RO & Local Material Filter

by Surya Hermawan

The Comparison of Brackish Water Treatment Using Local Filter Materials and Reverse Osmosis Filters

Surya Hermawan[1, a)], Angela Jasmine Tanya Tjahyana[1, b)], Peni Tiewanto[1, c)], Ivan Richardian Limantara[1, d)], Theo Lorenzo Senjaya[1, e)], Wilson Saputra[1, f)], Kiki Prio Utomo[2, g)], Nelly Wahyuni[3, h)]

[1] Civil Engineering Department, Petra Christian University, Siwalankerto 121-131 Surabaya, Indonesia
[2] Environmental Engineering Study Program, Tanjungpura University, Pontianak, Indonesia
[3] Chemical Engineering Study Program, Tanjungpura University, Pontianak, Indonesia

[a)] shermawan@petra.ac.id
[b)] angelaj@petra.ac.id
[c)] 21415250@john.petra.ac.id
[d)] 21415212@john.petra.ac.id
[e)] b1117173@john.petra.ac.id
[f)] b11170177@john.petra.ac.id
[g)] kikiutomo@teknik.untan.ac.id
[h)]

Abstract. Water is an important resource in human life. The Indonesian Central Bureau of Statistics in 2020 noted that it has access to clean water up to 90.21%. However, these data show that there has not been equal access to clean water in Indonesia. Therefore, this research focuses on the area of Tegal Sari Hamlet, Kupang Village, Jabon District, Sidoarjo Regency, East Java Province, where the area has problems with brackish well water. The purpose of this underway research is to find a comparison that occurs in brackish water treatment when using a filter made of local material with a Reverse Osmosis (RO) device from the market. This research used an experimental method, to determine the effect of treatment on the test object. The treatment that is carried out is by flowing water through the filter from local material / RO to make the water meet the existing standards of pH, TDS, and EC. The outcomes demonstrate that the comparison using local materials and RO according to pH, meet the requirement. Then, concerning TDS and EC measurements is reducing 51.5% and 91.9%, as well as a decrease of 52.16% and 91.3%. respectively. This research is still underway condition, the appropriate local material and suitable method are key for successful research in the future. Thus it can be suggested that in carrying out brackish water treatment can be used an RO device instead of using a local material filter considering the results obtained.

Keywords: brackish water, comparison, reverse osmosis, local material, Sidoarjo

INTRODUCTION

Humans always use water in almost every activity, this causes water to be an important resource in human life. Water can be categorized into 2, namely fresh water and saltwater (seawater) which is the largest part of this earth. Seawater has a salinity level of 35 grams/liter. Brackish water has a salinity between 0.5 ppt to 17 ppt, while freshwater is water with a salt content below 0.5 ppt [1]. In 2012 as many as 748 million people worldwide did not have access to drinking water which resulted in 1.7 million deaths each year due to lack of safe drinking water [2].

In 2020 according to [3], Indonesia has reached 90.21% access to clean water. One of the reasons why Indonesia has not reached 100% access to clean water is because Indonesia has many coastal areas whose water is affected by seawater. This results in high salinity in coastal areas where water with high salinity can damage health, if drunk, causing crop failure when used in farming, causing damage to equipment or buildings made of metallic elements [4]. To deal with this problem, an experiment was started to compare a water treatment filter that utilizes local materials that are easy to obtain and inexpensive with a Reverse Osmosis (RO) filter which is sold in the market. Thus, the goal of this underway research is to find a comparison that occurs in brackish water treatment when using a filter made of local material with a Reverse Osmosis (RO) device from the market.

The local materials used are sand, gravel, activated carbon, and kaolin. This underway integrated research is located in the area of Tegal Sari Hamlet, Kupang Village, Jabon District, Sidoarjo Regency, East Java Province [5,6,7,8,9,10]. Sidoarjo Regency itself is one of the areas which is considered prone to experiencing natural disasters such as floods and tornadoes. The failure of the mudflow technology in the Sidoarjo area is believed to have worsened the situation there. Apart from natural disasters Sidoarjo also experiences problems from the industrial waste sector which can cause environmental pollution as well as problems with shortages of clean water for daily life such as farming [11].

