Analysis of Groundwater Quality *in an Industrial Location at MM2100 and a Residential Location at Cibuntu, West Java, Indonesia*

Novera Elisa Triana[1], Titia Izzati[2], Aditya Hartanto[3]

[1]Industrial Engineering Program, Universitas Mercu Buana, 11650, Jakarta, Indonesia

Email : novera.elisa@mercubuana.ac.id; titia.izzati@mercubuana.ac.id; adich12321@gmail.com

Abstract. The aim of this study is to determine the difference in the quality of groundwater at an industrial location in MM2100 and a residential location, both in Cibuntu, West Java, Indonesia. The parameters used to establish whether or not the water is safe are: standard acidity of the water (pH), total dissolved solid (TDS), and Electrical Conductivity (EC). The results of water tested in MM2100 revealed an average of pH 7-9.7 for acidity, 127.8ppt for total dissolved solid, and 258.5 µS for EC. The results of water tested from the residential location recorded an average of pH 8.0-10 for acidity, 89.4ppt for total dissolved solid, and 179.9 µS for EC. The quality of groundwater for both the industrial and residential locations have been found to be unsafe based on governmental and international standards.

Keyword: Quality of Water, pH, TDS, EC

1. Preliminary

Water is necessary to support human life and development[1, 2]. The quality of water in different areas may differ depending on many factors such as land, level of industrialization, forestation, etc. Lower water quality can be expected in urban or industrialized areas when compared to forested or agricultural areas. In industrial areas, especially the area srrounding Jakarta[3-12], water can be contaminated by the emission of pollutants and indiscriminate waste disposal, including chemical waste[2, 13, 14]. Unsafe and low water quality can lead to various diseases and dysentery among the population because of limitation of open space[15].

(a) (b)

Figure 1. (a) location of analized water , (b) detailed zoom of the location

The location subjected to this study is located at Cibuntu with the geographical coordinates of 6˚17'10" South Latitude 107˚04'36" East Longitude. This region inside the Jabodetabek area is a densely populated area of both people and industry. The distance for both locations is 5 kilometers.

Figure 2. (a) Industrial area looks from google maps (b) Crowded situation inside Industrial region (c) Location at Kalimalang

From figure 2a, the area MM2100 is assumed to be an industrial area, home to some 76 companies. Figure 2b showed heavy traffic congestion in the industrial area. Pollution of all kinds may result due to the industry and its population. .Picture 2c showed an active growth of water hyacinth. From the scientific work of Yasti, the water quality is one of indicators that water has been polluted.

2. Research Methode

The duration of this analytical study was from March 4,2018 till April 30,2018 (at least 8 weeks) during which a water sample was taken daily at the same place and at the same

Source	Item Check	Standard Value				Note
(15) PMK	Acidity	6,5	-	8,5	pH	Normal water can use
		0	-	300	ppt	Excellent
(14) WHO		300	-	600	ppt	Good
(15) PMK	TDS	600	-	900	ppt	Fair
		900	-	1200	ppt	Poor
		1200	-	,,,	ppt	Unacceptable
		0,5	-	3	µS	Distilled water
		2	-	42	µS	Melted snow

		50	-	800	µS	Tap water
(12) Fondriest	EC	30	-	1500	µS	Portable water in US
		100	-	2000	µS	Fresh water streams
		2000	-	10000	µS	Industrial waste water
		10000	-	55000	µS	Seawater

