

# Monitoring of Microbiology Quality Raw Water and Refilled Drinking Water During Covid-19

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**Submission date:** 30-Mar-2023 09:45AM (UTC+0700)

**Submission ID:** 2050549497

**File name:** 4.\_HERNIWANTI\_1.pdf (513.86K)

**Word count:** 5474

**Character count:** 29323

# MONITORING OF MICROBIOLOGY QUALITY RAW WATER AND REFILLED DRINKING WATER DURING COVID-19

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## ABSTRACT

**Introduction:** Riau province regency / city data for drinking water depots in 2020 show that the largest number of Pekanbaru City in Riau Province has refill drinking water depots, there are 440 depots consisting of 220 feasible depots while 227 depots are not feasible. This research was conducted in the Tampan sub-district which is the most densely populated city of Pekanbaru. The purpose of this study was to evaluate the microbiological quality standards (Coliform) for refill drinking water depot, raw water source quality standards and population well quality standards during Covid-19. **Methods:** This research is quantitative descriptive analytic with triangulation methods observation with laboratory tests, in-depth interviews with correspondents of depot officers and residents of drinking water wells. The test was carried out at the UPT health and environment laboratory of the Riau provincial health office. **Result:** Data analysis compared 7 samples with laboratory test results according to quality standards. The results of the analysis stated that there were no Coliform bacteria in the tested samples. The source of raw water from housing will have better standard of quality the deeper it is. **Conclusion:** There is no periodic supervision from the health office / Puskesmas to drinking water depot during the Covid-19 period which is usually routinely carried out every 3-6 months according to regulation of ministers of health no.736,2010 concerning supervision of drinking water quality. Housing developers are required to provide a clean water source from a proper borehole from the start of housing development.

**Keywords:** drinking water, water quality, microbiology, coliform, Covid-19

## INTRODUCTION

The selection of Refill Drinking Water Depot (DAMIU) as an alternative to meet drinking water needs is a risk that can endanger health. Because the drinking water produced by the refill drinking water depot has recently decreased in quality. General problems include DAMIU which is not equipped with sterilization equipment, has low removing power against bacteria, or entrepreneurs do not yet know the quality of the raw water used, the type of drinking water depot equipment is good and how to maintain it and handle processed water (Nuria, Rosyid and Sumantri, 2009).

According to the UNICEF Joint Monitoring report, the performance of the water and sanitation sector in Indonesia is still considered low compared to other countries in Southeast Asia. In 2015, Indonesia's population of around 218 million people, it is estimated that around

103 million people (47%) do not have access to sanitation and around 47 million people (22%) do not have access to clean water access to drinking water (Ronny and Syam, 2016).

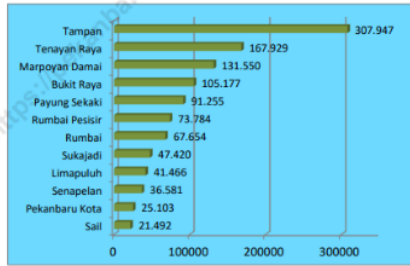
Drinking water depots are required to test the quality of drinking water products at the water quality inspection laboratory appointed by the regency/city government or accredited at least once a year. The test aims to ensure the quality of drinking water products produced, to support the creation of healthy business competition, and as an effort to protect consumer (Regulation of the Minister of Health of the Republic of Indonesia 32, 2017).

Regulation of the Minister of Health of the Republic of Indonesia Number 32 of 2017 concerning environmental health quality standards and water health requirements for hygiene purposes concerning quality standards of bacteriological parameters for raw water is

Cite this as: Herniwanti., & Rahayu, E.P. (2022). Monitoring of Microbiology Quality Raw Water and Refilled Drinking Water During Covid-19. The Indonesian Journal of Public Health, 17(3), 385-394. <https://doi.org/10.20473/ijph.v17i3.2022.385-394>

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0 for coliform bacteria and 50 for E.Coli while based on the Regulation of the Minister of Health of the Republic of Indonesia Number 492/2010 regarding drinking water quality requirements (Regulation of the Minister of Health of the Republic of Indonesia No.492, 2010)



