

Published online on the journal's website: <https://jes-tm.org/index.php/jestm/index>

Journal of Engineering Science and Technology Management

| ISSN (Online) 2828-7886 |



Article

Determination of Chloride Levels in Water from PDAM Semanggi 2 and Cinere Well Water, South Tangerang Using Precipitation Titration with the Method MOHR

Nurhasni¹, Putri Anjeli², Regita Cahya Prameswari³, Elita Delia Althaf⁴, Medina Sheril Fatamizzihar⁶

^{1,2,3,4,5,6} Chemistry Study Program, Faculty of Science and Technology, UIN Syaraif Hidayatullah Jakarta

DOI: 10.31004/jestm.v6i1.392

E-mail: nurhasni@uinjkt.ac.id *

ARTICLE INFORMATION

Volume 6 Issue 1
Received: 21 January 2026
Accepted: 10 February 2026
Publish Online: 31 March 2026
Online: at <https://JESTM.org/>

Keywords

PDAM Water,
Well Water,
Chloride Content,
Mohr Method,
Argentometric Titration

ABSTRACT

The Mohr method of argentometric precipitation titration is often used for chloride analysis in water due to its high accuracy and simplicity of procedure. This study aims to determine chloride levels in water from PDAM Semanggi 2 and well water from Cinere, South Tangerang. An experimental quantitative approach was applied to the Ciputat domestic water source population and 50 mL purposive samples from both locations on November 6, 2025. Instruments included a brown burette, a graduated pipette, an analytical balance, and AgNO₃, NaCl, and K₂CrO₄; data analysis used normality calculations and average duplo. The results showed that the chloride levels in PDAM Semanggi 2 water were 80.02 mg/L and in Cinere well water were 92.34 mg/L, both below the quality standard of 300 mg/L (PP No. 22/2021). It was concluded that well water has higher levels due to geological factors, so both sources are safe for domestic consumption with recommendations for regular monitoring.

1. Introduction

Argentometric precipitation titration is a quantitative analysis method that utilizes insoluble precipitate formers to measure the concentration of halide ions such as chloride, with the Mohr method being the most common technique using potassium chromate as an indicator, which produces a brick-red precipitate at the endpoint. Chloride ions dominate halogens in natural waters, affecting water taste and potential infrastructure corrosion if present in excess (Mardiyono, 2020; Hastika et al., 2025). Ideally, clean water should be clear, odorless, tasteless, and free of harmful contaminants to support daily human life (Aronggear et al., 2019; Mukromin & Wibowo, 2023).

The selection of PDAM Semanggi 2 and Cinere well water as study samples was based on their representativeness of two distinct domestic water supply systems in the Ciputat area of South Tangerang. PDAM Semanggi 2 represents treated surface water distributed through an extensive pipeline network in the Greater Jakarta region, making it subject to potential quality changes along long distribution lines and environmental contamination during transmission (Indrajaya et al., 2021; Ngibad & Herawati, 2019). In contrast, the Cinere well water represents shallow groundwater tapped from an unconfined aquifer at a depth of 3–44.73 meters below the soil surface, where the dominant lithology consists of clayey sand and tuffaceous sand formations characteristic of South Tangerang's geological structure. This aquifer type is inherently vulnerable to surface infiltration, as domestic septic tanks in densely populated areas of Greater Jakarta are commonly located in close proximity to household wells, facilitating the seepage of wastewater — including chloride-rich household effluent from detergents and urine — directly into the groundwater. The Cinere area is not suspected of significant seawater intrusion given its inland location, but the shallow and unconfined nature of its aquifer makes it susceptible to chloride loading from domestic waste and rock leaching through tuffaceous sediment layers. High chloride levels can alter the taste of water, accelerate pipe corrosion, and disrupt supply infrastructure (Mukromin & Wibowo, 2023; Hastika et al., 2025).