Material and Method

Local Material Filter

The local filter materials used are sand, gravel, activated carbon, and kaolin, which are expected to be able to process brackish water for everyday human life using. As can be seen in Figures 1a, b, c, and d local materials were taken from various cities such as sand from Lumajang City (130 km from research location), Kaolin from Trenggalek City (200 km).

(a) (b) (c) (d)

FIGURE 1. Local Material (a) Lumajang Sand, (b) Gravel, (c) Activated Charcoal & (d) Kaolin

Sand

In the water filter, this research used Lumajang sand or also known as concrete sand. This sand has a characteristic dark gray to blackish color. Besides that, Lumajang sand also has another characteristic, namely that the sand will not clump when held. The reason why the sand fineness is so that when it is held, the sand will scatter again [12]. The function of the sand in this water purification filter is to hold silt and fine impurities. The types of sediment and dirt that are filtered will also vary. Therefore, when conducting trials, an analysis must be carried out on the type of dirt present so that it can adjust the level of fineness of the sand you want to use. Given that the finer the dirt you want to filter, the finer the sand is needed to keep the dirt from passing.

Gravel

The gravel is a small stone and also smaller than the crust. Gravel has a physical character with smooth texture and a round shape. The function of gravel in the water filter is as a filter for coarse dirt and as a gap so that water can flow through the pipe under the filter [13]. In terms of the size of the pollutant filtered by gravel, it cannot filter as fine as sand, but if you only use sand, the speed of water flowing will be very slow. Apart from the problem of the speed of water flowing, and was also easily carried away by water so that the gravel can become resistant. Then, the sand was not carried away by the flow of water. The disadvantage of this gravel filter is that it cannot filter out too fine pollutants.

Activated Carbon

Activated carbon is the result of a process of mediating charcoal so that it has a high absorption capacity for materials in the form of a solution or vapor. Activated carbon can also come from other sources of material, coral reefs are one example. Activated carbon can be used for various industries, including the pharmaceutical industry, food, beverage, water treatment (water purification), and others [14]. The function of activated carbon in this water purification filter is to remove / filter odors, colors, pollutants in water, as protection and exchange of resin in equipment or water distillation [15].

Kaolin

Kaolin is a mineral from clay and sand which is physically clean white and yellowish, soft, fine-grained. The largest component of kaolin is kaolinite with the chemical formula Al2O3.2SiO2.2H2O. Kaolin should have a very fine particle size distribution (less than 2 μm) and be of high quality especially for applications such as plastics, paints, paper industry, pharmaceuticals, and cosmetics [16]. The function of kaolin in this water purification filter is as an adsorbent that absorbs unwanted ions and minerals in the water, besides that the use of kaolin can also be used to get fine grains, high levels of whiteness, certain water content, certain pH, and properties [17].

Reverse Osmosis

The tool used in the research of the brackish water treatment process is one of the most widely used membrane technologies, namely, Reverse Osmosis (RO). As can be seen, Figure 2b, the Reverse Osmosis membrane is defined as a semipermeable membrane capable of separating freshwater from a salt solution with a pressure higher than the osmotic pressure of a salt solution. Brackish water treatment with a reverse osmosis system consists of two parts, namely the pretreatment unit and the advanced treatment unit, the reverse osmosis unit. In the RO membrane, there is a molecular size filtering process, where particles whose molecules are larger than water molecules, such as salt molecules and others, will separate and will enter the wastewater [18].