Sumber : BPS Kota Pekanbaru

Figure 1. Total Population in 12 Districts in Pekanbaru City. Source: BPS Pekanbaru City, 2020

Pekanbaru City BPS data (Fig. 1), there are 12 sub-districts and Tampan Districts with the largest population and also, during the Covid-19 pandemic in 2020, it was often a red zone. Dense population will cause the need for refill drinking water to be higher and it is necessary to monitor the feasibility of bacteriological quality standards from drinking water depots operating in the Tampan sub-district - Pekanbaru City to ensure that it complies with applicable health standards. Therefore, based on this, this research was carried out in Tampan District. – Pekanbaru City represented by Sidomulyo Barat Village for sampling at refill drinking water depots.

The RIAU Provincial TPM data for the Type of TPM for Drinking Water Depots from the Health Service Report 2020 in (Fig. 2) show that the most Pekanbaru City HSP data from 12 districts and cities in Riau Province has DAMIU, namely 440 depots consisting of 220 depots. HSP Eligible and HSP Not Eligible as many as 227 Depots.

To find the number of drinking water depots in Pekanbaru City that are not HSP-worthy, a research was carried out in

one of the most densely populated sub-districts in Pekanbaru city, namely Tampan District, precisely in the West Sidomulyo Exit, with the aim of knowing the evaluation of microbiological quality standards for raw water and refill drinking water depots during the Covid-19 pandemic and whether the supervision of the Drinking Water Depot by the Health Service is it still running during the pandemic.

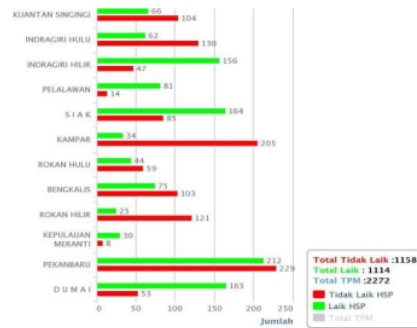


Figure 2. TPM Data for Regency/City RIAU Province – Types of TPM for Drinking Water Depots. Source: food sanitation hygiene website, 2020

**METHODS**

This research is quantitative analytical descriptive observational, namely with primary data analysis of Coliform bacteria content with the Double Tube Culture method, calculation of test results by: bacteriology contained in raw water / drinking water (Amount per 100 ml sample) in each water sample taken from the refill drinking water depot located in the Tampan District - Pekanbaru City in the West Sidomulyo Village.

To determine the presence of Coliform bacteria, a laboratory test is carried out. Presumptive test or TPC (Total Plate Count) for total coliform (Jlh/100ml) is to detect the presence of Coliform bacteria and compare it with the microbiological quality standard stipulated by the Regulation of the Minister of Health

of the Republic of Indonesia. Indonesia Number 32 of 2017 concerning environmental health quality standards and water health requirements for sanitary hygiene needs (raw water for refillable drinking water) and Regulation of the Minister of Health of the Republic of Indonesia Number 492/MENKES/PER/IV/2010 concerning Drinking Water Quality Requirements (Refill Drinking Water).

Variables of physical quality of water that can be observed directly without using a measuring instrument are: color, smell and taste. Good quality drinking water is: colorless, odorless and tasteless. The physical qualities that need to be measured with an instrument are: pH, turbidity and temperature. Meanwhile, the quality of microbiology that is directly related to consumer health needs to be tested in the laboratory.

The research location is in Tampan District in the West Sidomulyo Village for samples of refill drinking water and raw water. Samples were taken by random sampling, by placing in a cooling box so that the temperature was maintained; samples were sent to the laboratory in no more than 24 hours to comply with SOPs. Samples were examined at the Health and Environment Laboratory of the Riau Provincial Health Office. Sampling was carried out on Jalan Purwodadi, Sidomulyo Barat Village - Tampan District, Pekanbaru City on two samples of raw water at residential locations and two samples of refill drinking water at two depots and one comparison sample of raw water in Kec. Marpoyan Damai. The research and data processing process were carried out in July–September 2020. Water sampling was carried out on July 8, 2020, by providing sterile plastic bottles and taking water samples directly from raw water sources (water faucets) and from refill drinking water depots and delivering to the laboratory on the same day (requirements for samples to be analyzed in

less than 24 hours), as shown in Table 1 below.