Comparing treated PDAM water with raw,

untreated well water is methodologically intentional in this study, as it highlights the effect of water treatment processes on final chloride concentrations reaching end users. While PDAM water undergoes standardized treatment — including coagulation, flocculation, sedimentation, filtration, and chemical disinfection — well water in Cinere is consumed directly without pre-treatment, and its quality is entirely dependent on local soil geology, seasonal recharge patterns, and proximity to contamination sources such as septic tanks and domestic waste disposal (Indrajaya et al., 2021; Ngibad & Herawati, 2019). Excessive chloride levels pose health risks, including hypertension through impaired salt balance by the kidneys and renin enzyme activity, as well as the potential for gastric erosion or long-term chronic problems (Djuma & Talaen, 2014; Pratama et al., 2017; Kusumaningrum et al., 2020). National regulations through Government Regulation Number 22 of 2021 limit chloride to a maximum of 300 mg/L for class I–III water and 600 mg/L for class IV, guiding pollution control (Government of the Republic of Indonesia, 2021; Aronggear et al., 2019). In the context of potable water safety, the Ministry of Health Regulation (Permenkes No. 492/2010) sets a stricter chloride threshold of 250 mg/L as the maximum permissible level for drinking water quality, which provides a more relevant benchmark for assessing whether either water source is safe for direct consumption.

This study aims to determine chloride levels in water from PDAM Semanggi 2 and well water from Cinere, South Tangerang, using the Mohr precipitation titration method in duplicate. Its urgency lies in monitoring domestic water quality to prevent health risks and infrastructure damage in accordance with national regulations, while its novelty is providing the first empirical data for this specific sample in Ciputat, complementing previous studies and supporting local environmental management (Mardiyono, 2020; Hastika et al., 2025).

2. Literature Review

2.1 Chloride in Water & Its Significance

Chloride ions (Cl^-) are the most dominant halide species in natural water bodies and play a crucial role in determining water palatability, corrosive potential, and safety for human use.

According to the World Health Organization, chloride in drinking water at elevated concentrations imparts a salty taste and can promote corrosion of metal pipes and fittings in distribution systems. In Indonesian domestic water supplies, chloride concentrations have been consistently monitored as a key chemical parameter, with studies such as Ngibad and Herawati (2019) reporting chloride levels in well and PDAM water in Ngelom Village, Sidoarjo ranging from 92–491 mg/L in wells and 57–230 mg/L in PDAM water, all still within permissible limits under Permenkes No. 416/1990. These figures underscore the variability of chloride concentrations depending on source type, geological setting, and anthropogenic influence.

2.2 Argentometric Titration: The Mohr Method

The Mohr method of argentometric precipitation titration is one of the most established techniques for quantitative determination of chloride ions in water, relying on the reaction between Cl^- and silver nitrate (AgNO_3) to form a white AgCl precipitate, with potassium chromate (K_2CrO_4) as the indicator that signals the endpoint through the formation of a brick-red Ag_2CrO_4 precipitate. This method is widely favored in analytical chemistry due to its simplicity, low cost, high precision, and applicability to neutral or slightly alkaline conditions, making it particularly suitable for routine water quality testing in developing countries. Hastika et al. (2025) applied this method to analyze chloride in well water in South Kalimantan, obtaining reliable duplicate results that confirmed the method's suitability for field-collected environmental water samples.

2.3 Groundwater Quality and Contamination Factors

Shallow unconfined groundwater aquifers, such as those tapped by household wells in peri-urban areas of Greater Jakarta including South Tangerang, are inherently vulnerable to chemical contamination from surface infiltration. Research on groundwater quality in Tangerang showed that a substantial proportion of unconfined aquifer samples exceeded recommended thresholds for multiple chemical parameters, with domestic waste from septic tanks and household effluents identified as

primary contamination pathways. Aronggear et al. (2019) similarly noted that water quality is closely tied to source characteristics and local environmental conditions, reinforcing the importance of source-specific monitoring. In contrast to PDAM surface water — which undergoes multi-stage treatment including coagulation, flocculation, sedimentation, filtration, and disinfection — untreated well water quality is entirely dependent on local soil geology, land use, and seasonal recharge dynamics.

