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Electric Conductivity and Power of Hydrogen Value of Processed Seawater Using a Distillation Tool

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ABSTRACT

Water pollution in the coastal areas of Ternate has shown a serious increase. It can be seen from the amount of garbage and the appearance of water turbidity in areas near residential areas. Based on a preliminary study, several residents behind the mountain also complained about the brackishness of their wells due to seawater intrusion. This study aims to determine the effectiveness of the distillation method on decreasing the value of electrical conductivity and power of hydrogen (pH) in seawater. This research is an experimental study with a post-test only group control design with a sample of 10 litres of liquid waste from three places, namely Muara Maliaro, Muara Pasar Sayur, Muara Pelabuhan Besar. The results of this study were processed using data processing software with paired T-test and Wilcoxon. The average value of DHL in samples 1, 2, 3 after distillation was carried out successively was 116 mhos/cm, 109.33 mhos/cm, 109.66 mhos/cm. The average pH value in samples 1, 2, 3 after distillation in all samples have shown normal values with an average of 7. There is a difference in the DHL value before and after distillation with the Sig value (2-tailed), which is <0.05. There is a different pH value before and after distillation with the Sig value (2-tailed) <0.05. Distillation equipment can reduce the value of electrical conductivity and pH in seawater.

***Keywords**: distillation; electric conductivity; pH; seawater*

ABSTRAK

Pencemaran air di wilayah pesisir Ternate telah menunjukkan peningkatan yang serius. Hal ini terlihat dari banyaknya sampah, dan munculnya kekeruhan air di wilayah dekat pemukiman warga. Berdasarkan studi pendahuluan, beberapa warga di belakang gunung juga mengeluhkan payaunya sumur mereka akibat intrusi air laut. Penelitian ini bertujuan untuk mengetahui efektivitas metode destilasi terhadap penurunan nilai daya hantar listrik (DHL), dan pH pada air laut. Penelitian ini merupakan penelitian eksperimental dengan rancangan *post test only group control design* dengan sampel sebanyak 10 Liter limbah cair dari tiga tempat yaitu Muara Maliaro, Muara Pasar Sayur, Muara Pelabuhan Besar. Hasil penelitian ini diolah menggunakan *software* pengolahan data dengan uji T berpasangan dan Wilcoxon. Nilai rata-rata DHL pada sampel 1, 2, 3 setelah dilakukan destilasi secara berturut-turut adalah 116 mhos/cm, 109,33 mhos/cm, 109,66 mhos/cm. Nilai rata-rata pH pada sampel 1, 2, 3 setelah dilakukan destilasi pada semua sampel telah menunjukkan nilai normal dengan rata-rata 7. Terdapat perbedaan nilai DHL sebelum dan sesudah destilasi dengan nilai *Sig. (2-tailed)* diketahui <0,05. Terdapat

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perbedaan nilai pH sebelum dan sesudah destilasi dengan nilai *Sig. (2-tailed)* diketahui <0,05. Alat destilasi mampu menurunkan nilai konduktivitas listrik dan pH pada air laut.
Kata Kunci: destilasi; daya hantar listrik; pH; air laut

INTRODUCTION

The problem of environmental pollution, especially water pollution in big cities in Indonesia, has shown quite severe symptoms. The cause is from industrial discharges of factories and health facilities that dispose of their wastewater without prior treatment into rivers or the sea but who are no less responsible. Whether intentionally or unintentionally, it is the community itself, namely household wastewater, which is increasing day by day according to the development of the population and a city (Asmadi and Suharno, 2012). The impact on human health is not immediately felt but will have an effect after several years. Thus, environmental pollution often carries various risks to human health. Several environmental pollution incidents have had health impacts on humans in developed countries, such as mercury pollution in Minamata Bay in Japan and river pollution in Canada. Meanwhile, in Indonesia, this has occurred in Buyat Bay, North Sulawesi, due to mercury waste suspected of being from a gold mine (Rahmadi, 2012).

The more dissolved salts that can be ionized, the higher the electric conductivity value. With a large amount of total dissolved solid salt (TDS), the higher the TDS, this can be very dangerous for the kidneys if ingested by humans and can cause kidney damage. Seawater has a high TDS value because it contains many chemical compounds, resulting in increased salinity and electrical conductivity values (Gasim, Khalid and Muhamad, 2015; Nurrohim, Sanjoto and Setyaningsih, 2012; Afrianita, Edwin and Alawiyah, 2017).