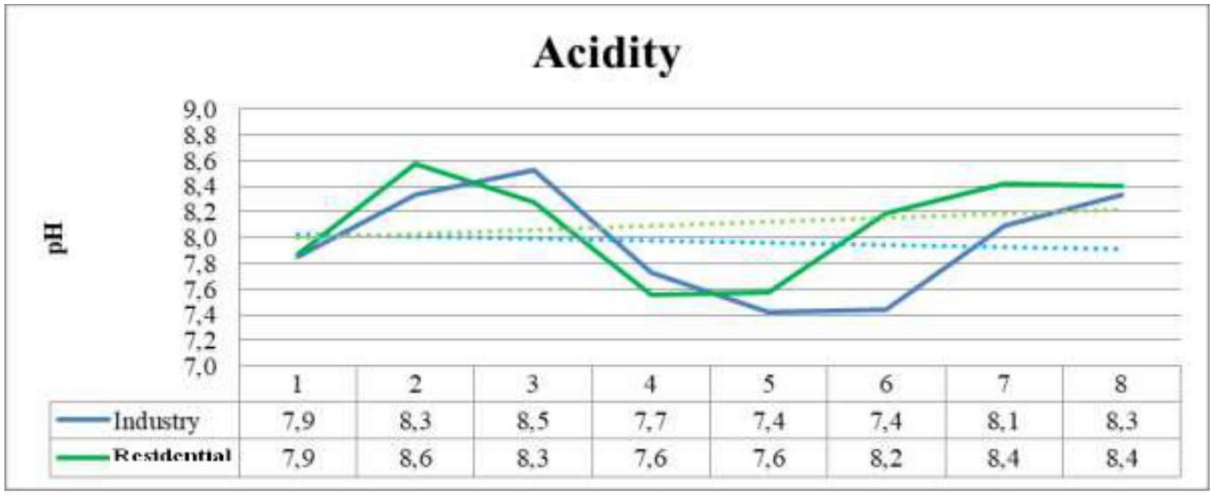
Figure 3. Standard value of research

time[16, 17]. The main parameter of checking are acidity of water (pH), Total disolved solid (TDS), Electrical Conductivity (EC). The other parameter is Temperature. The check tool use a multi meter water check, which can be used for all parameters. Test results are measured against government rule PMK number 32 on the standard of quality of water, WHO guidelines for drinking water quality, and Fondriest environmental measurements[18].

3. Result of analysis

a. pH

The graph below shows acidity levels at the industrial location to be between 7.4 - 8.5, with a trendline around 8.2 which is decreasing. Acidity at the residential area is between 7.6 - 8.6, with a trendline around 7.9 and rising. The higher acidity levels of the residential location can be attributed to waste from soap and detergents[19, 20]. Based on government rule PMK number 32, the study can conclude that the water at both the industrial and residential locations are unsafe for human use and activities[21].



	1	2	3	4	5	6	7	8
Industry	7,9	8,3	8,5	7,7	7,4	7,4	8,1	8,3
Residential	7,9	8,6	8,3	7,6	7,6	8,2	8,4	8,4

Figure 4. Acidity Graphic Result

b. TDS

TDS is the indicator information about the value of the particle inside the solvent. From the graphic, the TDS at the industrial location is between 115.6 - 140.5 with an average trendline of 128 and rising. On the other hand, TDS at the residential location is between 81.6 - 95.2, with an average trendline of 90 and rising. Based on government rule PMK number 32 and WHO standard, the study can conclude that the water at both the industrial and residential locations are unsafe for human use and activities[22, 23].

