turnitin 17

by I Made Arsana

Submission date: 25-Dec-2021 09:28AM (UTC+0700)
Submission ID: 1735562466
File name: 89-95_2.pdf (304.41K)
Word count: 4268
Character count: 22040

Journal of Mechanical Engineering Research and Developments
ISSN: 1024-1752
CODEN: JERDFO
Vol. 44, No. 11, pp. 89-95
Published Year 2021

Study on Car Emission Level in Big City and Its Prevention: Evidence from Surabaya, Indonesia

I Made Arsana[†*], Akmaludin[†], Mochamad Arif Irfai[†], Wahyu Dwi Kurniawan[†], Erlinda Ningsih[‡]

[†]Department of Mechanical Engineering, Universitas Negeri Surabaya, Surabaya 60231, Indonesia
[‡]Department of Chemical Engineering, Institut Teknologi Adhi Tama, Surabaya, Indonesia

*Corresponding Author Email: madearsana@unesa.ac.id

ABSTRACT

Air pollution is still become a global issue in big cities. The automotive emission is a major problem in this issue. This study aims to analyze the levels of emissions produced in Surabaya City, based on engine capacity and production year. Data collecting was undertaken in 5 regions of Surabaya). Emission test was was carried out based on SNI 19-17118.1-2005 for gasoline-engine vehicles and SNI 19-17118.2-2005 for diesel-engine vehicles). The test results were then compared to Environmental Regulation No. 05, year of 2006. Tests were carried out for vehicles with engine capacities of 1000 - 6800 cc and vehicle production years below 1995, between 1996-2006 and above 2007. Based on the results of testing, analysis and discussion carried out, several things can be stated as follows: (1) Based on engine capacity, the engine categories of 1200 cc, 1300 cc, 1500 cc, 1800 cc and 2000 cc have the highest number of units passing the emission test. Meanwhile, machines with a capacity of 1000 cc, 2300 cc, 2500 cc, 2800 cc, 3000 cc, 6000 cc and 6800 cc had the highest number of failed test units. (2) based on the year of production, the years 1995 and above have a balance between passing and failing. Meanwhile, the 1996 to 2006 production years had the highest number of units that passed the emission test, as well as the 2007 and lower production years, which also had the highest number of units passing the emission test. Surabaya as a big city has compiled and implemented a program to keep the environment clean and green, known as the Surabaya Green and Clean program.

KEYWORDS

air pollution, engine capacity, environment, green and clean policy

INTRODUCTION

Nowadays air pollution becomes more a global issue in big city in the world including Indonesia. The automotive emission is the major problem in this issue. Meanwhile, air quality is one of the important elements for the survival of human and other creatures on Earth. The increase in the number of vehicles and the use of fossil fuels have contributed greatly to the decline in urban air quality in the world [1,2]. Sources of air pollution in urban areas include trade, industry, power plants, domestic fuels and transportation. Transportation is a sector that causes significant carbon dioxide (CO) emissions and accounts for 7,738 million metric tons of fossil-fueled vehicles in 2015-2016 [3,4]. We have acknowledged air pollution as one of the "most dangerous killer" and as a "major threat towards health" because of the extraordinary effects towards the health of human in all ages and other creatures [5]. In fact, there were just a few countries took air pollution. However, along with the rapid development of technology and industry, more countries become aware towards the air pollution problem. They realized that technological developments such as motor vehicles and industrial processes leads to air quality problems [6,7]. The growth in the number of vehicles driven by socio-economic development is a major challenge related to air pollution, energy availability and public health in many countries. The table 1 shows the growth data of the motor vehicle number in Indonesia in the period of 2013-2017 [8].

