HYDROGEN
JURNAL KEPENDIDIKAN KIMIA
https://e-journal.undikma.ac.id/index.php/hydrogen/index

December 2025. 13(6)
e-ISSN: 2656-3061
p-ISSN: 2338-6487
pp. 1189–1199

The Relationship Between Septic Tank Distance And The Biological Quality Of Dug Well Water In Rensing Bat Village, West Sakra District

Iwan Desimal, Dahlia Rosma Indah*, M. Hario Tangkas Abqory
Public Health Department, Faculty of Sports Science and Public Mandalika University of Education. Jl. Pemuda No. 59A, Mataram, Indonesia
* Corresponding Author e-mail: dahliarosma@undikma.ac.id

Article History
Received: 12-11-2025
Revised: 22-12-2025
Published: 31-12-2025

Keywords:
Septic Tank Distance; Biological Quality of Excavated Well Water; Rensing Bat Village

Abstract
Based on data from the results of the Household Drinking Water Quality Surveillance of the Rensing Health Center in Rensing Bat Village in 2024, which was carried out from 15 wells, there were 13 wells that contained Eschericia colli bacteria and 2 wells that did not contain Eschericia colli bacteria. This study aims to determine the relationship between the distance of the septic tank and the biological quality of dug well water in Rensing Village, West Sakra District in 2025. This type of research is an analytical survey with a cross sectional approach. This research was conducted in Rensing Bat Village, West Sakra District. The population in this study is 124 houses that have dug wells and septic tanks with a sample of 55 houses taken using systematic random sampling techniques. Data analysis used univariate and bivariate tests. The results of the statistical test of the septic tank distance variable showed a value (p value = 0.027<0.05) with the biological quality of the dug well water. Conclusion: there is a relationship between the distance of the septic tank and the biological quality of dug well water in Rensing Bat Village, West Sakra District in 2025. It is recommended to the head of the Rensing Health Center to assign environmental health workers to intensify counseling activities on the safe distance of septic tanks to dug wells with a distance of ≥ 10 m and cook water before consumption in order to break the chain of water-transmitted diseases. Proper management of the septic tank distance is essential to prevent negative impacts on water quality and to protect public health and the environment.

How to Cite: Desimal, I., Indah, D. R., & Abqory, M. H. T. (2025). The Relationship Between Septic Tank Distance And The Biological Quality Of Dug Well Water In Rensing Bat Village, West Sakra District. Hydrogen: Jurnal Kependidikan Kimia, 13(6), 1189–1199. https://doi.org/10.33394/hjkk.v13i6.18917

https://doi.org/10.33394/hjkk.v13i6.18917

INTRODUCTION

Well water is shallow groundwater with a depth of less than 30 meters. Meanwhile, drilled wells are usually made to obtain deep groundwater, using a drill and inserting a pipe with a length of 100-300 meters. Currently, many people use drilled well water as a source of clean water. (Darwati, 2023). According to data from the 2018 Basic Health Research, the water sources used by households in Indonesia for clean water are: protected dug wells (24.7%), tap water (14.2%), drilled wells/pumps (14.0%), and Drinking Water Depot (13.8%). According to data from the 2023 Indonesian Health Survey, the percentage of people in West Nusa Tenggara who use dug wells as a source of clean water is 19.9% and drilled wells 14.6%.

Planning for clean water supply must meet the three conceps : quality, quantity, and continuity. Quality concerns the quality of water, both clean water and processed water ready for distribution. Quantity concerns the amount and availability of treated water in the clean water supply, as needed, according to the number of consumers served. Continuity concerns the ongoing need for water. This means whether the clean water source can consistently supply water needs, especially during the dry season (Madani.R.M, 2021).

Unpolluted water quality parameters must meet physical requirements (color, taste, precipitation, temperature), chemical requirements (pH, hardness, iron, aluminum, organic substances, nitrates and nitrites), and biological requirements that do not contain disease germs such as dysentery, typhoid, cholera, and disease-causing pathogenic bacteria. In general, disturbances caused by water pollution are waterborne diseases, which are diseases transmitted by drinking water that are directly contaminated with pathogenic microorganisms or substances in the water (Sari, 2023).