2.4 Health Risks of Elevated Chloride Intake

Excessive chloride intake through drinking water poses significant health risks, particularly in relation to cardiovascular and renal function. Morris et al. (2016) demonstrated that dietary chloride — not sodium alone — plays an independent role in blood pressure elevation by suppressing renin activity and altering vascular tone, a mechanism referred to as the "hidden hand of chloride in hypertension". A cross-sectional epidemiological study further found that exposure to high groundwater salinity, primarily driven by elevated chloride and sodium, was significantly associated with a 2.10-fold increase in the odds of hypertension and a corresponding elevated risk of chronic kidney disease (CKD). These findings highlight the importance of maintaining chloride concentrations within safe thresholds in domestic water sources.

2.5 Regulatory Standards for Water Quality in Indonesia

Indonesian water quality regulation establishes chloride thresholds across multiple use categories. Government Regulation No. 22 of 2021 on Environmental Protection and Management sets chloride limits at 300 mg/L for Class I–III surface water (suitable for drinking water sources post-treatment, recreation, aquaculture, and irrigation) and 600 mg/L for Class IV (limited use), serving as the primary benchmark for national water pollution control. For direct drinking water safety, the Ministry of

Health Regulation (Permenkes No. 492/Menkes/Per/IV/2010) imposes a stricter maximum permissible limit of 250 mg/L, a threshold that is more directly relevant when assessing whether water sources are safe for consumption without prior treatment. Together, these regulatory frameworks form the legal basis for evaluating domestic water quality in studies like the present one.

2.6 Previous Studies on Chloride in Indonesian Water Sources

Several studies have employed the Mohr argentometric method to assess chloride levels in Indonesian water sources, establishing a baseline for comparison. Pratama et al. (2017) analyzed chloride in dug well water in Nusa Penida, Klungkung Regency, using argentometric titration and found that levels were below the regulatory threshold, though proximity to septic tanks and coastal intrusion risk were noted as contributing factors to variability. Mukromin and Wibowo (2023) examined dug well water in Kaliwungu District, Kendal, using the same Mohr method and similarly found chloride concentrations within safe limits while attributing higher values in certain wells to domestic waste infiltration and rock leaching through sedimentary layers. Collectively, these studies demonstrate the consistent applicability of the Mohr method and point to domestic waste and geological factors as the dominant drivers of chloride variation in Indonesian shallow groundwater — a pattern also reflected in the higher chloride values observed in Cinere well water compared to PDAM-treated water.

3 Research Methodology

3.1 Types and Methods of Research

This study used an experimental quantitative approach with the Mohr technique of argentometric precipitation titration instrumental analysis to determine chloride ion levels accurately and with high precision. This approach is suitable for measuring analyte

concentration through the formation of AgCl precipitates, which is indicated by a color change of the K_2CrO_4 indicator to brick red (Mardiyono, 2020; Hastika et al., 2025; Sugiyono, 2023). The experimental research design ensured variable control and duplicate replication to increase the reliability of the results, as recommended in analytical chemistry methodology (Creswell & Creswell, 2023; Mukromin & Wibowo, 2023).

3.2 Data Analysis Instruments and Techniques

The main instruments included an analytical balance, a brown burette, a graduated pipette, an Erlenmeyer flask, a 500 mL volumetric flask, a spatula, a beaker, a Petri dish, a spray bottle, and a dropper for precise volume and mass measurements. Chemicals included $AgNO_3$, NaCl, 0.1 M K_2CrO_4 , distilled water, and water samples from PDAM Semanggi 2 and Cinere wells (Indrajaya et al., 2021; Ngibad & Herawati, 2019). The data analysis technique involved calculating the normality of $AgNO_3$ from standardization with NaCl using the formula $N_{AgNO_3} = (V_{NaCl} \times N_{NaCl}) / V_{AgNO_3}$, followed by Cl^- content = $(V_{AgNO_3} \times N_{AgNO_3} \times BE_{Cl} \times 1000) / V_{sample}$ with BE_{Cl} 35.5 g/eq, as well as statistical analysis of the average of duplicates for precision (Sudaryono, 2022; Emzir, 2021).