The working principle of an RO device is to produce viable water. use of brackish water is by pushing the pure water that is present in brackish water to fresh water through a semi-permeable membrane [19]. The RO tool is said to also be able to manage seawater to meet clean water quality standards following the Minister of Health's Regulation on clean water quality standards. Able to reduce pH from 8 to 7 and reduce TDS from 393 ppm to 27 ppm [20]. In China, similar research has also been carried out, based on the preparation of an RO device for brackish water and selecting the right RO membrane, the RO system can be used for brackish water. The RO system for brackish water is above the better method considering price or quality [21]

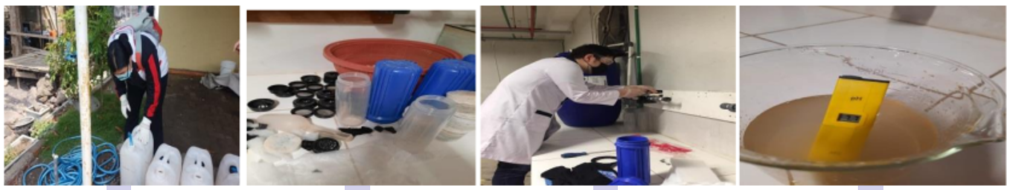
Indicators

Power of Hydrogen (pH), Total Dissolved Solids (TDS), and Electrical Conductivity (EC) are indicators that will be used as references in this research. The first indicator is pH, pH is an indicator that shows the level of acid or base of a solution. If the pH is less than 7 then the solution is acidic while the pH is greater than 7 then the solution is alkaline, and if the neutral solution has a pH of 7 [22]. According to the Regulation of the Minister of Health of the Republic of Indonesia number 32 of 2017 [23], the pH limit for drinking water is between 6.5 to 8.5.

The second indicator is Total Dissolved Solids (TDS) which are commonly referred to as solids that have a smaller size than suspended solids. High TDS levels can provide a warning that the water is contaminated by waste. Contaminated water can cause health problems such as cancer, nerve tissue damage, and heart disease [24]. According to the Regulation of the Minister of Health of the Republic of Indonesia number 32 of 2017 states that the TDS contained in drinking water is less than 1000 mg / l or 1000 ppm. The last indicator is Electrical Conductivity (EC) which is an indicator of the ability of a solution to conduct electric current. If water has a conductivity value that is too high, water can settle in the body and damage kidney stones [25], according to the World Health Organization (WHO) (2011) [26] which states that the conductivity of drinking water is less than 300 μs / cm.

METHODOLOGY

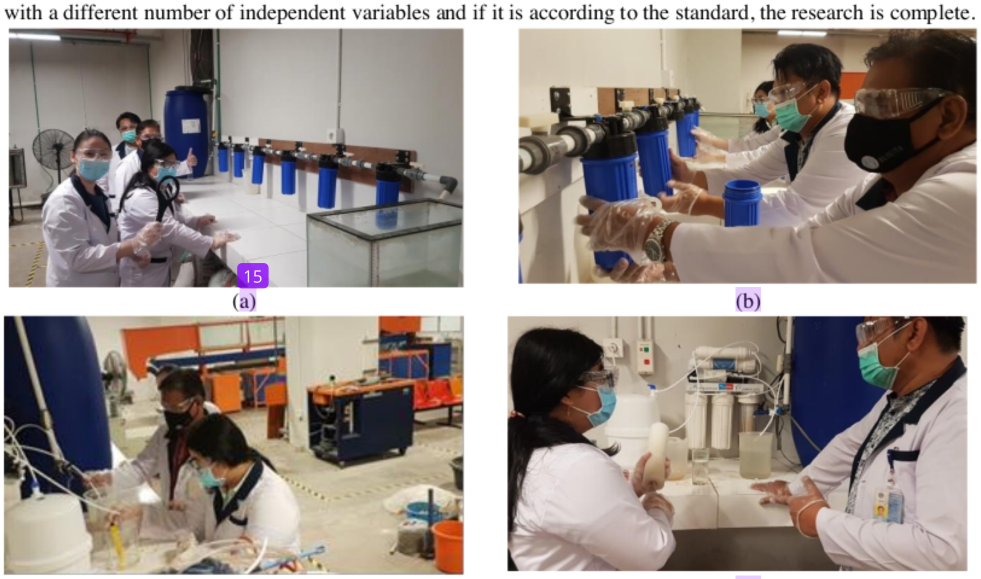
This research utilized experimental research method in the Environmental and Hydraulics Engineering Laboratory, Civil Engineering Department Petra Christian University. The research began with sampling in Tegal Sari hamlet, Kupang village, Jabon sub-district, Sidoarjo regency, East Java province. Water is taken from one of the residents' houses there (Figure 3a). After the required sample water is ready, the local material filter and RO equipment are prepared to be used (Figure 3b). After the two filters are ready, the tool can be arranged according to the predetermined design as shown in Figure 3c. After the sample water and both filters are ready for use, the sample water is tested for pH, TDS, and Ec values Figure 3 d).