Biological parameters include the presence or absence of organic matter or microorganisms such as Escherichia colli bacteria, viruses, bentos and plankton. Sensitive organisms will die in polluted water environments. Pathogenic bacteria that affect water quality according to the Ministry of Health are coliform bacteria, such as Escherichia colli, clostridium perfringens and Salmonella typhi (Julianto, 2022). The parameters used in this bacteriological requirement are measured through the bacterial content of Escherichia colli. Escherichia colli is a bacterium from the group of bacteria in the fecal group. Eschericia colli lives in the large intestines of humans and warm-blooded animals. The presence of eschericia colli in water is an indicator of human and animal fecal pollution, which means the risk of other types of pathogens in the water that are dangerous if exposed to humans. For this reason, an examination of Eschericia Colli must be carried out to find out whether water is safe to use or not and the need to handle water safety (Salsabila, 2021).

The distance between the septic tank and the unqualified dug well (< 10 meters) can be a factor in the presence of Escherichia coli bacteria. This is supported by research that has been carried out in Klitih Village, Plandaan District, Jombang Regency in 2019. Based on the results of the analysis, a value of P = 0.003 (p-value< 0.05) was obtained, so it can be concluded that there is a relationship between the distance between the septic tank and the content of Escherichia coli bacteria. From the results of the analysis, the RP value was 2,267 (95% CI: 1,150-4,469). Judging from the results of the RP, dug wells that have a distance from the septic tank < 10 meters have a risk of being contaminated with Escherichia coli bacteria 2,267 times greater than dug wells that have a distance from a qualified septic tank (≥ 10 meters) (Mandasari, 2019).

East Lombok Regency is one of the districts in West Nusa Tengga Province. According to data from the Central Statistics Agency in 2023, the people of East Lombok Regency who use dug wells as a source of clean water are 17.8%. West Sakra District is one of the sub-districts in East Lombok Regency consisting of 18 villages. This sub-district is included in the work area of the Rensing Health Center, where most of the people use dug wells as a source of water for drinking, bathing, cooking, washing, and so on. According to data from the 2023 Rensing Health Center's annual report, the number of wells dug in West Sakra District is 14,103 wells. Of the 18 villages in West Sakra District, the village that I will use in the research is Rensing Bat Village which has 124 wells dug as many. This is based on the recommendation of the Rensing Health Center because in the village almost all houses already have septic tanks.

Based on data from the results of the 2024 Household Drinking Water Quality Surveillance of the Rensing Health Center which was carried out on 15 residents' wells in Rensing Bat Village related to the biological quality of dug well water with indicators of the presence of eschericia colli bacteria . The results of surveys and lab tests carried out from 15 wells were 13 wells that contained Eschericia colli bacteria and 2 wells that did not contain Eschericia colli bacteria. In addition, based on the data from the inspection results of the 2024 Rensing Health Center dug wells in Rensing Bat Village, out of 15 wells, there are 10 wells that have a distance of < 10 meters and 5 wells that have a distance of ≥ 10 meters from the source of pollutants, such as septic tanks. After sampling was carried out in Rensing Bat Village, the results of laboratory tests from 15 samples were taken and 13 water samples were positive for the content of eschericia colli bacteria. The content of eschericia colli bacteria from the 13 houses has a variety of contents, including those that have a content of 1-15 CFU/100 ml, 16-30 CFU/100 ml, and above 31 CFU/100 ml.

Based on an initial survey in Rensing Bat Village, West Sakra District which was carried out on 10 residents who had dug wells. There were 4 residents who consumed water from dug wells directly and 6 residents who consumed water by cooking it first. In addition, there are cases caused by eschericia colli bacteria , namely diarrhea and skin diseases. Based on data from the annual report of the Rensing Health Center in 2024, there will be 59 cases of diarrhea and 23 cases of skin diseases in Rensing Bat Village.

METHOD

Tools and Materials

Based on the 2023 household drinking water quality surveillance guidebook, the tools and materials used in testing drinking water samples for microbiological parameters (*eschericia colli*) are as follows:

1. Compact Dry *Eschericia Colli* is a method of rapid detection of microbiological contaminants. Compact dry EC is specialized for detecting E-coli and coliform bacteria (Asyfiradayati, 2016).
2. The filter membrane is a unit of system that is sterile to be used as a water filter.
3. *Colony counter* is a tool that can be used to perform cell counts quickly and can be used for low cell concentrations.
4. An incubator is a tool used to incubate bacteria creating an optimal environment for bacterial growth.
5. A micropipette is a device used to move a liquid with a small volume, usually less than 1000 µl and in its use is more accurate than using a drip pipette. Micro pipette volume uses microliter units and is available in sizes ranging from 1 to 1000 µl (Muslim, 2010)
6. A sterile syringe is a device used to draw 100 ml of sample water which is in the filter membrane of the system, so that the existing sample water can come out quickly.
7. A bunsen burner is a laboratory tool used to produce flames for heating, combustion, or sterilization in various chemical and biological experiments.