3.3 Population and Sample

The study population consisted of domestic water sources in the Ciputat area of South Tangerang, specifically water from the Semanggi 2 Regional Water Company (PDAM) as surface treated water and well water from Cinere as domestic groundwater that is vulnerable to geological contamination and domestic waste. Samples were taken purposively at 50 mL per replication from each source on November 6, 2025, representing daily community use, considering accessibility and relevance to water quality regulations (Government of the Republic of Indonesia, 2021;

Aronggear et al., 2019). This sample selection followed a non-probability sampling technique for specific environmental analysis studies (Sugiyono, 2023; Cresswell & Creswell, 2023).

3.4 Research Procedures

The procedure begins with the preparation of a standard solution of 0.05 N NaCl (1.4610 g oven-dried crystals at 250°C/1 hour, dissolved to 500 mL) and ~0.05 N AgNO₃ (4.25 g oven-dried crystals at 120°C/1 hour, dissolved to 500 mL, stored in the dark). AgNO₃ standardization was carried out in duplicate: pipette 10 mL of NaCl into an Erlenmeyer flask, add 10 drops of 0.1 M K₂CrO₄, titrate with AgNO₃ until brick red (average 8.55 mL, N=0.0585 N). Application: rinse the equipment, pipette 50 mL of sample into an Erlenmeyer flask, add 10 drops of K₂CrO₄, titrate in duplicate until a stable brick red precipitate forms (PDAM: average 1.95 mL; well: 2.25 mL) (Hastika et al., 2025; Mukromin & Wibowo, 2023). All steps are carried out under neutral pH conditions to avoid indicator hydrolysis, with constant homogenization for stoichiometric accuracy (Emzir, 2021; Sudaryono, 2022).

4 Results and Discussion

4.1 Results

Standardization of AgNO₃ with NaCl was carried out in two titrations (duplo), the data can be seen in Table 1.

Table 1. Standardization of AgNO₃ with NaCl

Test	NaCl Volume (mL)	AgNO ₃ Volume (mL)
Simple	10 mL	8.6 mL
Duplo	10 mL	8.5 mL
Average	10 mL	8.55 mL

Normality of AgNO₃ : 0.0585 N
 End point : brick red sediment

Table 2. Determination of Cl⁻ Levels in Tap Water from PDAM Semanggi 2

Test	Sample Volume (mL)	AgNO ₃ Volume (mL)
Simple	50 mL	2 mL
Duplo	50 mL	1.9 mL
Average	50 mL	1.95 mL

Cl⁻ levels : 80.0241 mg/L
 End point : brick red sediment

Table 3. Determination of Cl⁻ Levels in Cinere Well Water Tap Water

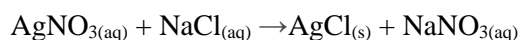
Test	NaCl Volume (mL)	AgNO ₃ Volume (mL)
Simple	50 mL	2.3 mL
Duplo	50 mL	2.2 mL
Average	50 mL	2.25 mL

Cl⁻ levels : 92.3355 mg/L
 End point color : Brick red

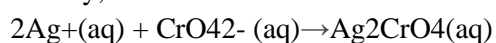
4.2 Discussion

On This experiment was carried out using the Mohr method, starting with the standardization of NaCl solution with a NaCl concentration of 0.05 N by weighing 1.4610 grams of NaCl crystals which must be dry and have been oven-dried at 250°C for 60 minutes, because its hygroscopic nature can absorb a little water vapor from the air which can cause the weighed mass to be greater than the actual mass and the solution concentration to be lower than the calculation obtained, the analysis results become inaccurate and can interfere with the reaction of the precipitation titration. Then dissolved in a 500 mL measuring flask with distilled water to the calibration limit after which it is homogenized, proper standardization will produce good titration in application.