(a) *(b)* *(c)* *(d)*

FIGURE 3. (a) Brackish Water Sampling, (b) Research Equipment, (c) Preparation of Tools & (d) Testing of Water Samples

After the sample test results are known, the sample can be tested according to the local material filter procedure and the Reverse Osmosis (RO) tool. As can be seen in Figure 4a and Figure 4b, water filtration with local material is deployed. The experiment was continued by preparing the results of the material filter and reverse osmosis filter (Figure 4c). After the trials have been carried out and have results, the sample results will be tested (Figure 4d). The examination is carried out to find out whether the results are following the predetermined standards or not. If the test results are not following the standard, the experiment will be repeated with a different number of independent variables and if it is according to the standard, the research is complete.



(a) (b) (c) (d)

FIGURE 4. The Instruments of the Water Filter from (a) Local Material and (b) Reverse Osmosis

The local material used in each experiment is always different, by looking for the best results, 10 of the best experiments were selected from the 34 experiments conducted (Table 1). There was a combination of the local material including kaolin, active carbon, gravel sand gravel along with an aquarium which contained gravel: sand: gravel with comparison 1:3:1.

TABLE 1. The Best Composition of the 10 Local Material Experiment

Trials Number	Materials						
1	KAO	KA	KPK				
2	KAO	KA	KPK				AQ
3	KAO	KAO	KA				
4	KAO	KAO	KA				AQ
5	KA	KA	KPK				
6	KA	KPK	KA				
7	KPK	KA	KA				
8	KPK	KPK	KA				
9	KA	KA	KA				
10	KA	KA	KA	KA	KA	KA	

Remarks :
KAO = Kaolin   KA= Active Carbon   KPK= Gravel Sand Gravel
FILTER = Filter 10 mikron
AQ = Aquarium which contained gravel: sand: gravel with comparison 1:3:1

RESULTS AND DISCUSSION

This study examined three indicators, namely: pH, TDS, and EC from each experiment (see Table 2). The data that has been obtained will be examined how significant the material used for the brackish water sample is. As well as comparing the results of this study meet the standards of the Regulation of the Minister of Health of the Republic of Indonesia and WHO or do not meet.

The properties of brackish water at the research location vary for three indicators. The pH ranges between 8,1 to 8,18, along with the TDS in the range of 2870 – 3200 mg/l, and the EC values are between 5790 – 6400 μs/cm. After the water treatment was conducted with local material including kaolin, active carbon, gravel sand gravel along with an aquarium which contained gravel: sand: gravel with comparison 1:3:1. It can be seen in Table 1 that the results of local material filter processing have not produced anything significant including TDS and EC. At trial, number 1, the water treatment utilized kaolin, active carbon, gravel-sand-gravel, the result of the water treatment show that the TDS and the EC are 2810 mg/l and 5630 μs/cm, respectively.

Meanwhile, it can be seen in Table 3 that the RO tool is capable of treating brackish water so that the pH and TDS can meet the existing standards from WHO along with the Regulation of the Minister of Health of the Republic of Indonesia number 32 of 2017. Unfortunately, the EC has not met the standard because, from 10 trials, the EC is still in the range of 864 – 870 µs/cm.

