



UTILIZATION OF ARTIFICIAL AQUIFERS BY ADDING ZEOLITE AND CARBON TO IMPROVE WATER QUALITY

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ABSTRACT

Water is the most important component of life. The function of water for living beings cannot be replaced by any other substance. One of the main issues currently faced regarding water resources is the declining quality of water for both domestic and non-domestic purposes. According to the Regulation of the Minister of Health of the Republic of Indonesia No. 492/Menkes/PER/IV/2010 concerning drinking water requirements, it states that safe and healthy drinking water for consumption must meet requirements that include physical, chemical, and bacteriological criteria. Strict requirements are imposed on drinking water because they are directly related to the biological processes of the body that determine human quality of life. The consumption rate of drinking water is very high in tropical regions. This is due to the high humidity, and people in tropical areas require a large amount of drinking water to quench their thirst. Therefore, high-quality drinking water is necessary to maintain health. The dangers or health risks resulting from the decline in the physical quality of water can have negative impacts on health. The utilization of groundwater remains a mainstay for communities in meeting their domestic and non-domestic water needs. The increasing population has led to a decline in the quality of clean water due to human activities that cause environmental pollution. Sources of groundwater pollution include industrial activities, waste disposal sites, mining areas, residential areas, salt industries, agricultural activities, and livestock farming.

Keywords: Mosque, Water Source, Water Quality

1. PRELIMINARY

The Al-Hidayah Harapan Jaya II Mosque is located on Jalan Sungai Kapuas, Harapan Jaya II Housing Complex , RT. 07, RW. 19, Harapan Jaya Village , North Bekasi District , Bekasi City, West Java Province . point coordinates 6°13'08.7"S 106°59'30.1"E.

The boundaries of the Harapan Jaya II Housing area include :

1. Northern Boundary: Harapan Jaya II Plot , Harapan Jaya Subdistrict , District North Bekasi, Bekasi City
2. South Boundary: Housing Tytyan Indah, Kali Baru Subdistrict , District Medan Satria, Bekasi City

3. West Boundary: Harapan Jaya Housing Complex , Harapan Jaya Subdistrict, District North Bekasi , Bekasi City
4. Eastern Boundary: Rawa Bugel Village, Marga Mulya Subdistrict , District North Bekasi , Bekasi City

The Al-Hidayah Harapan Jaya II Mosque area includes :

1. Building the main mosque used as building For prayer room , bathroom , warehouse and room administrator .
2. KB Building (Group) Learning) Al-Hidayah and TK (Kindergarten) Al-Hidayah which is on the side south building main mosque.
3. Buildings place stay the caretaker who is on the side south building main mosque.
4. Field sports and parks located on the side north building main mosque.

Al-Hidayah Harapan Jaya II Mosque has wide land covering an area of 300 m². The Al-Hidayah Harapan Jaya II Mosque which was previously named Al-Hidayah Prayer Room is 1 (one) floor building with total building area covering an area of 200 m². In 2021 , the Al-Hidayah Mosque in North Bekasi carried out construction of the terrace and 2nd floor followed with change of name to the current Al-Hidayah Harapan Jaya II Mosque own total building area The 1st floor is 300 m² and the 2nd floor is 290 m². The Al-Hidayah Harapan Jaya II Mosque has initial total capacity with the number of congregations increased by 150 people become 320 people congregation on the 1st floor and 300 congregation on the 2nd floor after done development .

Activities carried out at the Al-Hidayah Harapan Jaya II Mosque which is location study This participate increase along with the construction that took place at the mosque . With increase activities carried out at the Al-Hidayah Harapan Jaya II Mosque resulted in the number also increases congregation . The activities intended is as following :