The next stage is the preparation of the solution, in this experiment using AgNO₃ crystals with a concentration of 0.05 N by heating at a temperature of 120°C for 60 minutes, until completely dry, then put in a desiccator to cool. Then weighed 4.25 grams of AgNO₃ crystals which are then dissolved in a 500 mL measuring flask to the calibration limit, then homogenized, must be wrapped with carbon paper, after which stored in a dark place. This standardization is done because the AgNO₃ compound is an unstable reagent and is easily damaged when exposed to light or air, so that it can cause the concentration to fluctuate. To minimize damage and changes in the concentration of AgNO₃, therefore the storage of this compound is carried out in a dark container or tightly covered with carbon paper (black plastic). The raw material for standardizing AgNO₃ is NaCl, because it has stable properties, is easy to obtain for laboratory experiments, and is easy to purify. The first titration in standardizing the AgNO₃ solution with a previously standardized NaCl solution. Rinse the brown burette with a titrant, namely AgNO₃, after that take a clean 250 mL Erlenmeyer by measuring 10 mL of 0.05 N NaCl solution, then add 10 drops of 0.1 N K₂CrO₄ indicator. The addition of the K₂CrO₄ indicator aims to determine the equivalent point when standardizing, which is indicated by a color change to brick red. The reaction shown is;



Then, titrate AgNO₃ until a precipitate forms, indicated by a color change. Once the color change occurs, the titration is stopped. Once the NaCl solution is used up, the AgNO₃ solution will react with the K₂CrO₄ indicator. This reaction produces a brick-red precipitate, namely;



In the first experiment, the volume of AgNO₃ was 8.8 mL and in the second

experiment, 8.5 mL was obtained with an average of 8.65 mL. So the normality of AgNO₃ obtained was 0.0578 N from the calculation formula;

$$\begin{aligned} \text{Normality of AgNO}_3 &= 10 \times \text{Normality of NaCl} / \\ &\quad \text{Volume of AgNO}_3 \\ &= 10 \times 0.05 \text{ N} / 8.55 \text{ mL} \\ &= 0.0585 \text{ N} \end{aligned}$$

The next stage is the application stage using water samples from the Semanggi 2 and Cinere areas. This experiment was conducted on 11/06/2025. This is done to determine the Cl⁻ levels in clean water used in everyday life. This water is commonly used for bathing, washing clothes, household cleaning, vehicle washing, and other purposes. The titration process can be seen by determining the endpoint of the colored precipitate formation.

In the first sample, 50 mL of PDAM Semanggi 2 water was taken into an Erlenmeyer flask, then 10 drops of 0.1 M K₂CrO₄ indicator were added, then homogenized, the AgNO₃ solution was added to the burette, then the Erlenmeyer was shaken. In the first experiment, the volume of AgNO₃ produced was 2 mL and in the second experiment, it was 1.9 mL, so the average obtained was 1.95 mL. So, the chloride content obtained from PDAM Semanggi 2 water was 80.0241 mg/L from the calculation formula;

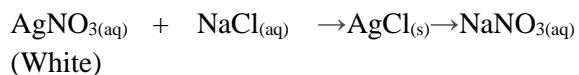
$$\begin{aligned} \text{Cl}^- \text{ content} &= \text{AgNO}_3 \text{ volume} \times \text{AgNO}_3 \\ &\quad \text{normality} \times \text{BE Cl}^- \text{ g/l} \times 1000 / \text{tap water volume} \\ &= 1.95 \text{ mL} \times 0.0578 \text{ N} \times 35.5 \text{ g/l} \times \\ &\quad 1000 / 50 \text{ mL} \\ &= 80.0241 \text{ mg/L} \end{aligned}$$

In the second sample, namely well water from Cinere, as much as 50 mL was added to the Erlenmeyer, then 10 drops of K indicator were added. K₂CrO₄ 0.1 M, then homogenized, the titrant AgNO₃ solution was added to the burette, then the Erlenmeyer was shaken. In the first experiment, the volume of AgNO₃ produced was 2.3 mL and in the second experiment it was 2.2

mL, so the average obtained was 2.25 mL. So, the chloride content obtained from the Cinere well water was 92.3355 mg/L from the calculation formula;

$$\begin{aligned} \text{Cl}^- \text{ content} &= \text{AgNO}_3 \text{ volume} \times \text{AgNO}_3 \\ &\text{normality} \times \text{BE Cl}^- \text{ g/l} \times 1000 / \text{tap water volume} \\ &= 2.25 \text{ mL} \times 0.0578 \text{ N} \times 35.5 \text{ g/l} \times \\ &\quad 1000 / 50 \text{ mL} \\ &= 92.3355 \text{ mg/L} \end{aligned}$$