TABLE 2. The Measurement of the pH, EC dan TDS Before and After Treatment Using Local Material

Trials Number	pH		TDS		EC	
	Before	After	Before	After	Before	After
1	8,18	7,84	2870	2810	5790	5630
2	8,18	7,77	2870	1389	5790	2770
3	8,18	7,56	2870	2850	5790	5190
4	8,18	7,67	2870	2640	5790	5290
5	8,2	7,7	3200	3030	6400	6060
6	8,1	7,9	3200	3010	6400	6070
7	8,1	7,9	3200	3050	6400	6110
8	8,1	7,9	3200	3020	6400	6080
9	8,1	7,9	3200	2970	6400	5970
10	8,1	7,9	3200	2980	6400	5980

Remarks :
pH = *Power of hydrogen*
TDS = *Total Dissolved Solids*
EC = *Electrical Conductivity*

TABLE 3. The Measurement of the pH, EC dan TDS Before and After Treatment Using Reverse Osmosis

Trials Number	pH		TDS		EC	
	Before	After	Before	After	Before	After
1	7,9	8,4	5260	435	10580	869
2	7,9	8,4	5260	434	10580	865
3	7,9	8,4	5260	432	10580	864
4	7,9	8,4	5260	432	10580	864
5	7,9	8,4	5260	432	10580	870
6	7,9	8,4	5260	433	10580	867
7	7,9	8,4	5260	434	10580	866
8	7,9	8,4	5260	434	10580	867
9	7,9	8,4	5260	433	10580	867
10	7,9	8,4	5260	433	10580	867

Remarks:
pH = Power of hydrogen; TDS = Total Dissolved Solids; EC = Electrical Conductivity

The improvement of pH, TDS, and EC which occurred during the research can be seen in Figure 5 for pH. Figure 6 for TDS, and Figure 7 for EC. The selected data including the 10 best results that can be produced by both local material filters and the Reverse Osmosis device. As can be seen in Figure 5, after the brackish water treatment was carried out by using both local material and RO demonstrate that all the criteria values meet the standard. However, for the TDS criteria only water with RO treatment meets the standard (see Figure 6). Then, regarding the EC, no water treatments can fit with the standard of 400 µs/cm (see Figure 7).