1. Obligatory prayer activities Congregations are held 5 times each the day. Congregation at dawn prayer increase from 30 people to 75 people . The congregation for Dhuhr and Asr prayers increased from 35 people to 45 people . The congregation for Maghrib and Isha prayers increased from 50 people to 75 people .
2. Friday prayer activities have begun held after name change from prayer room become a mosque. Friday prayer activities held every Sunday with congregation totaling 200 people.
3. Tahsin activities for congregation men who are routinely held 4 times a day a month with congregation totaling 40 people. Activities sermon for congregation men who are regularly held every day Sunday Morning with congregation totaling 15 people. Activities religious studies for congregation men who routinely hold it twice a day a month on Thursday evenings in the 1st and 3rd week with congregation totaling 35 people.
4. Activities sermon for congregation women who are regularly held every Tuesday afternoon after Dhuhr with congregation totaling 20 people. Activities religious studies for congregation women which is routinely held twice a year a month on Thursday evenings in the 2nd and 4th weeks with congregation totaling 45 people.
5. Regular congregational Tarawih prayer activities are carried out every days in the month of Ramadan with congregation totaling 370 people in the week first , 250 people in a week second , 200 people in a week third , and 150 in the week fourth .
6. Iktikaf activities carried out on 10 days last in the month of Ramadan with congregation totaling 30 people.
7. Eid al-Fitr prayer activities carried out One year once on the 1st of Shawwal with congregation totaling 1,000 people. The Eid al-Adha prayer activities were carried out One year once on the 10th of Zulhijah with congregation totaling 1,200 people. However , due to mosque capacity that is not capable accommodate all over

congregation , then congregational prayer activities This was carried out in the field in front of the mosque.

8. Activities sacrifice implemented after the Eid al-Adha prayer and held in the field in front of the mosque with amount animal sacrifice as many as 7 tails cows and 25 goats goats . Number committee sacrifice as many as 50 people.
9. Activities Work The routine service is carried out every 2 weeks very with amount the community that participated Work devotion as many as 10 people.
10. Activities cleaning the terrace area of the mosque is done routinely every day once by the caretaker .
11. TPA (Al-Qur'an Education Park) activities for children who are implemented every Monday to Thursday in the morning , afternoon and evening with Capacity of 7 children per class .
12. Family Planning Activities (Groups) Learning) Al-Hidayah and Kindergarten (Kindergarten) which is routinely carried out every Monday to Friday . Al-Hidayah Kindergarten has 3 classes with Capacity of 8 children per class .

When carry out activities carried out at the Al-Hidayah Mosque of course need water that covers water use for :

1. Perform ablution congregation of the Al-Hidayah Harapan Jaya II Mosque at the time perform obligatory prayers congregation . Number congregation performing ablution in the mosque during the dawn prayer a total of 20 people, at the Zuhur and Ashar prayers a total of 15 people, at the Maghrib prayer a total of 25 people, and at the Isha prayer a total of 20 people.
2. Perform ablution mosque congregation at the time performing Friday prayers congregation . Number The congregation who performed ablution in the mosque numbered 30 people .
3. Washing hands and urinate in the bathroom when Tahsin, Tausiyah and

recitation activities for congregation man ongoing .

4. Washing hands and urinate in the bathroom when activity Sermons and religious studies for congregation Woman ongoing .
5. Washing hands and defecate in the bathroom and perform ablution moment performing Tarawih prayers in congregation with congregation performing ablution a total of 35 people.
6. Perform ablution , bathe and defecate in the bathroom at the right time. do activity I'tikaf with congregation totaling 30 people.
7. Perform ablution at the time performing Eid al-Fitr prayers and Eid al- Adha . Number only worshipers who perform ablution in the mosque totaling 50 people.
8. Cleaning location used slaughter animal sacrifice , washing tool sacrifice , and washing the feet and hands at the time activity sacrifice ongoing .
9. Cleaning fence , washing prayer equipment , and washing feet and hands as well as drain fish pond in front of the mosque at the time do Work devotion around the mosque area.
10. Mopping the terrace area on the 1st and 2nd floors of the mosque and watering plant .
11. Washing and defecating in the bathroom when the Al-Hidayah TPA is taking place .
12. Washing hands in the sink , defecating in the bathroom and mopping room when KB Al-Hidayah and TK Al- Hidayah were taking place .