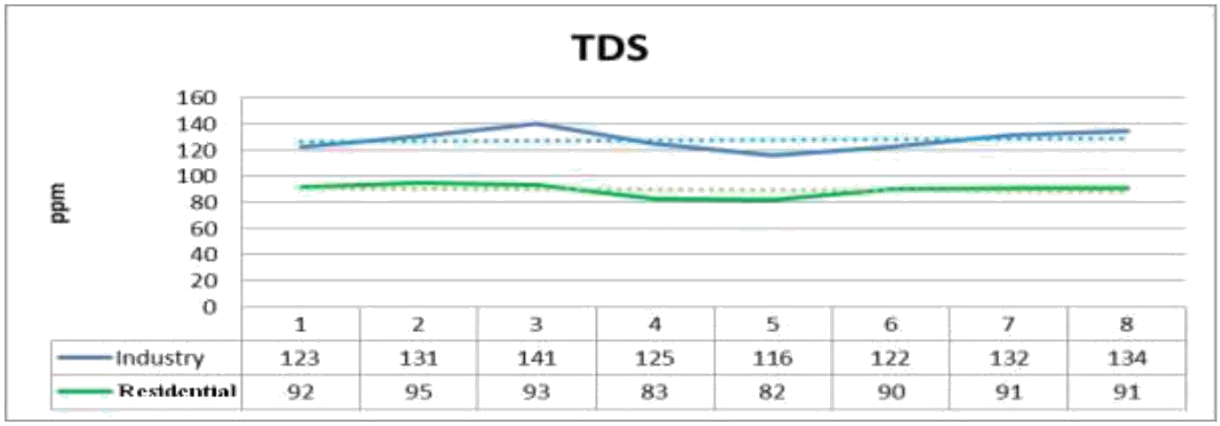


Figure 5. TDS Graphic Result

c. EC

Electrical Conductivity is the capability of the material for flowing the electrical[24]. EC can indicates the source of the water. We are taking from the tap water. Based on graphic below, the EC at the industrial location is between 240.3 - 287.0, with an average point 259 and rising. EC at the residential location is between 159.8 - 196.0, with an average point 180 and rising also.

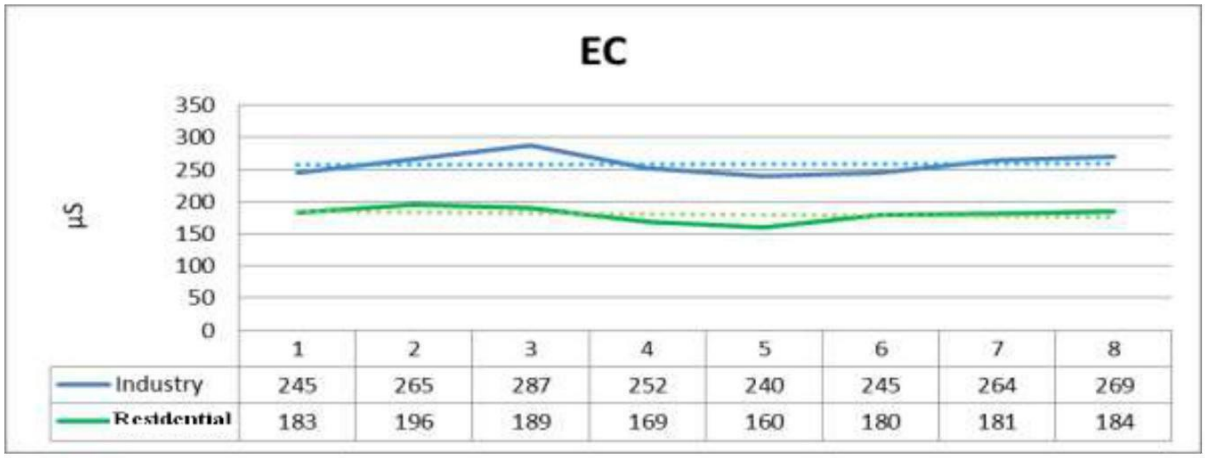


Figure 6. EC Graphic Result

d. Temperature

The temperature of water at the industrial location is between 25.7 - 29.1^{o}C while the same at the residential location is between 25.6 - 29.3^{o}C. The temperature cannot be the main standard because the checking condition is not taken on the same day[25].