Table 1. Growth In The Number Of Motor Vehicles In The Period 2013-2017

Types of Motorized Vehicles	Year				
	2013	2014	2015	2016	2017
Passenger car	1.484.514	12.599.038	13.480.973	14.580.666	15.493.068
Bus Car	2.286.309	2.398.846	2.420.917	2.486.898	2.509.258
Freight cars	5.615.494	6.235.136	6.611.028	7.063.433	7.523.550
Motorcycle	84.732.652	92.976.240	98.881.267	105.150.082	113.030.793
Total	104.118.969	114.209.260	121.394.185	129.281.079	138.556.669

Air pollution produced by motor vehicles comprises carbon monoxide (CO), carbon dioxide (CO_2), nitrogen oxides (NOx) in the form of nitric oxide (NO) and nitrogen dioxide (NO_2), hydrocarbons (HC), sulfur oxides (SO_X) in the form of sulfur dioxide (SO_2) and sulfur trioxide (SO_3), and particles (PM10)[9,10]. It causes CO emissions by two factors, incomplete combustion in the combustion chamber and poor mixture [2]. The level permitted pollutans exceeds the limit, cause a variety serious health problems, such as respiratory problems, allergies, cancer, cardiovascular and respiratory diseases, and even death. For the elder, infants, toddlers, children, sensitive people, and those who suffer from asthma and other disorders vulnerable to the effects of air pollution [11,12].

The World Health Organization (WHO) on its official website explains that air pollution is dangerous for children. In worldwide, 14% of children aged 5-8 years stated suffer from asthma, air pollution causes some of which. Every year, 543,000 children younger than 5 years die with respiratory ailments related to air pollution effect. Air pollution can also cause the growth of cancer cells in children, stunted fetal brain growth in pregnant women, and can cause cognitive impairment in both children and adults [13]. Several studies have explained the effects of air pollution on the respiratory system. According to [14] the problem of air pollution is the largest in Indonesia because it causes 50% of morbidity throughout the country. Diseases caused by vehicle emissions and air pollution include acute respiratory infections, bronchial asthma, bronchitis, skin irritation, lung cancer, and cardiovascular disease. It affects increasing of NOx up to 51%, PM2.5 increasing up to 26%, and other pollutants such as SO_2, PM10, VOC, and O3 [9,14]. The results of [15] research aimed at analyzing the impact of particles of less than 10 microns (PM10) on the ambient air quality of Jakarta and Palembang, showing that the highest PM10 concentrations in Jakarta and Palembang have exceeded the ambient air quality standard (150 µg / m^3). This will decreased visibility impact, dust exposure, increased sensitivity of asthma and bronchitis and also other respiratory diseases [15].

From several studies conducted above show that the high and low level of air pollution in an area has a negative impact towards the respiratory system of human and other creatures. The decline of air quality happened since over the last few year shows it is important to promote these emission reduction efforts. the awareness effort for improved air quality under vehicle sales. We conducted this research to analyze the emission level produced in one of the major cities in Indonesia, in the city of Surabaya. The focus in this study is the level of emissions produced based on engine capacity and the year of production both in gasoline and diesel-engine vehicles. Given that Surabaya is the second largest metropolitan city and the increase in vehicle growth is increasing, it is necessary to study the effect of engine capacity and vehicle production year. These two factors have never been studied and can be used as material for taking preventive measures. It is hoped that this study will be taken into consideration to anticipate and reduce air emissions in Surabaya.

METHODS

Type of Research

Research is one effort made in solving an existing problem, so it can justified. This research used is descriptive quantitative method, which is not only providing a description, but also collecting quantitative data and getting a conclusion

Research Sites

Researchers took place in the city of Surabaya, Central Surabaya, Jl Sedap Malam (Surabaya city hall), West Surabaya Jl. Mayjen Sungkono, North Surabaya Jl. Indrapura (in front of the East Java DPRD), East Surabaya Jl. Kertajaya (in front of the Kertajaya Sports Hall), South Surabaya (in front of the Surabaya Zoo). We choose Surabaya as a research site because the city of Surabaya is the largest in East Java, which produces the largest

pollution for its heavy traffic.

Threshold of Motor Vehicle Emission

In this study it carried the emission test out based on standards set by the Indonesian government Environmental Ministerial Regulation No 05 of 2006 as shown in table 2 [16].

Table 2. Motor Vehicle Emission Threshold Category; M, N, and O

Category	Production year	Parameter			Test method
		Co (%)	HC (ppm)	Opacity (%HSU)	
Gasoline motor vehicle	< 2007	4.5	1200		
	≥ 2007	1.5	200		
Diesel motor vehicle)					
- Gw ≤ 3.5 ton	< 2010			70	Idle Free Acceleration
	≥ 2010			40	
- Gw > 3.5 ton	< 2010			70	
	≥ 2010			50	

Research Instruments

To get gas emission test data for both gasoline and diesel engines, the instruments described in Figure 1 and testing standards required.