In doing activities the Al-Hidayah Harapan Jaya II Mosque of course need water that is not a little too. DKM (Mosque Welfare Council) Al-Hidayah Harapan Jaya II Mosque decided No subscribe to PDAM (Regional Drinking Water Company) water because the perceived cost Enough high . With However , the Al-Hidayah Harapan Jaya II Mosque is still there using

groundwater as raw water source . Water is obtained at a depth 40 meters Then pumped with machine jet pump with 370 watt power . The suction pipe used measuring 1.25 inches with speed water flow or flow rate of 40 liters per minute ago streamed through a 1 inch pipe until 12 meters above sea level surface land . Groundwater the Then accommodated in 2 water towers , each of which has water capacity of 1,300 liters of water so that can Holds a total of 2,600 liters of water with objective as water reserves if groundwater start dry in the season dry season . After that , the water in water tank is drained through the pipe to bathroom and water taps in the ablution area and taps in the outdoor area at the Al-Hidayah Harapan Jaya II Mosque

raw water is pumped to a clean water production facility (WTP) and then continues through a reservoir. However, before entering the reservoir, the water undergoes a chemical treatment to convert the raw water into clean water. From the reservoir, it is then distributed to the homes of PDAM water customers. During this distribution process, the water inevitably passes through distribution pipes, potentially degrading the quality of PDAM water.

The PDAM's task is to produce drinking water, and currently, PDAM's processed water output is still at the clean water level. Regulations regarding the differences in quality standards for clean water and drinking water are contained in the Minister of Health Regulation No. 492/MENKES/PER/IV/2010 on drinking water and clean water standards No. 416/MENKES/PER/IX/1990. The differences in quality standards are shown in Table 1.

No.	PARAMETER	STANDARD AIR MINUM	STANDARD AIR BERSIH
		No. 492/MENKES/PER/IV/2010	No. 416/MENKES/PER/IX/1990
1	Parameter Fisika		
	Warna	15	50
	Kekeruhan	5	25
2	Parameter Kimia		
	Nitrit	3	1
	Total Klor	≥0,2	≥0,2
	N. Amonia	1,5	1,5
	Besi	0,3	15
	Ph	6,5-8,5	6,5-9,0

Table 1. Differences in the quality standards of the Minister of Health's Regulation on drinking water and clean water

At PDAM Tirta Patriot Bekasi, the results of laboratory tests show that the water distributed to the community still does not meet the requirements for drinking water.

One of the decline that occurred namely the water color factor and level water turbidity in the community

Therefore that , in the research This will give other alternatives to public specifically PDAM water users for increase clean water quality in homes residents . The water being studied is PDAM water that has been pass various water supply pipes that have experienced change water quality from PDAM center to housing area citizens . The method used For handle the above problem is utilise sand on the method almost complete filtration customized with building Aquifer Building Rainwater Storage (ABSAH) For increase color and clarity of water in the Minister of Health Regulation No. 492/MENKES/PER/IV/2010 concerning drinking water and the Minister of Health Regulation No. 416/MEN.KES/PER/IX/1990 concerning clean water . The ABSAH method is method filtration intended for For filtering rainwater whereas in study This intended For filtering PDAM water in housing

residents who then filtered For furthermore enter to tub shelter House inhabitant.

2. LITERATURE REVIEW

a. Definition of Raw Water

Raw water is water that comes from from surface water sources , groundwater basins and / or rainwater that meets provision standard quality certain as raw water for drinking water .

b. Definition of Clean Water

Clean water is healthy water that is used For activity human and must free from germs reason disease , free from ingredients chemicals that can pollute clean water the

c. Filtration Method

Filtration is method separator physical used in separate liquid (solution) with solids . Liquids that have been through the filtration / screening process called filtrate , whereas For accumulated solids filtered That called with residue . Principle base filtration it's very simple namely filter molecules mixed solids in solution , then level purity the filtrate obtained from filtration the depends on the quality and size pore from the filter (the filter used).

Following is explanation about ingredients to be used in the screening process , including :

1) Gravel

Gravel is rocks small , usually broken granite. Size gravel that always used is between 2 and 75 mm.

2) Sand

According to SNI 02-6820-2002, aggregate fine is aggregate with big grains maximum 4.75 mm

3) Limestone

Limestone is rock the main sediment composed of calcium carbonate (CaCO₃) in calcite mineral form .