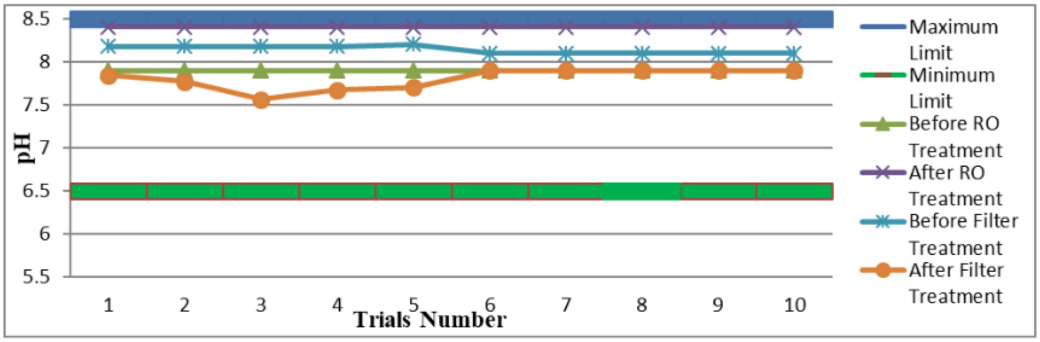


Figure 5. The Measurement of the pH

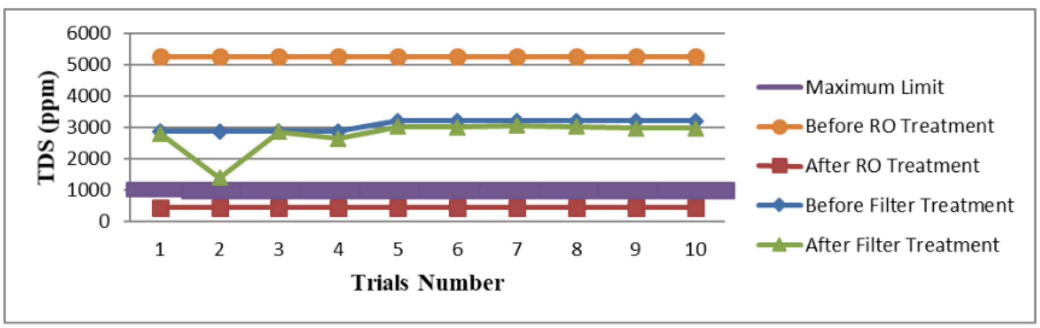


Figure 6. The Measurement of the TDS

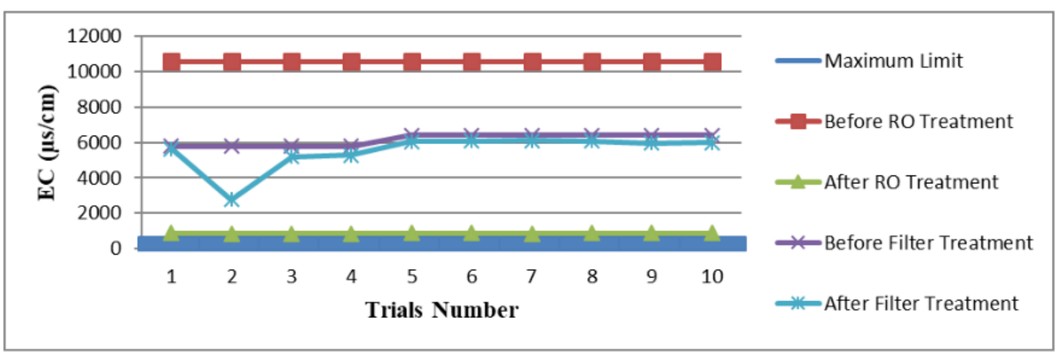


Figure 7. The Measurement of the EC

CONCLUSION

From the results of the research that has been done, it can be concluded that:

1) RO equipment can produce processing that meets more standards when compared to local material filters. Where the best results from the RO tool are a pH of 8.4, a TDS of 432 ppm, and an EC of 864 ms/cm. While the best results from local material filters are a pH of 7.5, a TDS of 1389 ppm, and an EC of 2770 ms/cm.
2) The biggest change that occurred in the RO device was an increase in pH of 6.35%, a decrease in TDS of 91.9%, and a decrease in EC of 91.83%. Meanwhile, the local material filter experienced a decrease in pH of 7%, a decrease in TDS of 51.5%, and a decrease in EC of 52.16%.

ACKNOWLEDGEMENTS

The authors would like to express appreciation for the support of the sponsors of the Directorate General of Higher Education Indonesia project number: **002/AMD-SP2H/LT-MULTI-TERAPAN/LL7/2021.**