**Table 1.** Number of Samples and Sampling Locations.

| Number of Samples | Sampling Locations   |
|-------------------|--|
| 1                 | Raw Water for Purwodadi Housing Location 1                             |
| 1                 | Raw Water for Purwodadi Housing Location 2                             |
| 2                 | Raw Water and Water Refill Water Depot Location 1- Exo. West Sidomulyo |
| 2                 | Raw Water and Water Refill Water Depot Location 2- Exo. West Sidomulyo |
| 1                 | Distrik Paus Ujung (Marpoyan Damai District)                           |

Note: Number of Samples 7 (5 Raw Water and 2 DAMIU Drinking Water)

The data in this study were analyzed descriptively by looking at the results of the water quality laboratory test whether positive or negative containing Coliform bacteria and observing the hygiene and sanitation of refill drinking water depots in Tampan District - Pekanbaru City, Table 2 shows the sample design matrix and the laboratory results for bacteriological test.

**Table 2.** Table of *Coliform* Bacteriological Test Data Analysis.

| Sample Design and Coding (7 samples)            | Microbiological Parameters – <i>Coliform</i> (CFU) |
|---|--|
| 1 Sample = Residential Raw Water 1              | x  |
| 1 Sample = Residential Raw Water 2              | x  |
| 2 Samples = DAMIU 1 (Raw Water + Treated Water) | x  |
| 2 Sample = DAMIU 2 (Raw Water + Treated Water)  | x  |

**Sample Design and Microbiological Coding (7 samples) 1 Parameters – Coliform (CFU)**

|   |   |
|---|---|
| 1 Sample = Residential Raw Water 3  | x |
| Calculation of laboratory test results for bacteriology of raw/drinking water (Amount per 100 ml sample)/ CFU (Colony Forming Unit) |   |
| X = Laboratory test results for <i>Coliform</i> bacteria.   |   |

This research process was pandemic, so when surveying and sampling the researchers applied the 3M health protocol (wearing masks, washing hands with soap and also keeping a distance). Especially for washing hands with soap, providing simple socialization by giving souvenirs of cleaning tools (small towels + Hand Sanitizer) to homeowners and owners of refillable drinking water depots.

**Strengths:** This research uses a validated sampling technique, namely: using a sterile bottle and a refrigerated storage area so that the sample is in a cool condition so as to avoid possible damage to the sample before arriving at the testing laboratory. This research was carried out during the Covid-19 pandemic, so it is very necessary to evaluate the feasibility of drinking water quality standards from raw water and drinking water from DAMIU in order to avoid people from diseases caused by water that is not in accordance with quality standards

The limitation of this research is that the scope of the research area is only carried out in one Kelurahan in Kec. Marpoyan Damai and even then only two depots due to limited access when conducting research during the Covid-19 pandemic. During the pandemic, interviews and observations could not be carried out optimally because DAMIU owners were reluctant to linger for interviews even though they had used health protocols and also were given

souvenirs as a sign of gratitude for being willing to provide information about their DAMIU condition. Quality standards in this study only tested the bacteriological quality standards, so it is necessary to continue with the chemical and physical quality standards which may not be in accordance with the quality standards. This research has gone through the Health Research Ethics Committee of the Hang Tuah High School Pekanbaru with the number: 680/KEPK/STIKes-TP/XII/2020.

## RESULTS

Bacteriological measurement results of seven water samples in the UPT Laboratory. Health and Environment of Riau Province stated that the Total Coliform Bacteria content was 0 (Zero), as shown in Table 3.