4) Red Brick

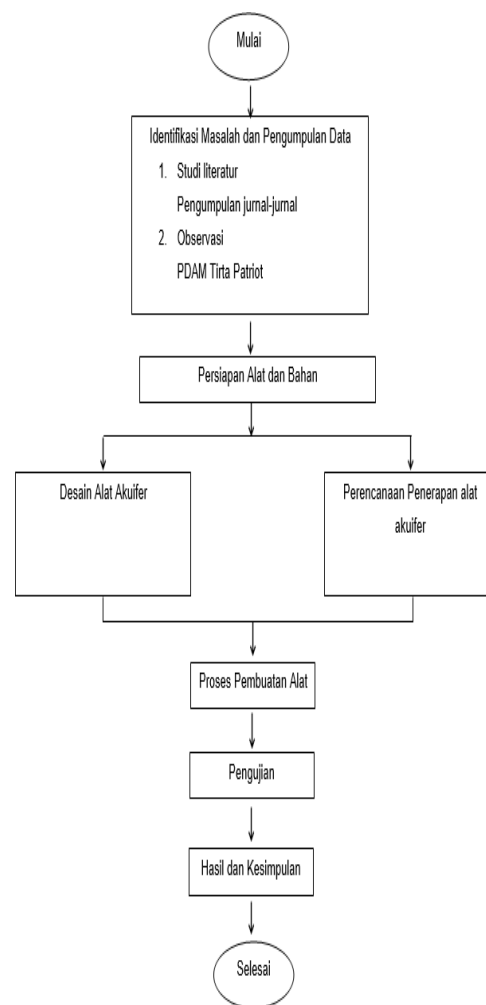
red brick in question is a brick that is made from printed land Then burned with temperature tall so that become truly dry , hardened , and colored reddish.

d. Standard Water Quality

Clean water is water that is not cause disease for human beings . Therefore that , that water should endeavored fulfil condition condition health , at least endeavored approach water requirements that have been determined (Kusnopranto , 2000). The Minister of Health Regulation used for drinking water moment This is No. 492/MENKES/PER/IV/2010 whereas Minister of Health Regulation for clean water is No. 416/MEN.KES/PER/IX/1990.

3. RESEARCH METHODS

Research conducted is manufacturing tool simple water treatment use system filtration with addition material zyolite and carbon , which can used in scale household needs .



Picture 2. Flowchart

a. Research Location

Study This done with see variables The water sample used was from the Al-Hidayah Harapan Jaya II Mosque located on Jalan Sungai Kapuas, Harapan Jaya II Housing Complex , RT. 07, RW. 19, Harapan Jaya Village , North Bekasi District , Bekasi City.

b. Research Time

Study done Morning day at 08.00 WIB.

c. Tools and Materials Used

As for the materials that will be used moment research including :

1. Raw water (ground water)
2. Sand rough 3 mm
3. 1 cm gravel
4. 5 mm broken bricks
5. Limestone 1 cm
6. Charcoal
7. 5 kg paint bucket
8. Water tap
9. Water tap thread
10. Pipe glue
11. Filter gauze
12. 3 meters long 1/2 inch hose
13. Leak-proof duct tape
14. Ziolite Language
15. Carbon Material

d. Thickness Variation

Following is plan thickness aggregates that will used.







Table 1. Variations thickness aggregate

No.	Material Layer	Sample 1	Sample 2 m ³
1	Medium Gravel	Mosque Groundwater	0.0045
2	Coarse Sand		0.0045
3	Red Brick		0.0045
4	Large Gravel and Limestone		0.0045
5	Coarse Sand		0.0045
6	Red Brick		0.0045
7	Fine Sand		0.0045


e. Tool Making


Following is steps For manufacturing tool filtration in table 2.

Table 2. Manufacturing tool

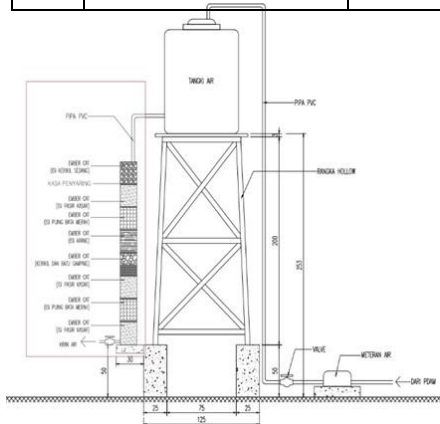
No	Picture	How to make
1	 	Get ready the tools that will used such as 7.5 liter paint buckets and 1.5 liter paint bucket that has been installed faucet for filtered water output , water filter , leak-proof glue , and tape
2	   	Furthermore prepare ingredients to be used For filter That Alone like sand , gravel , charcoal , limestone , and red brick