REFERENCES

1. Z. Destrina, "*Prototype alat pengolahan air laut menjadi air minum (pengaruh variasi koagulan dan packing filter terhadap kualitas air dengan analisa TDS, DO, salinitas dan kandungan logam Mg2+ Dan Ca2+)*", ST. thesis, Teknik Kimia, Politeknik Negeri Sriwijaya. Palembang, Sumatera Selatan, 2015.
2. R. Venkatesha, (2014), *Portable Water Purifiers*, Seminar report, Centre for Technology Alternatives for Rural Areas (CTARA) Indian Institute of Technology Bombay, Mumbai, India.
3. Badan Pusat Statistik, (2009), *Persentase Rumah Tangga menurut Provinsi dan Sumber Air Minum Layak, 1993-2019*.
4. Darmawansa, N. Wahyudi, and D. R. Jati, (2014), Desalinasi Air Payau Dengan Media AdsorbeN Zeolit di Daerah Persisir Pantai Kecamatan Sungai Kunyit Kabupaten Mempawah. Jurnal Teknologi Lingkungan lahan basah, 2(1), pp. 1-10.
5. S. Hermawan, and S. Leman, (2020), *Implementation Photography as a Media and Supports in Construction Era 4.0 atthe Civil Engineering forthe Construction Designto Face Tidal Floods Due to Global Warming*. Journal of Physics: Conference Series. Doi:10.1088/1742-6596/1625/1/012058.
6. S. Hermawan, K. Harsono, and N. Bong, (2020), *Sustainable Design for Passage Boat Ports in Remote Areas in Era Construction 4.0 at Sidoarjo East Java Indonesia*. Journal of Physics: Conference Series. Doi:10.1088/1742-6596/1625/1/012059.
7. S. Hermawan, O. Hans, C. Gunawan, D. Tjandra, and J. Purnomo, (2020), *The Utilisation of the Numerical HydrodynamicModel to Face Rob Floods in Coastal Areas in the Industrial Revolution Era 4.0 at East Java Indonesia*. Journal of Physics: Conference Series. Doi:10.1088/1742-6596/1625/1/012060.
8. S. Hermawan, J. Purnomo, and D. Tjandra, (2018), *The Synoptic Data For Adaptation Climate Chane In Sidoarjo Regency East Java*. International Journal of Civil Engineering and Technology, Volume 9, pp. 453–460. ISSN Online: 0976-6316, Petra Christian University.
9. S. Hermawan, J. Purnomo, and D. Tjandra, (2018), *The Use Of Unmanned Aerial Vehicles (UAV) For Reconstruction Of Topography And Bathymetry Maps: Consideration For Civil Construction Against Coastal Adaptation Due To Climate Changing*, International Journal of Civil Engineering and Technology, Volume 9, Issue 12, pp. 447–452. ISSN Online: 0976-6316.
10. S. Hermawan, J. Purnomo, and D. Tjandra, (2018), *The Benefit of Wind Distribution Analysis for Coastal Construction Design in East Java Province*. MATEC Web of Confrences 248, 05002.
11. S. Hermawan, and N. Anastasia, (2020), *Kegiatan Program Pengembangan Desa Mitra (PPDM) Masyarakat Pesisir Desa Kupang Kecamatan Jabon Sidoarjo Jawa Timur*. (02/HBK-ABDIMAS/LPPM-UKP/I/2020), Unpublished report, Universitas Kristen Petra, Surabaya.
12. W. Wilantara, (2016), *Rancang Bangun Ayakan Pasir (Perawatan Dan Perbaikan)*, Unpublished undergraduate thesis, Politeknik Negeri Sriwijaya, Palembang.

13. M. N. Fajri, Y. I. Handayani, and S. Sutikno, (2017), Efektivitas Rapid Sand Filter Untuk Meningkatkan Kualitas Air Daerah Gambut Di Provinsi Riau. Jom FTEKNIK, 4(1), pp. 1-9.
14. G. S. Pambayun, R. Y. E. Yulianto, M. Rachimoellah, and E. M. M. Putri, (2013), *Pembuatan Karbon Aktif Dari Arang Tempurung Kelapa Dengan Aktivator* $ZnCl_2$ *Dan* Na_2CO_3 *Sebagai Adsorben Untuk Mengurangi Kadar Fenol Dalam Air Limbah*. Jurnal Teknik Pomits Vol 2, No.1. ISSN: 2337-3539 (2301-9271 Print), Surabaya: Institut Teknologi Sepuluh Nopember.
15. R. Raihan, (2018), Karbon Aktif. Retrieved Juli 31, 2020 from http://myteknikkimiablogaddress.blogspot.com/2018/01/makalah-karbon-aktif.html
16. H. Sa'adah, M. Abdassah, and A. Y. Chaerunisaa, (2019), *Aplikasi Kaolin Dalam Farmasi Dan Kosmetik*. Jurnal Farmasi Indonesia Vol.16, page: 334-346. p-ISSN: 1693-3591, Bandung.
17. R. A. Hidayah, (2005), *Studi Genesa Kaolin Dan Pemanfaatannya*. Jurusan Teknik Geologi Fakultas teknologi Mineral Institut Sains & Teknologi Akprind, Yogyakarta, Indonesia.
18. W. Widayat, and S. Yudo, (2002), *Pengolahan Air Payau Menggunakan Teknologi Osmosa Balik*. Jurnal Teknologi Lingkungan, Vol. 3 No. 1, pp. 69-81.
19. Robiatun, 2003, *Membran Reverse Osmosis dalam Proses Desalinasi Airl Laut*,Bulletin Penelitian Vol.XXV No.3, Desember 2003.
20. A. Sefentry, and R. Masriatini, (2020), *Pemanfaatan Teknologi Membran Reverse Osmosis (RO) Pada Proses Pengolahan Air Laut Menjadi Air Bersih*. Jurnal Redoks. Palembang.
21. P. Zhang,P, J. Hu, W. Li, and H. Qi, (2013), *Research Progress Of Brackish Water Desalination By Reverse Osmosis*. Journal of Water Resource and Protection, 2013, 5, pp. 304-309.
22. E. Ihsanto, and S. Hidayat, (2014), *Rancang Bangun Sistem Pengukuran pH Meter Dengan Menggunakan Mikrokontroller Arduino Uno,* Jurnal Teknologi Elektro. ISSN: 2086-9479.
23. Peraturan Menteri Kesehatan Republik Indonesia (2017) *Standar Baku Mutu Kesehatan Lingkungan Dan Persyaratan Kesehatan Air Untuk Keperluan Higiene Sanitasi, Kolam Renang, Solus Per Aqua, Dan Pemandian Umum*.No.32/ 2017.
24. R. Zamora, Harmadi, and Wildian, (2015), Perancangan Alat Ukur TDS (Total Dissolved Solid) Air Dengan Sensor Konduktivitas Secara Real Time. Jurnal Sainstek, 7(1), pp. 11-15.
25. Khairunnas, M. Gusman, (2018), Analisis Pengaruh Parameter Konduktivitas, Resistivitas dan TDS Terhadap Saliitas Air Tanah Dangkal Pada Kondisi Air Laut Pasang dan Air Laut Surut di Daerah Persisir Pantai Kota Padang. Jurnal Bina Tambang, 3(4), pp. 1751-1760
26. World Health Organization (WHO) (2011) Guidelines for drinking-water quality, 4th edn Geneva, Switzerland: World Health Organization.