Water Sampling Procedure

The method of sampling water in the dug well according to SNI 6989.58:2008 is:

1. Turn on the bunsen burner or spirit burner.
2. Carefully rotate the mouth of the bottle over the heat for a few seconds until the entire mouth of the bottle is heated evenly.
3. Open the production well water faucet and let the water run for 1 minute – 2 minutes then put it in a container
4. Cap the bottle immediately after filling using a sterile cap.

Laboratory Testing Procedures

Based on the 2023 household drinking water quality surveillance guidebook related to testing drinking water samples of microbiological parameters (*eschericia colli*), both the point of access and the point of use using the same procedure, namely Preparation, testing and incubation:

1. Set up an incubator. Set the temperature to 35 ±2ºC
2. Set up compact dry EC (CD EC), Filter membrane system and syringe
3. Open the compact dry *aluminum wrapper*
4. Remove a number of *compact dry* discs as needed
5. Stick the sticker in the memorandum section of the disc
6. Install/connect the syringe and membrane filter system
7. Pour the homogenized water sample into the filter membrane (filter mouthpiece) to a limit of 100 mL
8. One mililiters pipette (with a micropipette or sterile drip pipette) to moisten the surface of the CD EC, by placing the CD EC on a flat surface, opening the plate cover, and then dripping the water sample over the entire surface of the CD EC
9. Filter the remaining water sample (99 mL) by slowly pulling the syringe valve, until the water sample is completely filtered.
10. Attach the filter from the mouthpiece (system filter membrane) to the surface of the CD EC plate that has been moistened with 1 mL of sample (point 8), using sterile tweezers (avoid bubbles). Reclose the EC CD.
11. Turn the plate upside down, then incubate at 35 ± 2ºC for 24 ± 2 hours, by inserting the EC CD into the incubator
12. Record storage time (sample incubation)

How to Count Bacterial Colonies

The following are the working instructions for using *colony counters* according to (Aulanni'am, 2012) :

1. Remove the EC CD from the incubator according to its incubation period standards
2. Connect the power outlet to the power source.
3. Switch on the appliance by pressing the 'ON' button.
4. Reset the calculation amount to a '0' number.
5. Place the EC CD containing the bacterial colonies to be counted on a table equipped with a scale.
6. Mark the colony by pointing the pen at the scale table.
7. Count separate bacterial colonies (*greenish-blue* eschericia colli colonies).
8. View the colony with the help of a magnifying glass.
9. Switch off the appliance by pressing the 'OFF' button

Data Analysis

Univariate analysis was carried out to dedefine the research variables by making frequencies and distributions in the form of tables. Univariate analysis in this study was carried out on the variables of septic tank distance and the biological quality of dug well water.

Bivariate analysis was performed using a statistical test (chi square p-value ≤ α (the commonly used significance value is 0.05). The results of the study are said to be related between independent variables and dependent variables if the p-value is <0.05.

RESULTS AND DISCUSSION

Septic Tank Distance

Based on the Indonesian National Standard (SNI) 2398:2017, the safe distance between the septic tank and the dug well is ≥ 10 meters. Groundwater contamination by bacteria from pollutant sources can reach a distance of 10 meters in the direction of groundwater flow. For this reason, the construction of pump wells or dug wells must be at least 10 meters away from the source of bacteriological pollutants (Suyono, 2010). Based on the results of the measurement with observation sheets and assisted by the roll meter measuring device, the following results were obtained.

Table 1. Septic Tank Distance Frequency

Septic Tank Distance	**Frequency**	**Presses**
Eligible	16	29,1 %
Not Eligible	39	70,9 %
Total	55	100 %

Based on the table above, it can be seen that 16 houses with septic tank distance (≥10 m) are eligible and 39 houses (70.9%) are not eligible for septic tank space. The emergence of the requirement of a distance of 10 meters between the well and the septic tank started from the bacterium eschericia colli which is an anaerobic pathogen that usually has a life expectancy of three days. Meanwhile, the speed of water flow in the soil is around 3 meters per day, so the ideal distance between the septic tank and the well is 9 meters obtained from the result of multiplying between 3 meters per day multiplied by 3 days. This figure was then increased to 10 meters after adding one meter as a safety distance. (Salsabila et al., 2019).

Biological Quality of Excavated Well Water

Based on the results of measurements with observation sheets and using the colony counter tool , the following results were obtained.