The coastal area is an important area from a variety of planning and management perspectives. The transition between land and sea in coastal areas has formed diverse and highly productive ecosystems that provide tremendous economic value for humans. In line with population growth and increasing socio-economic development activities, the regional values of the coastline continue to grow. The consequence of the pressure on the coast is a management problem that arises from conflicts over various interests in the area. Various activities along the coast and the paradigm of several coastal communities consider the sea a dumping ground for

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garbage. According to Damaianto and Masduqi (2014), various types of waste and pollutants in the sea will be found, which of course, can cause environmental degradation in coastal areas and the surrounding ecosystem. Thus, the excessive entry of organic and inorganic substances into water bodies adversely affects seawater and causes seawater physical, chemical, and biological degradation.

Coastal reclamation is one example of human efforts to overcome limited land in urban areas, which happened in Ternate City. Reclamation activities carried out along the coast of the city centre, from south to north of Ternate City, were carried out by the local government and several communities, last year tends to increase. In subsequent developments, the area was used for the construction of urban and residential facilities. The process of beach reclamation that is being carried out is still separating the reclaimed material, so it is feared that sediment will occur. If this continues, it will threaten the coastal ecosystem. Based on research conducted by Tambunan, Edisar and Juandi (2015) regarding seawater distillation using a solar heater with a concave mirror reflector, it shows that the water sample before and after the distillation. It shows a significant quality improvement, especially when the salinity decreased to 0 after being distilled from 27.5 ppt before distillation. The resulting Electric Conductivity distilled water at a cooling water rate of 0.5 L/minute, 1.0 L/minute, 1.5 L/minute, 2.0 L/minute and 2.5 L/minute respectively are: 1.11 μS/cm; 1.31 μS/cm; 1.67 μS/cm; 1.74 μS/cm; and 1.86 μS/cm. The electrical conductivity of equates is directly proportional to the discharge of cooling water. The greater the cooling water discharge, the higher the Electric Conductivity aquadest (Marjuni, Minarto and Wahyono, 2021). According to Putra, Martini and Wrasiati (2015), the results of the analysis of variance showed that the temperature treatment had a very significant effect, as well as the distillation time treatment had a very significant effect ($p<0.01$) on the pH value.

Seeing from the point of view and several studies that examine the use of distillation and electrocoagulation methods as an appropriate technology in wastewater treatment, it is necessary to make an effort to utilize alternative methods in the form of appropriate technology. These methods are capable and easy to work with materials commonly used in daily life to be widely applicable to all levels of society. Therefore, it is necessary to do further research on whether the distillation method

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can reduce the value of Electric Conductivity and pH in seawater.

METHOD

This type of research is a simple experimental study with a post-test only group control design. This research was conducted to determine whether the distillation method could reduce the value of electric conductivity (EC) and pH in seawater. The analysis was carried out at the chemical laboratory and workshop of the Department of Environmental Health, Health Polytechnic of Ternate. The population is all seawater around the coast of Central Ternate, and the sample was 10 litres of seawater. For the distillation method, the researchers used a simple device distillation system by utilizing an electric stove as a heater that then captured the steam from the heating using a hose that flowed into water containing cold water as a condenser in the condensation process. The sampling technique used was purposive sampling, which is a method of selecting subjects based on certain characteristics or traits related to the character of the population. The specific element used in this research is seawater samples around the island of Ternate from three places, namely Muara Maliaro, Muara Pasar Sayur, Muara Pelabuhan Besar, to obtain representative results. In this study, trials will be carried out using the distillation method used in this study is a simple distillation by evaporation for 1 hour with the design of the tool that has been made. Measurements of electric conductivity and pH were carried out at the laboratory campus B of the Department of Environmental Health, using a conductivity Meter and a pH Meter. The research ethics approved by the Health Research Ethics Committee of Health Polytechnic Ministry of Health Ternate number LB.02.04/2.3/179/2021.