Figure 1. Research instrument

Emission test of gasoline-engine vehicles has carried out based on SNI standards 19-17118.1-2005, using an exhaust gas analyzer instrument [17]. The test steps operated:

1. Starting and stabilizing the engine condition until it reaches a working temperature of + 80^{o}c;
2. Increasing the engine speed until it reaches 2100 rpm then hold for + 60 seconds and then returned to idle condition;
3. Inserting the probe in the tile pipe, wait for 20 seconds and then start the data retrieval process;
4. Processing the data retrieval with loading at lap 1500-5500 with range of 500;
5. Conducting the test, 2 times of each test and calculate the average of data;
6. Shutting down engines, exhaust gas analyzers, blowers, and other equipment;
7. Cleaning the test site.

Diesel-engine vehicle has tested for its emission testing which conducted based on SNI 19-17118.2-2005 using smoke opacity meter [18]. The test steps operated:

1. Starting and stabilizing the engine condition until it reaches a working temperature of + 80^{o}c;
2. Increasing the engine speed until it reaches 2,900 rpm then holding it for 60 seconds then turning it back to the idle position;
3. Inserting the probe in the tile pipe, waiting for 20 seconds and then processing the data retrieval;
4. Stepping on the gas pedal in maximum level as soon as possible until reaching the maximum engine speed;
5. Recording the opacity values; data collecting conducted in 3 times;
6. Turning off the engine, smoke opacity meter, and other equipment;
7. Cleaning the test site

RESULTS AND DISCUSSION

Surabaya is one of the metropolitan cities in Indonesia with a very dense population and transportation. Industrial activity in Surabaya is also high which can worsen the quality of air pollution. Total SO_2 emissions of 247.45 tonnes / year and NOx of 99.56 tonnes / year produced in the Karang Pilang Industrial area of Surabaya[19]. The largest pollutants in the air are particles having a diameter of 10 microns which are the most significant source of fossil fuels burning. According to WHO, 10 micron particle matter has been a carcinogen since 2013, as are sulfur dioxide and Nitrogen Dioxide [20]. Vehicles with a production year below 2007 play a role in increasing gas emissions[21]. Based on [22] research, most of the motorized vehicles for younger years over 2004 meet the threshold. Reducing emissions in the air is a very complex step and requires today's very sophisticated technology, so that companies and technicians working in machinery can develop to create friendly and reliable vehicles for long-distance travel. [3] We made efforts to reduce vehicle emissions, such the London Atmospheric Emisssion Inventory development. The development comprises 3 steps, conducting high-solution traffic data collection, analyzing world emission factors based on data [23], and allocating technology from the total fleet based on real traffic data [24].

Emission Test Results Based on Engine Capacity

The results of emission test of motor vehicles based on engine capacity, grouping presents which based on the volume of all the pistons in the internal's cylinder combustion engine expressed by using cubic centimeters (cc). It fails most vehicles in category of 1000 cc to pass the emission test, which are 65 units, while those who passed the emission test are 30 units. Unlike the 1000 cc, the other categories such as 1200 cc, 1300 cc, 1500 cc, 1800 cc and 2000 cc, most of them pass the emission test. In category of 1200 cc there are 5 units pass the emission test, no vehicle fails the tests. Then in category of 1300 cc there are 37 units pass the emission test, while it fails 33 units in emission test. Meanwhile in category of 1500 cc there are 115 units pass the test, and it fails 47 units. In category of 1800 cc there are 24 units pass the emission test, while 15 units do not pass the test. Then for the 2000 cc category, the number of vehicles that pass the emission test are 32 units, while it fail 10 units.