Table 2. Frequency of Biological Quality of Excavated Well Water

Biological Quality of Excavated Well Water	Frequency	Presses
Eligible	12	21,8 %
Not Eligible	43	78,2 %
Total	55	100 %

Based on the table above, it can be seen that 12 houses that have the biological quality of dug well water meet the requirements (0 CFU/100 ml) and houses that have the biological quality of dug well water do not meet the requirements (>0 CFU/100 ml) as many as 43 houses (78.2%)

Environmental technology researchers from the Indonesian Institute of Sciences (LIPI) stated that in one gram of feces contains one billion infectious virus particles, which are able to survive for several weeks at temperatures below 10 degrees Celsius. There are four pathogenic microorganisms contained in feces, namely viruses, protozoa, worms, and bacteria which are generally represented by Eschericia colli. Although the four microorganisms are considered to be a source of drinking water pollution, generally the main indicator is the presence of Eschericia colli bacteria. If no Eschericia colli bacteria are found, then the water is microbiologically declared unpolluted (Salsabila et al., 2017.

Escherichia colli is an indicator of clean water quality bacteria because its presence in the water indicates that it is contaminated by feces, which may also contain other pathogenic enteric microorganisms. Eschericia colli bacteria in water are generally non-pathogenic eschericia colli but sometimes pathogenic strains such as enterotoxins and eschericia colli are also found that produce shiga-toxin (Enterohemoragi) (Rahayu et al., 2018).

Bivariate Analysis

The skins and seeds of agricultural products after the fruit is used by the food industry, are often thrown away. In the last two decades, the use of agricultural waste has often been researched for its function as an absorbent of dyes and harmful metals in waters. In addition to its abundant availability, low cost and wide distribution, agricultural waste can also reduce solid waste that interferes with aesthetic value. The use of agricultural industrial waste as an absorbent is caused by the existence of functional groups contained in it that can bind to dyes or heavy metals.

Bivariate analysis was performed using a statistical test (chi square p-value ≤ α (the commonly used significance value is 0.05). The results of the study are said to be related between independent variables and dependent variables if the p-value is <0.05. The bivariate analysis in this study is to determine the relationship between the distance of the septic tank and the biological quality of the dug well water.

Based on a bivariate analysis, the relationship between the distance of the septic tank and the biological quality of dug well water in Rensing Village, West Sakra District in 2025 can be seen in the following table.

Table3. Distance Analysis of Septic Tank with Biological Quality of Dug Well Water

SepticTank Distance	**Biological Quality of Excavated Well Water**			**p value**
	Eligible	**Not Eligible**	**Total**	
Eligible	7 (58,3 %)	9 (20,9 %)	16 (29,1 %)	0,027
Not Eligible	5 (41,7 %)	34 (79,1 %)	39 (70,9 %)	
Total	12 (21,8 %)	43 (78,2 %)	55 (100 %)	

Based on the table above, it shows that of the 12 houses that have the biological quality of dug well water (0 CFU/100 ml), the septic tank distance (≥ 10 m) is 7 houses (58.3%) more than the septic tank distance (<10 m) is not eligible as many as 5 houses (41.7%). Of the 43 houses that have the biological quality of dug well water that is not qualified (>0 CFU/100 ml), there are 9 houses (20.9%) where the septic tank distance (≥ 10m) is less qualified than the septic tank distance (<10 m) is not eligible, namely 34 houses (79.1%).

From the results of the Chi-square test (Fisher's Exact Test), it was found that p value = 0.027 (P = <0.05), then H0 was rejected and Ha was accepted so that it can be concluded that there is a relationship between the distance of the septic tank and the biological quality of the dug well water in Rensing Bat Village, West Sakra District.

The Relationship between Septic Tank Distance and Biological Quality of Dug Well Water

Distance according to the Great Dictionary of the Indonesian Language is the space between two objects or places. In the context of septic tank spacing, spacing refers to the safe distance that must exist between the septic tank line and the water source to prevent pollution. This distance is important to ensure that groundwater or surface water is not contaminated by wastewater that could cause health risks.

The distance of septic tanks that are not qualified is influenced by the availability of land in Rensing Bat Village. Land availability is the amount and area of land available for various needs, such as settlements, agriculture, industry, and infrastructure. In the context of sanitation and the environment, land availability refers to the space that can be used for the construction of sewage treatment facilities, including septic tanks and wastewater treatment systems.