RESULTS AND DISCUSSION

Based on the results of research that has been carried out at the Environmental Chemistry Laboratory, Department of Environmental Health, Poltekkes Kemenkes Ternate on Sunday, 27 June 2021, can be seen in the table as follows:

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Table 1. Comparison results of electric conductivity (EC) values before and after distillation in sample water

Location	**EC Value Before distillation (1)**	**EC Value Before Distillation (2)**	**EC Value Before Distillation (3)**	**Average**	**EC Value after Distillation (1)**	**EC Value after Distillation (2)**	**EC Value after Distillation (3)**	**Average**
Muara Maliaro	1578 mhos/cm	1815 mhos/cm	1294 mhos/cm	1622.33 mhos/cm	117 mhos/cm	121 mhos/cm	110 mhos/cm	116 mhos/cm
Muara Pasar Sayur	1485 mhos/cm	1791 mhos/cm	953 mhos/cm	1409.67 mhos/cm	112 mhos/cm	118 mhos/cm	90 mhos/cm	109.33 mhos/cm
Muara Pelabuhan Besar	1391 mhos/cm	1723 mhos/cm	1002 mhos/cm	1372 mhos/cm	111 mhos/cm	115 mhos/cm	103 mhos/cm	109.66 mhos/cm

Note (1): Morning (08.00-10.00), (2): Afternoon (13.00-15.00), (3): Afternoon (17.00-18.00)

Table 1 shows that the comparison of electric conductivity values before and after distillation shows a very drastic decrease at each sampling point. The average electric conductivity value in samples 1, 2, 3 before distillation is 1622.33 mhos/cm, 1409.67 mhos/cm, 1372 mhos/cm. Based on this value, the sample in the water category is quite good. The average value of electric conductivity in the sample 1, 2, 3 after distillation is 116 mhos/cm, 109.33 mhos/cm, 109.66 mhos/cm respectively. Based on this value, the sample after distillation is in the excellent water category based on Colorado University standards. Electrical conductivity is closely related to the salinity value of water. The higher the salinity value of feeding water, the higher the electric conductivity value because of the large number of dissolved salts that can be ionized (Susila and Poerwanto, 2013). The ability of water to conduct electricity is influenced by the number of ions or salts dissolved in the water. The more salt dissolved, the higher the electrical conductivity that occurs. Electric conductivity is an indirect measurement of salt concentration that can generally determine the suitability of water for crop cultivation and monitor nutrient solution concentrations (Susila and Poerwanto, 2013). It is known that the electric conductivity value in the sample before distillation falls into a fairly good category based on the standards set by (Bauder, Waskom and Davis, 2014) at Colorado university. It can be said that the sample water before distillation can have strong electrolytic properties and can conduct

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electricity quite well, and contains sufficient inorganic and inorganic materials. As for the water that has been distilled, it is known that the electric conductivity value has dropped drastically, which makes the water category very good, and the electrical conductivity of the water is reduced. It can be said to be a weak electrolyte solution.

Table 2. Comparison of pH values before and after distillation in sample water

Location	**pH Value Before distillation (1)**	**pH Value Before distillation (2)**	**pH Value Before distillation (3)**	**Average**	**pH Value Before distillation(1)**	**pH Value Before distillation (2)**	**pH Value Before distillation (3)**	**Average**
Muara Maliaro	7	8	8	7.6	7	7	7	7
Muara Pasar Sayur	7	8	7	7.3	7	7	7	7
Muara Pelabuhan Besar	7	8	7	7.3	7	7	7	7

Note (1): Morning (08.00-10.00), (2): Afternoon (13.00-15.00), (3): Afternoon (17.00-18.00)

Table 2 shows that the comparison of pH values before and after distillation shows a very drastic decrease at each sampling point. The average pH value in samples 1, 2, 3 before distillation is carried out in a row is 7.6; 7.3; 7.3, based on this value, the pH of the sample in the category meets the requirements but is not normal based on the standard of the Minister of Environment Decree No. 112 of 2003. The average pH value in samples 1, 2, 3 after distillation on all samples have shown a standard value with an average of 7. It is known that the pH value before distillation with an average range of 7.3 – 7.6. It is included in the category that meets the requirements but has not been categorized as usual. As for the water that has been distilled, it is known that the pH value has entered the normal category with an average of 7.