The titrant will react with the Cl⁻ ion from the analyte to form an insoluble salt, namely AgCl. The addition of the indicator K₂CrO₄ causes the color of the solution to change to yellow, this reaction indicates;



The K_{sp} of AgCl is 1x10⁻⁵. Chloride ions (Cl⁻) can be precipitated with AgNO₃ to produce a white AgCl precipitate. This precipitation is carried out in a neutral atmosphere so that the indicator does not hydrolyze. The potassium chromate indicator (K₂CrO₄) will form a brick-red silver chromate (Ag₂CrO₄) precipitate when one drop is added. The AgCl solution will precipitate first, because its solubility is smaller than that of Ag₂CrO₄, the reaction that occurs is;



The Cl⁻ level in water samples is necessary because if it exceeds the specified threshold, the chlorine reacts with the water to form hypochlorous acid, which can damage body cells and cause digestive problems, leading to erosion of the stomach lining and ulcers. In the long term, it can lead to kidney disease and cancer.

In accordance with applicable laws, safe water levels for drinking and daily needs, such as washing and bathing, are regulated by regulations. The chloride content of drinking

water in Indonesia is regulated by Indonesian Government Regulation Number 22 of 2021, which establishes national water quality standards, namely categories I to IV. A limit of 300 mg/L for categories I-III water is considered safe for various purposes, such as drinking water sources (after undergoing treatment), recreational activities in the water, freshwater fish farming, livestock, and irrigation. On the other hand, a value of 600 mg/L for category IV water is still considered safe for limited use, especially in the context of irrigation and for purposes not related to consumption. This provision serves as a guideline for assessing water quality and controlling water pollution in Indonesia (Government of the Republic of Indonesia, 2021).

In our experiment, we cannot compare it with other experiments or studies, because in addition to the differences in the water sources we used, differences in the time of collection, location, and temperature at the water location can affect chloride levels. Based on calculations, the chloride ion (Cl⁻) level in the Semanggi 2 PDAM water sample was 80.0241 mg/L, while the level in the Cinere Well Water sample was 92.3325 mg/L. This significant difference in levels indicates the influence of different sources and environments on the two water samples. Higher Cl⁻ levels in well water are often caused by several factors, such as: Seawater Infiltration (Intrusion): If the well is close to the coast, seawater intrusion can increase salinity. Domestic/Septic Pollution: Household waste (including detergents and urine) has high chloride levels. Because well water comes from groundwater that is susceptible to infiltration, contamination from septic tanks or sewage seepage can be the main source of high levels. Rock Leaching: Groundwater moves slowly, allowing the dissolution of chloride minerals from rock layers more intensively.

From a chemical perspective, PDAM Semanggi 2 water originates from surface water sources such as rivers and reservoirs, and contains numerous organic and inorganic

contaminants, requiring treatment. Water treatment at PDAM Semanggi 2 can utilize coagulation, flocculation, filtration, pH adjustment, and disinfection. For chemical parameters, PDAM Semanggi 2 water tends to have a stable pH of around 6.5 to 8.5, with relatively low metal content and water hardness. Meanwhile, well water originates from groundwater, and its chemical composition is strongly influenced by geology, depth, and local pollution. Well water is generally untreated, and its quality depends on soil conditions. Well water exhibits a more varied pH and high metal content and water hardness.

5 Conclusion

This study determined that chloride levels in Semanggi 2 PDAM water reached 80.02 mg/L and in Cinere well water reached 92.34 mg/L through Mohr precipitation titration with duplicate replications, both well below the safe limit of 300 mg/L as stipulated in Government Regulation No. 22 of 2021 for class I-III water. Key findings indicate that well water has higher levels due to geological factors, domestic waste infiltration, and rock leaching, while PDAM water has lower levels due to treatment processes such as coagulation and disinfection. Practical implications include recommendations for routine monitoring of domestic water sources in Ciputat to prevent pipe corrosion and health risks such as hypertension, as well as guidance for PDAM in optimizing distribution quality.