3





Destroy moreover formerly aggregates of size big such as red brick and limestone Then sieve aggregate with size the sieve 0.5 cm in diameter for red brick and 1 cm for limestone after obtained aggregate with specified size Then wash moreover formerly aggregates that will used



Picture 3. Equipment installation arrangement

4. RESULTS AND DISCUSSION

Following is results analysis from laboratory about filtration is carried out In the Al-Hidayah Harapan Jaya II Mosque , located on Jalan Sungai Kapuas, Harapan Jaya II Housing Complex , RT. 07, RW. 19, Harapan Jaya Subdistrict , North Bekasi District , Bekasi City, using aquifer :

Table 3. Research results sample from House inhabitant

No.	PARAMETER	SATUAN	NILAI
			SAMPEL 1
1	Parameter Fisika		
	Warna	TCU	2
	Kekeruhan	NTU	0.892
2	Parameter Kimia		
	Nitrit	mg/l	0.024
	Total Khlor	mg/l	0.02
	N. Amonia	mg/l	Under range/Baik
	Besi	mg/l	0.56
	Ph		7.51

From table 3 we can explained that water before enter filtration for customer water there are 2 parameters that are not fulfil condition for drinking water that is content iron with value 0.56 mg/ liter and Total Chlorine 0.02

Table 4. Results of research sample 2 after passed artificial aquifer

No.	PARAMETER	SATUAN	NILAI
			SAMPEL 3
1	Parameter Fisika		
	Warna	TCU	Under range/Baik
	Kekeruhan	NTU	0.74
2	Parameter Kimia		
	Nitrit	mg/l	0.052
	Total Khlor	mg/l	0.28
	N. Amonia	mg/l	0.1
	Besi	mg/l	0.08
	Ph		7.45

Laboratory results show results laboratory the fulfil all condition in accordance Minister of Health Regulation No. 492/MENKES/PER/IV/2010 on drinking water and clean water standards No. 416/MENKES/PER/IX/1990

From the comparison table above obtained results as following :

Parameter	Unit	Mark				Drinking Water Standard No. 492/MENKES/PER/IV/2010
		Raw Water	Aquifer + Zeolite	Aquifer + Carbon	Aquifer Combined	
Color	TCU	15	19	16	21	15
TDS	mg/L	417	676	618	648	500
Turbidity	NTU	1.84	2.81	10.9	10.5	5
Temperature	C	26.6	26.7	26.9	26.9	Temperature ±3
Iron	mg/L Fe	0.12	0.10	0.20	0.30	0.3
Manganese	mg/L Mn	0.580	0.362	0.343	0.386	0.4
pH	-	7.35	7.62	7.69	7.55	6.5-8.5
Copper	mg/L Cu	0.04	0.06	0.17	0.23	2
Ammonia	mg/L NH3-N	0.07	0.53	0.46	0.46	1.5
Oxygen Dissolved	mg/L	5.8	6.1	5.4	6	>4

Source : Laboratory Test Results , 2024

Information :

MS = Meets Condition

TMS = Not Meets Condition

5. CONCLUSION

From the results conclusion that :

a. Amount The highest water requirement at Al-Hidayah Mosque is 11,777 liters/ day .

b. Amount Water availability at the Al-Hidayah Mosque is 2,600 liters, so required regular water pumping 4-5 times a day or increase the volume of the water tower so that water availability becomes more big .

c. In the research This there are 4 tests water quality , namely raw water and water that has been pass Aquifer 1 (addition of zeolite), Aquifer 2 (Addition of Carbon), and Aquifer 3 (Addition of Carbon and Zeolite). Of the four water samples tested , results testing best water quality there is in the results testing raw water quality .

Water quality standard as the best water Still have weakness that is height The Manganese parameter value exceeds the set value limit stipulated in Drinking Water Standard No. 492/MENKES/PER/IV/2010

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