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Table 3. The results of the different tests on the electric conductivity value before and after distillation

Variable	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	Sig. (2-tailed)
				Lower	Upper		
Electrical conductivity (pre-post test)	1,34E+03	310.973	103.658	1098.187	1576.258	12.9	0.000

Based on table 3, the Sig. (2-tailed) is known <0.05, indicating a significant difference between the initial variable and the final variable. It shows that there is a significant effect on the differences in the treatment given to each variable. In the sense that there are differences in the value of electric conductivity before and after distillation. It is in line with the research conducted by (Khotimah, Anggraeni and Setianingsih, 2018), which states that distilled water produces an electric conductivity value of 0 with a temperature of 1250 C. The research results conducted by Risbandini (2020) show that distilled aquadest for four consecutive months also using a used autoclave will produce suitable water parameters where the final result for the electric conductivity value is three mhos/cm. In research Eriyati (2018) states that acid mine drainage can reduce its electric conductivity value by distillation. The electric conductivity value of AAT ranges from 500-600 µs/cm. While for the rest, it exceeds the value of the AAT, but for the distillation results, it has a value of tens of less than 50 µs/cm. According to Rosari, Hadi and Masduqi (2014), their research tested the desalination tool by comparing several parameters. They stated that the TDS and electric conductivity removal ability was 99,9% using a desalination device using solar energy with a parabolic trough.

According to Rachmawati and Mulyono (2019), AC water can also be used as a substitute for distilled water because it has an electric conductivity value of 0.02-0.03 ms. According to Indrawati and Ningsih (2018), following the Rbar-chart data, TDS, electric conductivity, and temperature are within control limits with a 99% confidence level. They conclude that AC wastewater can be used as aquades. It is known that AC wastewater comes from

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condensing the surrounding air containing water vapour to produce water in liquid form. The value of electric conductivity will increase along with the increase in TDS content in water (Astuti, 2018). Research Desiandi, Sitorus, and Hasyim (2010) state that the higher the TDS level, the higher the value of electric conductivity in these waters. According to Effendi (2003), TDS is usually caused by inorganic materials in the form of ions commonly found in waters where the number of ions or salts dissolved in water will significantly affect the ability of water to conduct electricity. Therefore, the more ions in water, the greater the electric conductivity value in these waters.

Table 4. Test results for differences in pH values before and after distillation using the Wilcoxon test

Variable	Z score	Sig. (2-tailed)
pH value (pre-post test)	-2.000	0.046

Based on table 4, Sig. (2-tailed) is known <0.05, indicating a significant difference between the initial variable and the final variable. It shows that there is a significant effect on the differences in the treatment given to each variable. In the sense that there are differences in pH values before and after distillation. In general, marine and coastal waters have a relatively more stable pH and are in a narrow range, usually ranging from 7.6 – 8.3, which means they are alkaline or called alkaline (Brotowidjoyo, 1995). However, under certain conditions, the value can change to be lower so that it becomes acidic. Such changes in pH value can affect the quality of the waters, which will have an impact on the life of the biota in it. This research is in line with Fachraniah, Fona and Rahmi (2016), which states that the refractive index and pH of liquid smoke after distillation are lower than the refractive index before distillation. It is the same as what is said by Walangare et al. (2013), which states that after distillation of seawater, the water pH level follows the standard of healthy ready-to-drink water. In research conducted by Azhari, Azhar and Kamal (2019) said that from the test results using pH paper with a colour indicator, the pH results of seawater were 8.0 and the pH of water after distillation was 6.5. Based on the research results also conducted by Pratama, Nurdiana and

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Meicahayanti (2017) said that there was a decrease in the pH value after distillation of seawater from 8.7 to 7.4. Mastiawan, Salim and Rahmadani (2012) also carried out research related to pH before and after distillation. The pH of seawater before going through the distillation process is 8 (alkaline). After the distillation process took place, the pH of seawater was 7 (neutral). The research conducted by Taqwa, Rosalina and Ramza (2020) says that the water content of the distillation process of seawater has a water pH of about 7.5. According to Walangare et al. (2013), the water produced by the distillation device can be directly consumed because it has gone through a heating process up to 110°C, which kills germs and other biological compounds. Also, with the distillation process, the salinity and pH levels of the water follow healthy drinking water standards.