In addition, the distance of the septic tank is also affected by the soil permeability in Rensing Bat Village. Soil permeability is one of the physical properties of soil that plays an important role in the process of water flow through the soil, which is very relevant in agricultural irrigation management. The level of soil permeability affects the speed and amount of water that is able to penetrate into the soil, thus affecting the availability of water for plants (Foth, 1990). Sandy soils tend to have larger pore spaces and better drainage, which results in high permeability (Brady & Weil, 2002). In contrast, clay soils with smaller pores and high cohesion have lower permeability, so water moves more slowly (Lal & Shukla, 2004). This factor has a relationship with the determination of septic tank spacing, as soil permeability affects how quickly wastewater from septic tanks can seep into the soil and potentially contaminate groundwater sources.

Soil elevation or land elevation can affect the direction and speed of groundwater flow, which in turn impacts the risk of contamination between septic tanks and dug wells. In general, groundwater flows from areas with higher elevations to lower areas. Therefore, if the septic tank is located at a higher position than the dug well, there is a high chance that contaminants from the septic tank can seep and flow into the dug well, increasing the risk of contamination (Sapulete, M. R., 2010).

In addition, the slope of the land also plays an important role. On land with a sharp slope, surface water flow and water infiltration into the soil can occur more quickly, which can accelerate the movement of contaminants from the septic tank to the dug well. On the other hand, on flat land, the flow of groundwater may be slower, but the risk of contamination remains if the distance between the septic tank and the dug well is inadequate (Sapulete, M. R., 2010).

The 12 houses that have the biological quality of dug well water (0 CFU/100 ml), the septic tank distance (≥ 10 m) is 7 houses (58.3%) more than <5 houses (41.7%) are not eligible Of the 43 houses that have the biological quality of dug well water that is not qualified (>0 CFU/100 ml), there are 9 houses (20.9%) where the septic tank distance (≥ 10m) is less qualified than the septic tank distance (<10 m) is not eligible, namely 34 houses (79.1%).

The results of the study showed that 5 (five) houses with septic tank spacing (<10 m) were not eligible but the biological quality of the dug well water was qualified (0 CFU/100 ml) due to factors such as the construction of dug wells that have met the Indonesian National Standard (SNI) 03-2916-1992 concerning Specifications of Dug Wells for Clean Water Sources suggests that dug wells should have waterproof walls to a depth of at least 3 meters to prevent infiltration contaminants from the soil surface. In addition, the septic tank factor meets the Indonesian National Standard (SNI) 2398:2017 concerning Procedures for Planning Septic Tanks with Advanced Treatment, the septic tank must meet the structural requirements and be waterproof. The building materials used, such as reinforced concrete, must be able to resist acids and not allow wastewater to seep out. In addition, the pipe connection between the septic tank and the advanced treatment system must also be watertight. On the other hand, 9 (nine) houses with septic tank spacing (≥ 10 m) were eligible, but the biological quality of dug well water was not qualified (>0 CFU/100 ml) due to the construction of dug wells that did not meet the Indonesian National Standard (SNI) 03-2916-1992 and septic tanks that did not meet the Indonesian National Standard (SNI) 2398:2017.

From the results of the Chi-square test, it was found that p value = 0.028 (P = <0.05), then H0 was rejected and Ha was accepted so that it can be concluded that there is a relationship between the distance of the septic tank and the biological quality of the dug well water in Rensing Bat Village, West Sakra District.

The results of this study are in line with the research (Sapulete, M. R., 2010) on the distance between dug wells and septic tanks or sewage storage pits that meet health requirements as many as 5 dug wells (17%), still from the results of laboratory examinations on bacteriological quality, the 5 dug wells also contain eschericia colli that exceed the maximum allowable rate. According to this study, in addition to the distance from the dug well, other conditions that must be met to obtain clean water (drinking and washing) are the wall structure (plastered concrete) and the floor of the dug well and the wastewater disposal system (SPAL). Based on the results of the statistical analysis carried out, there was a very significant relationship (at $\alpha=0.05$; $p=0.039$) between the distance between the well and the septic tank or sewage storage hole with eschericia colli content.