Although the results were accurate and reliable thanks to AgNO₃ standardization, the study's limitations lie in the single sample without seasonal analysis or supporting parameters such as pH and hardness, and the lack of direct comparison with other studies due to variations in sampling location and time. Suggestions for further research include multi-sample testing, integration of spectrophotometric methods for validation, and long-term impact studies on local community health to enrich the environmental data for South Tangerang.

References

Aronggear, T. E., Supit, C. J., & Mamoto, J. D. (2019). Analysis of the quality and quantity of clean water use at PT. Air

Manado, Wenang District. *Jurnal Sipil Statik*, 7(12), 1625–1632.

Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications.

<https://doi.org/10.4135/9781071817903>

Djuma, A. W., & Talaen, M. S. (2014). The analysis of chloride in argentometry on dug well water in Kupang Regency of Kupang Tengah District Oebelo Village in 2014. *Jurnal Info Kesehatan*, 12(1).

Emzir. (2021). *Metodologi penelitian kualitatif: Analisis data*. Pustaka Setia.

Government of the Republic of Indonesia. (2021). *Peraturan Pemerintah Republik Indonesia Nomor 22 Tahun 2021 tentang Penyelenggaraan Perlindungan dan Pengelolaan Lingkungan Hidup*. <https://peraturan.go.id/id/pp-no-22-tahun-2021>

Hastika, F. Y., Ihsan, M. F., Nadiya, D., Trianty, D., Angreini, A., & Tania, M. A. (2025). Analisis kadar klorida air sumur RT 01 Sungai Pinang Kecamatan Sungai Tabuk Provinsi Kalimantan Selatan dengan metode titrasi argentometri. *Sains Medisina*, 4(1), 15–19. <https://doi.org/10.63004/snsmed.v4i1.709>

Indrajaya, I. N. R., Irfansyah, A. N., & Pirngadi, H. (2021). Microcontroller for measuring calcium carbonate (CaCO₃) levels in limestone through automatic titration. *Jurnal Teknik ITS*, 10(2). <https://doi.org/10.12962/j23373539.v10i2.68285>

Kusumaningrum, W., Rosita, I. I., & Awaliyah, N. M. (2020). *Argentometri (metode Mohr)*. Universitas Islam Negeri Syarif Hidayatullah Jakarta.

Mardiyono. (2020). Penetapan kadar asam sianida pada talas (*Colocasia esculenta*) dengan variasi waktu perendaman

- menggunakan analisis argentometri. *Jurnal Analis Farmasi*, 5(1), 30–37.
- Mukromin, A., & Wibowo, Y. M. (2023). Penentuan kadar ion klorida (Cl⁻) pada sampel air sumur gali di Kecamatan Kaliwungu Kabupaten Kendal menggunakan metode argentometri Mohr. *Jurnal Kimia dan Rekayasa*, 4(1), 17–22.
- Ngibad, K., & Herawati, D. (2019). Analysis of chloride levels in well and PDAM water in Ngelom Village, Sidoarjo. *JKPK (Jurnal Kimia dan Pendidikan Kimia)*, 4(1), 1–7. <https://doi.org/10.20961/jkpk.v4i1.24526>
- Pratama, I. W. P. A., Parwata, I. M. O. A., & Subhaktiyasa, P. G. (2017). Analisis kadar klorida pada air sumur gali di Banjar Telaga Desa Kutampi Kaler Kecamatan Nusa Penida Kabupaten Klungkung dengan titrasi argentometri. *Media Bina Ilmiah*, 4(1), 492–497. <https://doi.org/10.36376/bmi.v4i1.55>
- Sudaryono. (2022). *Metodologi penelitian kuantitatif dan kualitatif dalam bidang pendidikan dan pengembangan profesi*. Graha Ilmu.
- Sugiyono. (2023). *Metode penelitian kuantitatif, kualitatif, dan R&D* (3rd ed.). Alfabeta.
- World Health Organization. (2003). *Chloride in drinking-water: Background document for development of WHO guidelines for drinking-water quality*. WHO. <https://cdn.who.int/media/docs/default-source/wash-documents/wash-chemicals/chloride.pdf>