**Table 3.** Table of *Coliform* Bacteria Test Results on Raw Water and Drinking Water samples

| <b>Samples Identification</b>                             | <b>Results Samples – Coliform Bacteria</b> |
|---|--|
| 1, Purwodadi Housing Raw Water Location 1                 | 0  |
| 2. Raw Water for Housing Purwodadi Location 2             | 0  |
| 3.Raw Water Location 1- Ex. West Sidomulyo                | 0  |
| 4.Water Refill Water Depot Location 1- Ex. West Sidomulyo | 0  |
| 5.Raw Water Location 2- Ex. West Sidomulyo                | 0  |
| 6.Water Refill Water Depot Location 2- Ex. West Sidomulyo | 0  |
| 7. Street Paus Ujung (Marpoyan Damai District)            | 0  |

Note:  
Meet Quality Standard for All Samples

The results of observations of raw water samples in Purwodadi 1 housing from physical tests are: smell, taste and colorless, the well depth is six meters. The results of interviews with homeowners stated that, if the water just came out of the well using a sanio machine, it would smell very sulfuric ( $H_2S$ ), meaning that the water contained sulfur or acid and could also contain high levels of iron in the form of FeS. So the well water is only used for daily household needs such as bathing and washing but it is not suitable for further processing into drinking water so that the homeowners are very dependent on drinking water from DAMIU around the housing. For Raw water samples in Purwodadi 2 Housing from physical test: odorless, tasteless and colorless, the well depth is 12 meters. The results of interviews with homeowners stated that their water was clean and suitable for further processing for drinking water, so they boiled their own drinking water and did not depend on DAMIU.

The results of observations of raw water and drinking water samples at DAMIU Purwodadi 1 and Purwodadi 2 from physical tests: odorless, tasteless and colorless, the well depth is more than 12 meters.

The results of interviews with depot owners stated that their water was clean and suitable for further processing for drinking water, so that they could operate DAMIU for the needs of the community around the housing. The depot is usually visited once in 3/6 months by the Delima Health Center which is the health center that supervises DAMIU in all districts. Tampan- Pekanbaru City. During this Covid-19 pandemic, there are no more visits from Puskesmas officers to supervise their places.

Laboratory test of raw water samples were in housing at jalan paus ujung Marpoyan Damai District which was carried out as a comparative test of raw water quality in the Kec. Tampan from the Physical Test, the results are: Odorless,

Tasteless and Colorless, the well depth is 12 meters. The results of interviews with homeowners stated that their water was clean and suitable for further processing for drinking water, so they boiled their own drinking water and did not depend on DAMIU.

## DISCUSSION

Research results of testing bacteriological quality standards in two drinking water depots and two raw water locations in Kec. Tampan and one in Kec. Marpoyan Damai as a comparison has obtained laboratory test results for bacteria total *Coliform* = 0 (empty/zero). This states that the quality standards for raw water and drinking water are met according to the Minister of Health of the Republic of Indonesia No. 32 of 2017 concerning environmental health quality standards and water health requirements for hygiene purposes regarding *Coliform* bacteriological parameter quality standards for raw water is 0. Regarding Regulation of the Minister of Health of the Republic of Indonesia No.492, 2010 for drinking water quality (refillable drinking water), the *Coliform* bacteriological parameter quality standard must be zero. The bacteriology in water depot the point the contamination for raw water in water depot as research Kab. Kampar, Riau 2019 (Herniwanti, Purnawati Rahayu and Purwawinata Mohan, 2021).

Actually the problem of unclean water in Depot because the employee didn't aware about cleaning of their hand before process the production and operational of water depot (Sarah Atyikah, Herniwanti, Novita Rany. Oktavia Dewi, 2021) (Yen Purwawinata Mohan, Herniwanti, 2021).

This is in line with research in the City of Surabaya in 2020 regarding water that comes directly from the PDAM, which can be consumed by the community after going through an advanced processing process ((Novitasari, 2020), Although the

test results show that the quality of raw water from drinking water depots and raw water from resident wells shows the same results (not contaminated with bacteria), it is different from resident wells on Buru Island, Maluku, which are not suitable for processing into drinking water (Muharam Heluth, 2013) but people prefer to subscribe to refill drinking water to the nearest DAMIU for reasons of practicality and also shuttle facilities by DAMIU owners and low prices. In Kampar, Pekanbaru research the hygiene sanitation of depot 2019 still the problem of water depot (Endang Purnawati Rahayu, 2022)

Raw water in Purwodadi 1 and Purwodadi 2 Housing has different physical quality standards caused by the depth of the bore wells owned by each home owner. The deeper Drilling Wells in Purwodadi Housing 2 (12 meters) have better physical quality standards than the quality standards in Purwodadi 1 Housing (6 meters); this is because the deeper the borehole the water coming from the ground will be more filtered by the soil layer so that it will produce a water source of better quality: clear, tasteless and odorless.