Based on research conducted by (Mandasari, 2019). Of the 30 respondents surveyed, 18 (60%) were < 10 meters away from the dug well. Meanwhile, 12 (40%) wells dug have a distance of ≥ 10 meters that are qualified. Of the 30 respondents who were examined for the content of Escherichia coli bacteria in the dug well in Klitih Village, Plandaan District, Jombang Regency, there were 22 (73.3%) wells with Escherichia coli bacteria content that did not meet the requirements (>0 CFU/100ml). Meanwhile, 8 (26.7%) wells with Escherichia coli bacteria content were eligible (0 CFU/100ml). According to this study, from 6 respoden, there was a distance between the dug well and the Septic tank was not eligible but there was no Escherichia coli bacteria content of 1 (5.6%). Meanwhile, the distance between the dug well and the Septic tank is eligible, but there is still a content of Escherichia coli bacteria amounting to 5 (41.7%). Dug wells that are far from the Septic tank are eligible but there is still a content of Escherichia coli bacteria because the location of the soil between the septic tanks is higher than the dug well, and besides that pollution can also come from the location of the dug well adjacent to the cattle pen or adjacent to the river. Based on the results of the analysis, a value of $P = 0.003$ (p-value< 0.05) was obtained, so it can be concluded that there is a relationship between the distance between the septic tank and the content of Escherichia coli bacteria.

This study is different from previous research that examined more physical and chemical parameters of well water, this study specifically analyzes the impact of septic tank spacing on biological parameters, such as the content of Escherichia coli bacteria. Not only does the study consider the horizontal distance between the septic tank and the dug well, it also explores the effect of differences in soil elevation and soil permeability on the spread of biological contamination, an aspect that has not been widely discussed in previous studies.

CONCLUSION

Most of the septic tank distances were not qualified (<10 m) i.e. 39 houses (70.9%) of the 55 houses studied. Most of the biological quality of dug well water was not qualified (>0 CFU/100 ml) i.e. 43 houses (78.2%) of the 55 houses studied. There was a relationship between the distance of the septic tank and the biological quality of the dug well water in Rensing Bat Village, West Sakra District with a p value = 0.027<0.05. It is recommended to the head of the Rensing Health Center to assign environmental health workers to intensify counseling activities on the safe distance of septic tanks to dug wells with a distance of ≥ 10 m and cook water before consumption in order to break the chain of water-transmitted diseases. Proper management of the septic tank distance is essential to prevent negative impacts on water quality and to protect public health and the environment.

RECOMMENDATIONS

Based on the conclusion that there is a significant relationship between the distance of the septic tank and the biological quality of the water of the dug well in Rensing Bat Village, West Sakra District, it is recommended to the head of Rensing Bat Village to convey to the community to cook water before consumption in order to break the chain of water-transmitted diseases.

BIBLIOGRAPHY

Aulanni'am. (2012). Instruksi Kerja Pemakaian Colony Counter. Program Kedokteran Hewan Universitas Brawijaya, 3.

Azizah, N., Rivai, A., & Rasman. (2023). Faktor Yang Berhubungan Dengan Keberadaan Bakteri Escherichia Coli Pada Air Sumur Gali Di Kelurahan Jeppe'e Kec.Tanete Riattang Barat Kab.Bone. Sulolipu: Media Komunikasi Sivitas Akademika Dan Masyarakat, 23(2). https://doi.org/10.32382/sulo.v23i2.71

Badan Standarisasi Nasional (BSN). (2017). Tata cara perencanaan tangki septik dengan pengolahan lanjutan (SNI 2398:2017). Jakarta: BSN.

Bapeldada Kota Pekanbaru. 2007. Laporan Pendataan Usaha atau Kegiatan Industri yang Memanfaatkan Air Bawah Tanah di Kota Pekanbaru.

Brady, N. C., & Weil, R. R. (2002). The nature and properties of soils. Pearson Education.

Darwati, J. (2023). Analisis Faktor Fisik Dan Biologi Pada Air Sumur Bor Di Desa Bangun Sari Baru Kecamatan Tanjung Morawa Sumatera Utara. Skripsi.

Foth, H. D. (1990). Fundamentals of soil science. John Wiley & Sons.

Harahap, Lia Hardina, & Kristian. (2021). Kontribusi Penggunaan Peralatan Ukur Tanah Terhadap Hasil Belajar Survey dan Pemetaan Siswa Kelas XI Program Keahlian Teknik Konstruksi Batu dan Beton SMK Negeri 2 Binjai. *Jurnal Pendidikan Teknologi dan Kejuruan*, 27(1), 1-9.

Huwaida, R.N. (2014). Faktor-Faktor Yang Mempengaruhi Jumlah Eschericia Colli Air Bersih Pada Penderita Diare Di Kelurahan Pakujaya Kecamatan Serpong Utara Kota Tangerang Selatan Tahun 2014.

Julianto, 2022. (2022). Identifikasi Bakteri Escherichia coli (E. coli) Pada Air Minum Isi Ulang di Kecamatan Hamparan Perak Kabupaten Deli Serdang Sumatra Utara. Jurnal Kesehatan Lingkungan Universitas Halu Oleo, 3(2).