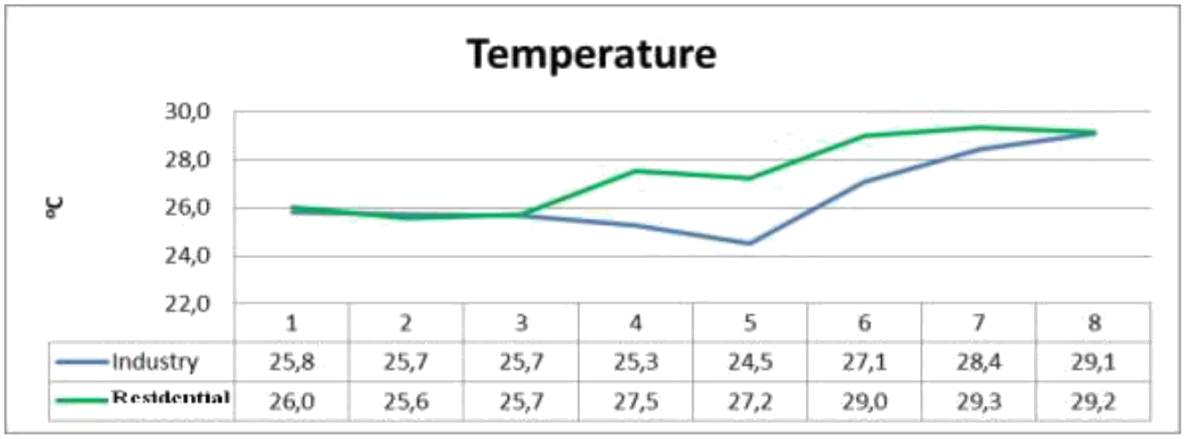


Figure 7. Temperature Graphic Result

Location	*Parameter Check*				Result
	pH	TDS	EC	₀C	
Work Industry	X	O	O	-	X
Home Casidential	X	O	O	-	X

Residential

Note O Recommended
X Not Recommended
-Not Defined

Figure 8. Conclusion Result

The results of water tested from the residential location recorded an average of pH 8.0-10 for acidity, 89.4ppt for total dissolved solid, and 179.9 µS for EC. The quality of groundwater for both the industrial and residential locations have been found to be unsafe based on governmental and international standards.

4. Conclusion

A summary of the study results is shown in Figure 8. Based on the standard value of research, Figure 3, it can be concluded that the quality of groundwater at both the industrial and residential locations are unsafe for use because acidity values does not meet both the accepted standards of the government and international health organizations[26-29].

5. References

[1] S.D. Richardson, T.A. Ternes, Water analysis: emerging contaminants and current issues, Analytical chemistry, **86** (2014) 2813-2848.

[2] R.L. Olsen, R.W. Chappell, J.C. Loftis, Water quality sample collection, data treatment and results presentation for principal components analysis–literature review and Illinois River watershed case study, Water research, **46** (2012) 3110-3122.

[3] T. Izzati, An Initial Study Of The Air Pollution Through Rainwater In An Industrial Area Of Bekasi, *World Chemical Engineering Journal*, **1** (2016).

[4] T. Izzati, An Initial Study Of The Air Pollution Through Rainwater In An Industrial Area Of Cikarang, West Java, Indonesia (A Case Study), Science International, **28** (2016).

[5] T. Izzati, W. Suprihatiningsih, M. Kristovorus, A.G. Andrean, An Initial Study Of Laundry Industrial Effects To The Water Pollution In East Jakarta, *IOSR Journal of Environmental Science*, Toxicology and Food Technology **10** (2016) 35-37.

[6] T. Izzati, W. Suprihatiningsih, W. Satuti, F.S. Febrian, M.N. Rahayu, J.R. Jenario, An Initial Study Of Industrial Area's Effects For The Air Pollution Through Rainwater In East Jakarta, *IOSR Journal of Mechanical and Civil Engineering*, **13** (2016) 159-162.

[7] T. Izzati, N.E.R. Wuryandari, S. Ayudia, F. syafei, F. Triyadi, An Initial Study Of Laundry Industrial Effects To The Water Pollution In Bekasi, *IOSR Journal of Business and Management*, **18** (2016) 109-111.

[8] T. Izzati, Water Quality Analysis Of Residential And Industrial Areas In Bogor, West Java, Indonesia, Science International, **29** (2017) 37-370.