The 2300 cc category and above, do not pass the emission test. Category of 2300 cc has 13 units do not pass the test, while those who passed the emissions test are 5 units. In the category of 2500 cc, the number of vehicles that do not pass the emission test are 70 units of vehicles, while those which pass the emission test are 50 units. In the 2800 cc category, the number of vehicles that do not pass the emission test are 6 units of vehicles, while those which pass the emission test is 1 unit of vehicle. Then for the category of 3000 cc the number of vehicles that do not pass the emission test are 8 units, while those which pass the emission test are 4 units. Category of 6000 cc the number of vehicles that do not pass the emission test are 2 units, while those that pass the emission test are 2 units. Then for the 6800 cc category, the number of vehicles that do not pass the emission test is 1 unit, while those which pass the emission test is 1 unit of vehicle. I could see moregraphs of emission test results based on engine capacity in Figure 2.

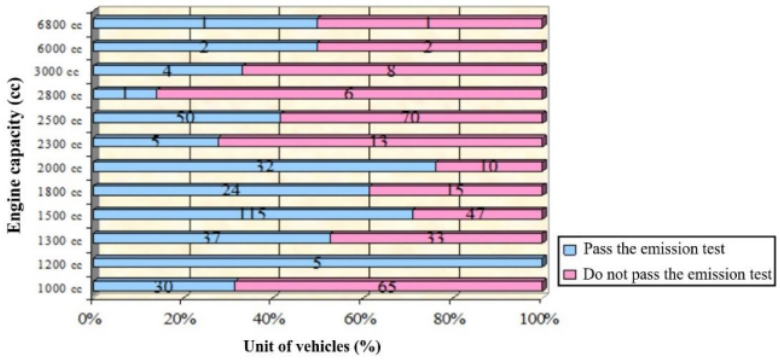

Figure 2. Emission test result based on engine capacity

This shows that the small engine capacity affects the emissions produced by the vehicle. When a large capacity engine requires a lot of power and influences the high energy use of fossil fuels. This condition causes the time

needed for combustion to be longer, increasing CO emissions [25]. However, this is not a dominant factor, machine maintenance and inspection can also contribute to reducing emissions [26].

Emission Test Results by Vehicle Production Year

Figure 3 shows that for the production year of above 1995, the number of vehicles that pass and do not pass is almost balanced, which states that 78 units of vehicles passed the emission test while those that do not pass the emissions test of 77 units of vehicles. Then for the production year of between 1996 and 2006, the vehicle which pass the emission test large which is 215 units, while those that do not pass the emission test are 190 units. Meanwhile, for the production year of 2007 and below, vehicles pass the emission test, which is amount of 12 units while those that do not pass the emission test are 3 units.

The overall analysis shows that vehicles with a production year below 2007 have failed the emission test [27]. This is caused by the wear and tear of the engine components and a lot of dirt stuck to the air filter. Young vehicle age can reduce emissions released into the air. However, that does not mean that young vehicles are not likely to pollute the air. This, if excessive use and irregular maintenance, can also produce air emissions. Based on a case study conducted by [26] (they found it that there are three factors that influence exhaust emissions, vehicle age, vehicle maintenance, and engine capacity by having multiple linear relationships.

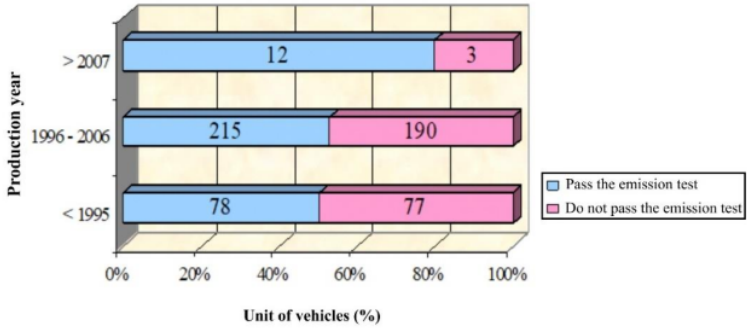

Figure 3. Emission test results based on engine capacity

The form of government attention to efforts to reduce air pollution caused by the transportation sector by following the United Nations Framework Convention on Climate Change (UNFCCC) in Bali. The result of the meeting, the government made a policy by increasing the quality of fuel in accordance with Euro standards and revitalizing the use of CNG and improving fuel quality [28]. Meanwhile, in Surabaya, which has gas emission problems above the tolerance threshold for human health, it is also taking preventive measures[29]. Surabaya since 2000 has been very concerned about problems related to air pollution. This is stated in the 2000-2005 Surabaya City Strategic Plan to carry out a program of direct handling of emission pollution sources[30].