Kementerian Kesehatan Republik Indonesia. (2017). Peraturan Menteri Kesehatan Nomor 32 Tahun 2017 tentang Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air untuk Keperluan Higiene Sanitasi, Kolam Renang, Solus Per Aqua, dan Pemandian Umum. Jakarta: Kementerian Kesehatan RI.

Kementrian Kesehatan RI, K. Peraturan Mentri Kesehatan No. 3 Tahun 2014. 139 (2014).

Kodoatie, Robert J. 2010. Tata Sumberdaya Air. Teknik Penyediaan Air. Yogyakarta: Andi

Kusnoputranto, H. 1997. Kesehatan Lingkungan. Jakarta: Direktorat Jenderal Pendidikan Tinggi Departemen Pendidikan dan Kebudayaan.

Lal, R., & Shukla, M. K. (2004). *Principles Of Soil Physics*. CRC Press.

Lisnawati, L., Hakim, A. R., & Darsono, P. V. (2023). Uji Aktivitas Antimikroba Sarang Burung Walet Putih (Aerodramus fuciphaga) Terhadap Bakteri Escherichia coli. *Jurnal Farmasi SYIFA*, 1(2), 54–58. https://doi.org/10.63004/jfs.v1i2.201

Madani.R.M. (2021). Analisis Distribusi Pipa Air Bersih di Lingkungan Universitas Lampung.

Mandasari, Nia. (2019). Hubungan Jarak Septic Tank Dengan Jumlah Kandungan Bakteri Eschericia Coli Dalam Sumur Gali di Desa Klitih Kecamatan Plandaan Kabupaten Jombang

Muchlis, Thamrin, & Sofyan Husein Siregar. (2017). Analisis Faktor yang Mempengaruhi Jumlah Bakteri Escherichia coli pada Sumur Gali Penderita Diare di Kelurahan Sidomulyo Barat Kota Pekanbaru.

Muhadi. (2008). Hubungan Kandungan *E. Coi* Pada Air Minum Dengan Kejadian Diare Pada Balita Di Kecamatan Koja Kota Administrasi Jakarta Utara Tahun 2008 .

Mulia, R.M. 2015. Kesehatan Lingkungan. Yogyakarta: Graha ilmu. Nadirawati.

Muslim. “Pengaruh Konsentrasi Antikoagulan EDTA Terhadap Perubahan Parameter Pemeriksaan Hematologi”. Jurnal Kesehatan 2010.

Najamuddin, D, P. 2016. Analisa Kualitas Air Pada Sumur Dangkal (Sumur Gali) Berdasarkan Tingkat Kekeruhan Di Kecamatan Lhoknga Kabupaten Aceh Stikes Widyagama Husada Besar Berbasis SIG. Skripsi. Universitas Syiah Kuala Darussalam, Banda Aceh.

Nawawi, Gunawan.(2001). Modul Program Keahlian Mekanisasi Pertanian: Mengukur Jarak dan Sudut (Kode Modul SMKP2K02-03MKP). Universitas Padjadjaran.

Nazar, Herman, dkk. 2010. Kebijakan Pengendalian Pencemaran Sumber Air Bersih Perumahan Sederhana di Kota Pekanbaru (Kasus di Kecamatan Tampan). Journal of Environmetal Science, Vol (1), No. 4. 2010: 1-18

Notoadjmojo. (2010). Prilaku Kesehatan. Rineka Cipta.

Notoatmodjo, S, (2012). Kesehatan Masyarakat Ilmu dan Seni. Jakarta. PT. Rineka Cipta.

Notoatmodjo. (2018). Metodologi Penelitian Kesehatan. Jakarta: Rineka Cipta

Putranto, Y. A. S. (2017). Hubungan jarak TPA dan kondisi fisik sumur gali dengan kualitas mikrobiologi air.

Rahayu, W. P., Nurjanah, S., & Komalasari, E. (2018). *Escherichia coli: Patogenitas, analisis, dan kajian risiko*. Bogor: IPB Press.

Riyanti, R., Putri, D. H., Erlinda, & Yuniarti, E. (2021). Deteksi Bakteri E.Coli dan Coliform dengan Metode CFU pada Uji Kualitas Air Bersih. Inovasi Riset Biologi Dalam Pendidikan Dan Pengembangan Sumber Daya Lokal, 925934.https://semnas.biologi.fmipa.unp.ac.id/index.php/prosiding/article/view/222

Rolisa, H. N., & Muhelni, L. (2024). Hubungan Jarak Jamban Terhadap Kandungan Bakteri Fecal Coliform Pada Air Sumur Gali Desa Kuranji Di Nagari Lubuk Jantan. Venus: *Jurnal Publikasi Rumpun Ilmu Teknik*, 2(3), 56–64.