CONCLUSION

There are differences in the value of electric conductivity and the pH value before and after distillation. Distillation equipment can reduce the value of electric conductivity and pH in seawater. Future research can examine other variables not examined by researchers, such as total dissolved solid salt (TDS) or chemicals that may be present in seawater, such as lead cadmium, etc.

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REFERENCES

Afrianita, R., Edwin, T. and Alawiyah, A. (2017) 'Analisis Intrusi Air Laut dengan Pengukuran Total Dissolved Solids (TDS) Air Sumur Gali di Kecamatan Padang Utara', *Jurnal Dampak*, 14(1), p. 62. doi: https://doi.org/10.25077/dampak.14.1.62-72.2017.

Asmadi and Suharno (2012) *Dasar – Dasar Teknologi Pengolahan Air Limbah*. Yogyakarta: Gosyen Publishing.

Astuti, A. D. (2018) 'Kualitas Air Irigasi Ditinjau Dari Parameter DHL, TDS, pH Pada Lahan Sawah Desa Bulumanis Kidul Kecamatan Margoyoso', *Jurnal Litbang: Media Informasi Penelitian, Pengembangan dan IPTEK*, 10(1), pp. 35–42. doi: https://doi.org/10.33658/jl.v10i1.75.

Azhari, R. M., Azhar and Kamal, M. (2019) 'Rancang Bangun Sistem Pengendalian Suhu dan Level Pada Proses Penyulingan Air Laut Menjadi Air Tawar dengan Metode Boiling', *Jurnal Tektro*, 3(2), pp. 113–118.

Bauder, T. A., Waskom, P. L. and Davis, J. G. (2014) *Irrigation Water Quality Criteria, Irrigation (Colorado State University)*.

Brotowidjoyo (1995) *Pengantar Lingkungan Perairandan Budidaya Air*. Yogyakarta: Liberty.

Damaianto, B. and Masduqi, A. (2014) 'Indeks Pencemaran Air Laut Pantai Utara Kabupaten Tuban dengan Parameter Logam', *Jurnal Teknik ITS*, 3(1), pp. D1–D4. doi: https://doi.org/10.1109/ISSPIT.2005.1577147.

Desiandi, M., Sitorus, R. and Hasyim, H. (2010) 'Inspection of Drinking Water Quality on the Regional Preparation of Zona Air Minum Prima (Zamp) Pdam Tirta Musi Palembang', *Jurnal Ilmu Kesehatan Masyarakat*, 1(1), pp. 74–79.

Effendi, H. (2003) *Telaah Kualitas Air Bagi Pengelolaan Sumberdaya dan Lingkungan Perairan*. Yogyakarta: Kanisius.

Eriyati, E. (2018) *Alternatif Pengelolaan Air Asam Tambang Menggunakan Sistem Destilasi Terhadap Kegiatan Penambangan Batubara PT. Miyor Pratama Coal Parambahan Desa Batu Tanjuang, Kec.Talawi, Kota Sawahlunto*.

Fachraniah, Fona, Z. and Rahmi, Z. (2016) 'Peningkatan Kualitas Asap Cair Dengan Distilasi', *Jurnal Sains dan Teknologi Reaksi*, 7(1), pp. 1–11. doi: https://doi.org/10.30811/jstr.v7i1.133.

Gasim, M. B., Khalid, N. A. and Muhamad, H. (2015) 'The influence of tidal activities on water quality of paka river Terengganu, Malaysia', *Malaysian Journal of Analytical Sciences*, 19(5), pp. 979–990.

Indrawati, T. and Ningsih, N. I. D. (2018) 'Penerapan Statistics Process Control Dalam Pengamatan Sifat Fisika Dan Kimia Air Buangan Dari Air Conditioning (AC)', *Integrated Lab Journal*, 6(2), pp. 39–46. doi: https://doi.org/10.14421/ilj.2018.%25x.

Khotimah, H., Anggraeni, E. W. and Setianingsih, A. (2018) 'Karakterisasi Hasil Pengolahan Air Menggunakan Alat Destilasi', *Jurnal Chemurgy*, 1(2), p. 34. doi: https://doi.org/10.30872/cmg.v1i2.1143.