The introduction and implementation of Surabaya government programs in schools and campuses in increasing awareness and participation to jointly reduce exhaust gas emissions[31]. The Car Free day program has been implemented in several points in Surabaya, such as Jl. Darmo and Jl. H.Ir. Soekarno[32]. The Surabaya government is also collaborating with campuses to control air pollution[33]. According to [34] there are 2 ways to deal with pollution pollution in Surabaya, namely: 1. With the Law on Environmental Health, air pollution can be controlled in an effort to prevent and / or mitigate the impact of air pollution; and 2. The government disseminates government regulations and laws regulating the environment in order to raise awareness among the public about the importance of environmental conservation. To this day, the Surabaya government continues to pay attention to reducing air pollution by developing and improving existing programs, namely 'Surabaya Green and Clean' initiated by the mayor of Surabaya.

CONCLUSION

Based on the data got from the results of testing, analysis, and discussion, some conclusions can be drawn: (1) Based on engine capacity, vehicles with a capacity below 2000cc have the highest number of units that pass the emission test. Meanwhile, engines with engine capacities above 2000 cc to 6800 cc have the highest number of

failed test units; and (2) based on the year of production, the years 1995 and above have a balance between passing and failing. Meanwhile, the 1996 to 2006 production years had the highest number of units that passed the emission test, as well as the 2007 and lower production years, which also had the highest number of units passing the emission test. Preventive actions taken by the Government to keep the environment clean and green in an effort to reduce air pollution include the Surabaya Green and Clean program.

REFERENCES

[1] A. T. Hoang, Q. V. Tran, A. R. M. S. Al-Tawaha, V. V. Pham, and X. P. Nguyen, "Comparative analysis on performance and emission characteristics of an in-Vietnam popular 4-stroke motorcycle engine running on biogasoline and mineral gasoline," Renew. Energy Focus, vol. 28, no. 00, pp. 47–55, 2019, doi: 10.1016/j.ref.2018.11.001.

[2] R. Sasikumar and G. Sankaranarayanan, "A study of emission & performance characteristics of diesel engine run by dual fuel (bio diesel + acetylene gas)," J. Mech. Eng. Res. Dev., vol. 42, no. 1, pp. 104–108, 2019, doi: 10.26480/jmerd.01.2019.104.108.

[3] T. O. Akinyemi and O. J. Ramonu, "Mitigation of CO2 Emissions in Transportation and Industrial Processes using Renewable Energy Technologies," Eur. J. Eng. Res. Sci., vol. 4, no. 5, pp. 58–66, 2019, doi: 10.24018/ejers.2019.4.5.1118.

[4] D. C. Carslaw, S. D. Beevers, J. E. Tate, E. J. Westmoreland, and M. L. Williams, "Recent evidence concerning higher NOx emissions from passenger cars and light duty vehicles," Atmos. Environ., vol. 45, no. 39, pp. 7053–7063, 2011, doi: 10.1016/j.atmosenv.2011.09.063.

[5] W. M. Sweileh, S. W. Al-Jabi, S. H. Zyoud, and A. F. Sawalha, "Outdoor air pollution and respiratory health: A bibliometric analysis of publications in peer-reviewed journals (1900 - 2017)," Multidiscip. Respir. Med., vol. 13, no. 1, pp. 1–12, 2018, doi: 10.1186/s40248-018-0128-5.

[6] A. Ghorani-Azam, B. Riahi-Zanjani, and M. Balali-Mood, "Effects of air pollution on human health and practical measures for prevention in Iran," J. Res. Med. Sci., vol. 21, no. 5, 2016, doi: 10.4103/1735-1995.189646.

[7] J. Jakubiak-Lasocka, J. Lasocki, R. Siekmeier, and Z. Chłopek, "Impact of Traffic-Related air pollution on health," Adv. Exp. Med. Biol., vol. 834, no. October 2014, pp. 21–29, 2014, doi: 10.1007/5584_2014_14.