[9] T. Izzati, An Initial Study of the Water Pollution Analysis at Residential, Office Building and Industrial Area's in Bogor, *World Chemical Engineering Journal*, **1** (2017).

[10] M.E. Beatrix, T. Izzati, F.A. Razak, A. Pratama, Analysis of Water Quality to Industrial and Residential Development Area in Bogor, West Java, Indonesia (A Case Study), Science International, **30** (2018) 159-1661.

[11] T. Izzati, K.Y. Utomo, P. Hastuti, M. Fachrizal, An Initial of the Pollution of Water in Industrial Area Surronding Coastal Zone of North Jakarta, Indonesia, Science International, **30** (2018) 325-328.

[12] W. Suprihatiningsih, T. Izzati, A.R.A.P.B.E. Pambudi, D. Zulfikar, Y.E. Utomo, Analytical Report on Water Quality of Residential and Industrial Area of East Jakarta, Jakarta, Indonesia, Science International, **30** (2018) 169-172.

[13] J.G. Dean, F.L. Bosqui, K.H. Lanouette, Removing heavy metals from waste water, Environmental Science & Technology, **6** (1972) 518-522.

[14] J. Stauffer, The water crisis: Constructing solutions to freshwater pollution, Routledge, 2013.

[15] T. Izzati, Y. Poerwanti, Enhancing The Productivity And Multifunctionality Of Open Space Using Simple Techniques In Green Buildings, Science International, **26** (2014) 689-690.

[16] T. Izzati, Kimia dan Praktikumku, Pustaka Mandiri, Jakarta, 2017.

[17] T. Izzati, Kimia dan Praktikumku, Pustaka Mandiri, Jakarta, 2017.

[18] F. Edition, Guidelines for drinking-water quality, WHO chronicle, **38** (2011) 104-108.

[19] A.F. Widiyanto, S. Yuniarno, K. Kuswanto, Polusi Air Tanah Akibat Limbah Industri dan Limbah Rumah Tangga, *Jurnal Kesehatan Masyarakat*, **10** (2015) 246-254.

[20] A. Bahtiar, Polusi Air Tanah Akibat Limbah Industri Dan Rumah Tangga Serta Pemecahannya, Abstrak, (2007).

[21] L.N.W. Astuti, Gambaran Pengolahan Limbah Cair Di PT Smart TBK Marunda Bekasi Berdasarkan Peraturan Menteri Lingkungan Hidup No 5 Tahun 2014, in, Universitas Sebelas Maret, 2015.

[22] H. Zulkifli, Pemanfaatan Limbah Padat (fly ash) untuk Mencegah Cemaran Mikrobiologis dan Kimiawi Sampah Kota pada Ekosistem Rawa, Majalah Ilmiah Biologi BIOSFERA, **26** (2009) 65-70.

[23] H. Sudrajat, Mengelola Sampah Kota, Niaga Swadaya, 2006.

[24] J. Huang, E. Scudiero, W. Clary, D. Corwin, J. Triantafilis, Time-lapse monitoring of soil water content using electromagnetic conductivity imaging, Soil Use and Management, 33 (2017) 191-204.

[25] S.D. Faust, O.M. Aly, Chemistry of water treatment, CRC Press, 2018.

[26] R. Indonesia, Peraturan Menteri Kesehatan in: K.R. Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air untuk Keperluan Higine Sanitasi, Solus Per Aqua, dan Pemandian Umum (Ed.) 864, Kementerian Kesehatan Republik Indonesia, Jakarta, 2017.

[27] M.K.R. Indonesia, Peraturan Menteri Kesehatan No. 416 Tahun 1990 Tentang: Syarat-syarat Dan Pengawasan Kualitas Air, in, 2016.

[28] W.H. Organization, Guidelines for drinking-water quality: first addendum to the fourth edition, (2017).

[29] W.H. Organization, Safely managed drinking water-thematic report on drinking water 2017, Accessed July, 10 (2017) 2017.