Marjuni, Minarto, O. and Wahyono, S. C. (2021) 'Modifikasi Sirkulasi Air Pendingin Alat Destilasi pada Proses Pembuatan Akuades', *Jurnal Fisika Flux*, 18(1), pp. 16–24. doi: https://doi.org/10.20527/flux.v18i1.8888.

Mastiawan, M. N. A. P., Salim, S. and Rahmadani, S. A. (2012) 'Penguapan dan pengembunan air dengan sistem terbuka sebagai metode pemurnian air', in *Seminar Nasional Teknik Mesin Politeknik Negeri Jakarta*. Jakarta, pp. 221–223.

Nurrohim, A., Sanjoto, T. B. and Setyaningsih, W. (2012) 'Kajian Intrusi Air Laut Di Kawasan Pesisir Kecamatan Rembang Kabupaten Rembang', *Geo-Image*, 1(1), pp. 21–27. doi: https://doi.org/10.15294/geoimage.v1i1.942.

Pratama, A. W., Nurdiana, J. and Meicahayanti, I. (2017) 'Pengaruh Perbedaan Jenis Plat Penyerap Kaca dan Papan Mika Terhadap Kualitas Dan Kuantitas Air Minum Pada Proses Destilasi Energi Tenaga Surya', in *Prosiding Seminar Nasional Teknologi IV*, pp. 35–40.

Putra, I. G. G. S. A., Martini, N. M. and Wrasiati, L. P. (2015) 'Pengaruh Suhu dan Lama Distilasi Terhadap

Randemen dan Karakteristik Distilat Alkohol dari Cairan Pulpa Hasil Samping Fermentasi Biji Kakao', *Jurnal Rekayasa Dan Manajemen Agroindustri*, 3(3), pp. 95–102.

Rachmawati and Mulyono (2019) 'Pemanfaatan Buangan AC untuk Memenuhi Kebutuhan Air Bersih pada Praktikum di Laboratorium Kimia Fisika Utilization of AC Disposal to Meet Pure Water Needs in Experiment at the Physical Chemistry Laboratory', in *Prosiding Seminar Nasional Kimia Jurusan Kimia FMIPA Universitas Negeri Surabaya*, pp. 5–8.

Rahmadi, T. (2012) *Mediasi Penyelesaian Sengketa Melalui Pendekatan Mufakat*. Jakarta: PT.Radja Grafindo Persada.

Risbandini, C. (2020) 'Utilization of Unused Autoclaves to Produce Aquades (Aquabits) in the Laboratory of Biosciences and Plant Technology, Department of Biology, Faculty of Science ITS', *Jurnal Teknologi Manajemen Pengelolaan Laboratorium*, 3(1), pp. 19–24. doi: https://doi.org/10.25077/temapela.3.1.19-24.2020.

Rosari, T., Hadi, W. and Masduqi, A. (2014) 'Desalinasi Air Payau Menggunakan Energi Solar dengan Parabolic Trough', *Jurnal Purifikasi*, 14(1), pp. 55–64.

Susila, A. D. and Poerwanto, R. (2013) *Irigasi Dan Fertigasi*. Bogor: Institut Pertanian Bogor.

Tambunan, F. S., Edisar, M. and Juandi, M. (2015) 'Destilasi Air Laut Menggunakan Pemanas Matahari dengan Reflektor Cermin Cekung', *JOM FMIPA*, 2(1), pp. 116–122.

Taqwa, B. B., Rosalina and Ramza, H. (2020) 'Perancangan Alat Proses Distilasi Air Laut menggunakan Pemanas Elektrik', in *Prosiding Seminar Nasional Teknoka*, pp. 204–214. doi: https://doi.org/10.22236/teknoka.v5i.327.

Walangare, K. B. A. *et al.* (2013) 'Rancang Bangun Alat Konversi Air Laut Menjadi Air Minum Dengan Proses Destilasi Sederhana Menggunakan Pemanas Elektrik', *Jurnal Teknik Elektro dan komputer*, 2(2), pp. 1–11. doi: https://doi.org/10.35793/jtek.2.2.2013.1786.

DOI: 10.32668/jitek.v9i1.571