Salsabila, D. U., & Audrey, E. I. (2019). *Bakteri E. coli Setitik Rusak Air Sebelanga*. Yogyakarta: Universitas Gadjah Mada.

Salsabila, D. Y. El. (2021). Faktor yang Mempengaruhi Keberadaan E. Coli pada Sumur Gali di Desa Sei-Lendir Kecamatan Sei Kepayang Barat Kabupaten Asahan Tahun 2021. https://repository.helvetia.ac.id/id/eprint/5511/

Sandi, E. (2021). Uji Cemaran Coliform Dan Escherichia Coli Pada Air Sumur Desa Macah Kecamatan Suka Makmue Kabupaten Nagan Raya. Skripsi.

Sapulete, M. R. (2010). *Hubungan antara Jarak Septic Tank ke Sumur Gali dan Kandungan Escherichia coli dalam Air Sumur Gali di Kelurahan Tuminting, Kecamatan Tuminting, Kota Manado*. Fakultas Kesehatan Masyarakat, Universitas Sam Ratulangi.

Sari, A.(2023). Hubungan Higiene Sanitasi Dengan Keberadaan Bakter Eschericia Colli Pada Depot Air Minum Isi Ulang di Wilayah Kerja Puskesmas Air Gemuruh Tahun 2023

Soamole, S. Hubungan Pengetahuan, Sanitasi Lingkungan dan Peran petugas Kesehatan Terhadap Pencegahan Stunting Pada Balita Di Wilayah Kerja Puskesmas Sabatai Kabupaten Pulau Morotai Tahun 2022. 4, 57–66 (2022).

Subair, Y. N., Masyarakat, J. K., Kesehatan, F. I., Islam, U., & Alauddin, N. (2012). Gambaran Kualitas Air Sumur Gali Dengan Kejadian Diare di RW IV Kelurahan Tamangapa Kecamatan Manggala Kota Makassar 201.

Sugiyono. (2008). *Metode Penelitian Pendidikan: Pendekatan Kuantitatif, Kualitatif, dan R&D.* Bandung: Alfabeta.

Sugiyono, 2016, *Statistika untuk penelitian*, Alfabeta,Bandung.

Sumantri, Arif. 2010. Kesehatan Lingkungan dan Perspektif Islam. Jakarta: Prenada Media

Suyono, Dan Budiman. 2010. *Ilmu Kesehatan Masyarakat Dalam Konteks Kesehatan Lingkungan*. Jakarta: Penerbit Buku Kedokteran EGC

Syafarida, U. Y., Jati, D. R., & Sulastri, A. (2022). Analisis Hubungan Konstruksi Sumur Gali dan Sanitasi Lingkungan Terhadap Jumlah Bakteri Coliform Dalam Air Sumur Gali (Studi Kasus: Desa PAL IX, Kecamatan Sungai Kakap). https://doi.org/10.14710/jil.20.3.437-444

Triana, T., & Lilia, D. (2023). Hubungan Kondisi Fisik Dan Sanitasi Sumur Gali Terhadap Keberadaan Bakteri Coliform Dalam Air Sumur Gali. Media Informasi, 19(2). https://doi.org/10.37160/mijournal.v19i2.295

Wulandari, C., Nasir, N. dan Agustien, A., 2014. Kondisi Bakteriologis Air Sumur Di Sekitar Tempat Pembuangan Akhir Air Dingin Kota Padang.Jurnal Biologi Universitas Andalas. Vol. 3 No.4 : 289-295 : ISSN : 2303-2162

Yang X & Wang H. 2014. Pathogenic E. coli. Lacombe Research Centre, Lacombe. Canada.

Zahirrah, N. E. (2022). Hubungan Jarak Septic Tank, Jarak Sumber Pencemar Dan Kondisi Lantai Sumur cengan Kandungan Coliform Pada Air Sumur Gali (Studi Di Desa Hegarmanah Wilayah Kerja Puskesmas Cilimus Kabupaten Garut) [Doctoral Dissertation]. Universitas Siliwangi.

Zubir. (2021). Pengaruh Pembubuhan Kaporit [Ca(Clo)2] Terhadap Bakteri Escherichia Coli Pada Air Sumur Gali Di Gampong Jawa. Jurnal Aceh Medika, 9623(2)