This is in line with a similar study in Tampan District in 2010, where with the denser population and increasing housing, the construction of new housing does not pay attention to the distance between the wells for raw water sources that are close to the septic tank, causing the raw water to smell bad (Nazar, H., Kasri, A., Saam, 2010). Stinging can come from sulfur ( $H_2S$  or  $FeS$ ) which means the water contains acid from dissolved iron/sulfur and can also come from organic substances dissolved in water because the Pekanbaru area is a peat area. which contains high organic matter so that it becomes acidic

The construction of dug wells are not deep so that the water taken is still surface water that has not been filtered and the distance from the septic tank that is <10 m can cause diarrheal disease in the community (Dangiran and Dharmawan, 2020).

From the results of in-depth interviews, information was obtained that the owner of the Purwodadi 2 house took an independent initiative when the developer of their house asked to deepen the well from 6-meters to 12 meters with an additional fee. Which means that the developer provides a source of drinking water in housing only if there is a water source but does not pay attention to its quality so that residents who do not have time to supervise the construction of their house from the beginning will get it when the house is finished,. The well water source is not suitable to be processed into drinking water and this will be difficult to repair because deepening the well is not an easy job (costs money, narrow land and makes it dirty during the construction period) (Nazar, H., Kasri, A., Saam, 2010).

The hope is that, if the drilled water provided in housing by the developer from the beginning of the construction of the house is feasible to be processed into drinking water, the community around the housing will not depend on the Drinking Water Depot, which is sometimes not guaranteed quality and can also save economic costs on household expenses by boiling. own drinking water. So that the source of raw water / decent well water affects the daily water consumption of DAMIU which is higher if the water source is not feasible as much as 7.6% compared to 1.8% suitable for drinking water (Elsi *et al.*, 2019).

Drinking Water Depot 1 and 2 in Jalan Purwodadi Kel. West Sidomulyo, Tampan District is usually supervised by the Health Service, in this case represented by the Delima Health Center. Microbiological Monitoring for Raw Water and DAMIU according to the Regulation of the Minister of Health is carried out once every 1-3 months. This is necessary to ensure that the drinking water sold to the community is of proper quality standard and to avoid diseases caused by contaminated/inappropriate drinking water. In Garuda Puskesmas, Pekanbaru of

evaluation water depot find the employee weren't healthy check regulary (Herniwanti and Ray, 2022).

Factors that affect the quality of DAMIU's bacteriological quality standards are the sanitation hygiene of operators/handlers, most of whom have not carried out regular health checks and also do not have training certificates and socialization regarding PHBS (Weni et al., 2017). Most of the DAMIU use ultraviolet light and ozone technology as disinfection which is useful for killing germs in the DAMIU operational filtration process (Dewanti and Sulistyorini, 2017).

The root of the problem is where, during this pandemic period, health workers are busy serving Covid-19 patients, so the schedule for surveillance visits to DAMIU will no longer be carried out from January 2020. This is due to the busyness of health workers serving Covid-19 patients and limited human resources, limited funds, and inadequate drinking water quality monitoring equipment (Atyikah & Herniwanti, 2020; Purnawinata & Herniwanti, 2020).

The feasibility of drinking water quality standards is one of the efforts to prevent the transmission of the coronavirus. Drinking water that is proper will make the body healthy and immune to increase. Diseases caused by polluted water will cause the community's immunity to be low and vulnerable to infectious diseases such as Covid-19. Supervision of sanitation and hygiene is an absolute must to help maintain the quality of DAMIU consumed by the community on a daily basis, especially operators and depot owners must have their own awareness to check the quality of the depot water quality standards and pay attention to environmental cleanliness (Wulandari & Siwiendrayanti, 2015).