[8] M. P. Walsh, "PM2.5: global progress in controlling the motor vehicle contribution," Front. Environ. Sci. Eng., vol. 8, no. 1, pp. 1–17, 2014, doi: 10.1007/s11783-014-0634-4.

[9] A. R. Pratama, J. Arliansyah, and M. Agustien, "Analysis of Air Pollution due to Vehicle Exhaust Emissions on the Road Networks of Beringin Janggut Area," J. Phys. Conf. Ser., vol. 1198, no. 8, 2019, doi: 10.1088/1742-6596/1198/8/082030.

[10] J. Wang et al., "Vehicle emission and atmospheric pollution in China: problems, progress, and prospects," PeerJ, vol. 7, no. 41571162, p. e6932, 2019, doi: 10.7717/peerj.6932.

[11] H. Wang et al., "Trade-driven relocation of air pollution and health impacts in China," Nat. Commun., vol. 8, no. 1, 2017, doi: 10.1038/s41467-017-00918-5.

[12] S. A. Rajper, S. Ullah, and Z. Li, "Exposure to air pollution and self-reported effects on Chinese students: A case study of 13 megacities," PLoS One, vol. 13, no. 3, pp. 1–21, 2018, doi: 10.1371/journal.pone.0194364.

[13] I. Manisalidis, E. Stavropoulou, A. Stavropoulos, and E. Bezirtzoglou, "Environmental and Health Impacts of Air Pollution: A Review," Front. Public Heal., vol. 8, no. February, pp. 1–13, 2020, doi: 10.3389/fpubh.2020.00014.

[14] B. Haryanto, "Climate Change and Urban Air Pollution Health Impacts in Indonesia," Springer Clim., pp. 215–239, 2018, doi: 10.1007/978-3-319-61346-8_14.

[15] I. Agustine, H. Yulinawati, D. Gunawan, and E. Suswantoro, "Potential impact of particulate matter less than 10 micron (PM10) to ambient air quality of Jakarta and Palembang," IOP Conf. Ser. Earth Environ. Sci., vol. 106, no. 1, 2018, doi: 10.1088/1755-1315/106/1/012057.

[16] PERMENLH5, "Ambang Batas Emisi Gas Buang Kendaraan Bermotor Lama," p. 62, 2006.

[17] S. N. Indonesia and B. S. Nasional, "Pengukuran konsumsi bahan bakar kendaraan," 2010.

[18] SAE Heavy-Duty In-Use Emission Standards Committee, "SAE J1667 Recommended Practice," Snap-Acceleration Smoke Test Proced. HeavyDuty Diesel Powered Veh., no. 1996–02, 1996.

[19] R. E. Handriyono and M. N. Kusuma, "Estimasi beban emisi so 2 dan no," no. x, pp. 19–24.

[20] WHO, Health effects of transport-related air pollution. 2544.

[21] R. Iskandar, Sutiman, Sukoco, Z. Arifin, N. F. Adkha, and J. N. Rohman, "The quality of vehicle exhaust gas emission in Sleman, Indonesia in 2019," J. Phys. Conf. Ser., vol. 1456, no. 1, 2020, doi: 10.1088/1742-6596/1456/1/012030.

[22] J. Winarno, "Studi Emisi Gas Buang Kendaraan Bermesin Bensin Pada Berbagai Merk Kendaraan Dan Tahun Pembuatan," J. Tek., no. 55, pp. 1–9, 2005, [Online]. Available: http://jurnalteknik.janabadra.ac.id/wp-content/uploads/2015/01/6-Joko-Winarno-April-2014.pdf.

[23] S. Zhang et al., "Historic and future trends of vehicle emissions in Beijing, 1998-2020: A policy assessment for the most stringent vehicle emission control program in China," Atmos. Environ., vol. 89, no. 2014, pp. 216–229, 2014, doi: 10.1016/j.atmosenv.2013.12.002.

[24] S. Vallamsundar and J. Lin, "MOVES and AERMOD used for PM 2.5 conformity hot spot air quality modeling," Transp. Res. Rec., no. 2270, pp. 39–48, 2012, doi: 10.3141/2270-06.

