water sample does not contain Fe contamination.



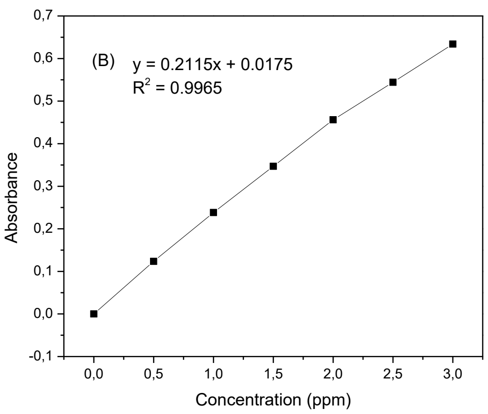


Figure 5. Calibration Curve for Fe and Mn Standard Solution

The second analysis is Mn. Based on the measurement, the linear area of Mn was obtained using a concentration series of 0.5 mg/L, 1 mg/L, 1.5 mg/L, 2 mg/L, 2.5 mg/L, and 3 mg/L, which were then measured using AAS at a wavelength of 279.5 nm. The calibration curve shows a linear equation (Wulandari et al., 2025), y = 0.2115x + 0.0175, with an R^2 value of 0.9965. Based on the measurement results (Table 1), the Mn concentration in the A-G Water code sample was 0 mg/L in the G code. It indicates that the water sample did not contain contamination from Mn. According to the Regulation of the Minister of Health of the Republic of Indonesia No. 907/MENKES/SK/VII/2002 concerning the requirements and supervision of drinking water quality, the maximum permissible level for Fe is 0.3 mg/L. The concentration of Mn is 0.1 mg/L. Of all the samples analyzed, no Fe and Mn were found.

4. CONCLUSION

The measurements of ammonia, phosphate, Fe, and Mn concentrations in water samples have been conducted. The pH results indicate that most samples were within the acceptable range of 6 to 8; however, samples E, F, and H showed lower pH values, indicating non-compliance with the standard.. Temperature parameters were also analyzed, and the results showed that all samples were still within the threshold of 28 ± 3. Turbidity was analyzed using a turbidimeter, and two samples showed high levels (greater than 3 NTU). Dissolved oxygen (DO) levels indicated that most samples were within the acceptable range of 4–6 ppm; however, samples F and H had lower DO values of 3.8 ppm, which are below the required threshold. Total Dissolved Solid analysis results showed all samples were still below the threshold of <300 ppm. Electrical conductivity was also analyzed to determine the amount of ion content in the samples. The results showed that eight samples were still below the threshold of 1500 μS/cm. The salinity level was 0% in all samples. Organic compound levels were tested to determine the levels of ammonia and phosphate. The results showed that ammonia levels were still below the threshold, while 1 sample exceeded the threshold of 0.5 ppm. Meanwhile, phosphate concentration for all samples did not exceed the threshold of 0.2 ppm. Testing of Fe and Mn metal levels did not exceed the threshold of 0.3 ppm (Fe) and 0.1 ppm (Mn). The results of this analysis are expected to provide the public with information on the importance of maintaining water quality to prevent pollution. Efforts to improve drinking water quality align with Sustainable Development Goal (SDG) 6, which aims to ensure the availability and sustainable management of clean water and sanitation for all. Synergy is needed between the government, communities, and water management institutions to strengthen water quality monitoring systems, expand access to clean water, and encourage ecosystem-based water management.

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