RO & Local Material Filter

ORIGINALITY REPORT

10%	8%	7%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	garuda.ristekbrin.go.id Internet Source	2%
2	R N Afiah, W Supartono, E Suwondo. " Optimizing pre-cooking treatment condition for reducing lead (Pb) content in Seaweed (sp.) ", IOP Conference Series: Earth and Environmental Science, 2019 Publication	1%
3	repository.petra.ac.id Internet Source	1%
4	www.coursehero.com Internet Source	1%
5	Communications in Computer and Information Science, 2015. Publication	1%
6	N Vina, Van Harling, Markus Dwiyanto Tobi. "Analysis of Groundwater Quality in Dusun Salam and Randuacir, Argomulyo District", Journal of Physics: Conference Series, 2021 Publication	1%

7	Submitted to UPN Veteran Jawa Timur Student Paper	1 %
8	www.mdpi.com Internet Source	1 %
9	B.A. Dogadkin, E.N. Beliaeva. "The role of free radicals in the low-temperature crosslinking (vulcanization) of rubber", Polymer Science U.S.S.R., 1960 Publication	<1 %
10	www.researchgate.net Internet Source	<1 %
11	docs.lib.purdue.edu Internet Source	<1 %
12	iopscience.iop.org Internet Source	<1 %
13	www.jeeng.net Internet Source	<1 %
14	Pan Zhang, Jingtao Hu, Wei Li, Houbo Qi. "Research Progress of Brackish Water Desalination by Reverse Osmosis", Journal of Water Resource and Protection, 2013 Publication	<1 %
15	epdf.tips Internet Source	<1 %

16	S D Muktiningsih, D M A R M S Putri. "Study of the potential use of rainwater as clean water with simple media gravity filters: A review", IOP Conference Series: Earth and Environmental Science, 2021 Publication	<1%
17	ejournal.poltekkes-smg.ac.id Internet Source	<1%
18	faculty.ksu.edu.sa Internet Source	<1%
19	journal.poltekkes-mks.ac.id Internet Source	<1%
20	www.neliti.com Internet Source	<1%

Exclude quotes	On	Exclude matches	< 5 words
Exclude bibliography	On		