[25] N. A. Ngoc, N. X. Khoa, and C. D. Hung, "The effects of combustion duration on engine emission characteristics," J. Mech. Eng. Res. Dev., vol. 43, no. 1, pp. 272–277, 2020.

[26] D. Muziansyah, R. Sulistyorini, and S. Sebayang, "Model Emisi Gas Buangan Kendaraan Bermotor Akibat Aktivitas Transportasi (Studi Kasus : Terminal Pasar Bawah Ramayana Koita Bandar Lampung)," Jrsdd, vol. 3, no. 1, pp. 57–70, 2015.

[27] Z. Arifin, Sutiman, and M. Solikin, "Assessment of the air quality monitoring system in Sleman district by vehicle emission measurement," J. Phys. Conf. Ser., vol. 1446, no. 1, pp. 0–5, 2020, doi: 10.1088/1742-6596/1446/1/012036.

[28] [DNPI] Dewan Nasional Perubahan Iklim, "Peluang dan Kebijakan Pengurangan Emisi Sektor Transportasi," 2010.

[29] H. Gunawan and G. S. Budi, "Kajian Emisi Kendaraan di Persimpangan Surabaya Tengah dan Timur serta Potensi Pengaruh terhadap Kesehatan Lingkungan Setempat," J. Wil. dan Lingkung., vol. 5, no. 2, p. 113, 2017, doi: 10.14710/jwl.5.2.113-124.

[30] S. Devica, "Kebijakan Sistem Transportasi Kota Surabaya dalam Rangka Pengendalian Pencemaran Udara Area Transportasi," Pengaruh Harga Disk. Dan Persepsi Prod. Terhadap Nilai Belanja Serta Perilaku Pembelian Konsum., vol. 7, no. 9, pp. 27–44, 2015.

[31] Warju, S. P. Harto, Soenarto, and M. D. Hartmann, "Evaluating the Implementation of Green School (Adiwiyata) Program: Evidence from Indonesia," Int. J. Environ. Sci. Educ., vol. 12, no. 6, pp. 1483–1501, 2017, [Online]. Available: http://www.ijese.net/makale/1914.

[32] A. Syafei, "Kajian Penurunan Emisi CO2, CO, PM10 pada Program Car Free Day di Jalan Utama Kota Surabaya," no. June 2016, 2017.

[33] Irawan Denny, "Collaborative Governance (Studi Deskriptif Proses Pemerintahan Kolaboratif Dalam Pengendalian Pencemaran Udara di Kota Surabaya)," IR-Perpustakaan Univ. Airlangga, vol. 5, pp. 1–12, 2017.

[34] Y. Yusrianti, "Studi Literatur tentang Pencemaran Udara Akibat Aktivitas Kendaraan Bermotor di Jalan Kota Surabaya," Al-Ard J. Tek. Lingkung., vol. 1, no. 1, pp. 11–20, 2015, doi: 10.29080/alard.v1i1.29.

turnitin 17

ORIGINALITY REPORT

9%	6%	6%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	ijisrt.com Internet Source	2%
2	journals.plos.org Internet Source	1%
3	link.springer.com Internet Source	1%
4	Garikai Makuyana, Nicholas M. Odhiambo. "Public investment versus private investment: The case of Zambia", Journal of Governance and Regulation, 2014 Publication	1%
5	jimex.co.jp Internet Source	1%
6	I Agustine, H Yulinawati, D Gunawan, E Suswantoro. " Potential impact of particulate matter less than 10 micron (PM) to ambient air quality of Jakarta and Palembang ", IOP Conference Series: Earth and Environmental Science, 2018 Publication	1%

7	Shaojun Zhang, Ye Wu, Ruikun Huang, Han Yan, Yali Zheng, Jiming Hao. "High-resolution simulation of link-level vehicle emissions and concentrations for air pollutants in a traffic-populated East Asian city", Copernicus GmbH, 2016 Publication	1 %
8	es.scribd.com Internet Source	1 %
9	www.coursehero.com Internet Source	1 %

Exclude quotes	On	Exclude matches	< 20 words
Exclude bibliography	On		