Poor supervision of DAMIU is actually also caused by the person in charge of health supervision at the Puskesmas not understanding their duties and also not receiving training; there is no

supervision from superiors, there are no routine reports so that the monitoring data must always be up to date and also testing equipment for quality standards and limited drinking water. Actually, it would be easier if the DAMIU quality standard test equipment was owned by each puskesmas and operated by an operator who is capable of operation and maintenance because this tool is sensitive.

Another issue is that sometimes the equipment already exists, but the operator is incompetent and the equipment is damaged or the reagent is not available due to running out of funds or not being budgeted anymore (Mirza, 2014). The most dominant variables affecting microbiological contamination in DAMIU are knowledge, operator hygiene, depot sanitation, and drinking water (Pakpahan, Picauly and Mahayasa, 2015). Supervision by filling out the hygiene sanitation checklist from DAMIU regularly and coaching is the most effective thing in maintaining DAMIU's operational quality standards (Kasim et al., 2016; Rahayu & Setiani, 2013).

The implication of this research is the need for attention and responsibility from housing development developers when building housing to provide boreholes with optimal depth of wells so that the water source physically meets quality standards: clear, odorless, tasteless so that residents do not need to renovate the well, enabling them to get proper clean water.

Academic Study of Well Water/ Raw Water in Kec. Tampan needs to be done and a solution for the treatment is found so that it is feasible to be further processed into drinking water so that it does not depend on DAMIU. Although the responsibility for drinking water sanitation hygiene is not the responsibility of the developer directly, it is a social responsibility in helping to provide proper clean water facilities to the community.

Academic study of well water/raw water in Kec. Tampan needs to be done and



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Regular regular supervision by Health Officers/Puskesmas on DAMIU under their operational area according to the provisions of the Minister of Health for each quality standard, although the quality of sanitation and bacteriology is not directly related to the performance of health workers but supervision is the main task of health workers to DAMIU and also the community's raw water sources on a regular basis (Suriadi, Husaini and Marlinae, 2016). Third parties (NGOs, academics, communities) need to jointly supervise the feasibility of DAMIU in their area by participating in maintaining public health together, if it is not feasible to report and follow up (Pratiwi, 2007).

The Institute of Health Science/University as an independent institution can help monitor the DAMIU quality standards and also evaluate the performance of the DAMIU supervisory officers on a regular basis as part of the tri dharma of higher education toward public health by doing community service regarding sanitation hygiene (Herniwanti, Yunita et al., 2020) behavior for a clean and healthy life (PHBS) (Herniwanti, Dewi et al., 2020) and community-based total sanitation program (STBM) (Herniwanti *et al.*, 2021). If the health campus, especially the Kesling specialization, has a drinking water quality standard (Kesling Kit/Mobile Laboratorium Kesling) test equipment, it will be very helpful to assist DAMIU supervision on a regular basis, especially in areas that need to monitor the quality of their drinking water (Asfawi, Nurjazuli and Sulistiyani, 2015).

## CONCLUSION

The results of the Laboratory Test for Coliform Bacteria in seven water samples in the West Sidomulyo Village were zero or in accordance with the Quality Standard of the Minister of Health. Sources of raw water from housing originating from drilled wells with a depth of six meters have poorer physical quality (smells and tastes) from a well which is 12 meters deep. There is no regular supervision from the Health Office/Puskesmas on DAMIU during this Covid-19 period. The community around the district Tampan whose well water is not suitable for processing into drinking water depends on DAMIU. There is no internal and external supervision of DAMIU's operations and quality standards

It is recommended that housing developers must provide clean water sources from proper bore wells from the beginning of housing development. It is necessary to have an academic study of the Raw Water Quality Standards in the Kec. Purwodadi and its processing solutions so that it is suitable to be processed into drinking water. Health workers/Puskesmas who are responsible for monitoring DAMIU's raw water and drinking water MUST conduct regular supervision, especially during the Covid-19 pandemic.

Third parties (NGOs, academics, communities) need to work together in supervising proper drinking water for the community. The Institute of Health Science/University, especially the Environmental Health Specialist, needs to have a Kesling Test Kit and a Mobile Kesling Laboratory to assist in monitoring the DAMIU Quality Standards in Pekanbaru City in collaboration with the Pekanbaru City Health Office.

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