Increased Efficiency Dust Catcher Equipment Manufacturing Method of Fogging in Andesite

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Increased Efficiency Dust Catcher Equipment Manufacturing Method of Fogging in Andesite

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Abstract. The purpose of this study is to make efforts to increase the efficiency particle of dustextraction tool fogging method in andesite stone processing industry PT. Semesta Indonesia Alam Raya. This industrial location in the village Hargomulyo, Kokap, Kulon Progo, D.I.Yogyakarta. The background of this study is the amount particle of dustgenerated in the processing industry of andesite and scattered with the wind so dangerous to public health. Therefore, it is necessary to control the spread particle of dustfrom the appliance stone crusher with the flow of exhaust gases. This study was conducted in the laboratory and simulation using dust extraction equipment fogging method. Optimized variable is the waterer to the tool, while others are considered fixed quantities.replications, then the results are averaged. After doing study, the study data obtained that the optimum conditions mass particle of dustarrested by the mist that is the distance between the waterer to the tool 2 m with an average particle of dust that can be arrested by the mist that is 13675.00 g and an average efficiency value of 73, 87%. Equation stating the relationship between variables within the waterer to the tool with the dust arrested by the masses mist is $Y = -87{,}083.X^3 + 514.82\ X^2 - 3{,}0952X + 11056$ with percent error 0.20%, while the equation of a line that states the relationship between variable distance waterer to the tool with the efficiency that is $Y = -0{,}9408X^3 + 6{,}8496X^2 - 8{,}8895X + 60.892$ with percent average error of 0.09%.

PRELIMINARY

Our country is carrying out development in all fields, especially in the field of infrastructure. One of the materials used in infrastructure construction activities are split. Split made from raw materials andesite reduced in size. The manufacturing process of split from andesite stone, will be the dust emission. It is almost similary with the production process of cement that will increase the emission of dust [7]. According to Martin [8], the one that make to effect air movement and the dustiness grain is emissions of dust. This business opportunity is arrested by PT. Indokarya Mitra Sejahtera to produce split. Industrial location in the area of Parry Village 3, Village Hargomulyo, Kokap, Kulon Progo, Yogyakarta. According Fityatur [4] the existence of an industry will have an effect on the lives of people around the location of industries such as public opinion and public health. Likewise, the existence of the activities of PT. Indokarya Mitra Sejahtera also caused some effect, both positive and negative.

On the other hand, the activities of PT. Indokarya Mitra Sejahtera also cause some negative effect. One of them is the appearance of air pollution in particular are easily identifiable is the deployment particle of dust waste. According to Caffrey [3], one of the major contributors in global warming up to 6% in the world and climate change is emissions from cement or other very small particle. Emissions from cement manufacturing are one of The major contributors in global warming up to 6% in the world and climate change is emissions from cement manufacturing [5]. Dust waste is spread both within the industry and in the surrounding neighborhood. According Saraswati [10] The development of this sector will encourage urbanization and threaten the environment through pollution of air, soil, and water caused. The appearance particle of dust from the production process of a split in the PT. Indokarya Mitra Sejahtera can be dispersed into the environment around industrial sites. In effect, then the

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environment will be exposed to dust. Exposure to dust is inhaled dust particles public both outdoors and indoors. Exposure to this dust can interfere with the respiratory community outside the home [12]. Air pollution is also responsible for the occurrence of the greenhouse effect, climate change, acid rain, and others is a form of a result of air pollution. The one of major challenges of our time and this item make to contribute for stressing to the environment dan societies is climate change [1]. The dust particles size from 0.001 to 0.25 m/s have the relatife low settling velocity [2]. According to Zimwara et al [13], flexible pulse jet filters, electrostatic precipitators, and wet scrubbers are the various strategy for controlling air pollution. According Otaru et al [9], plants typically use hardware controllers dust in the form of Bag Filters (BF) Electrostatic Precipitator (ESP) and Bag Filters (BF), while according to Khattak, et al (2013) [6], there are five types of design engineering namely particulate control the gravitational deposition chamber controls particles, mechanical collector, wet particulate scrubber, electrostatic precipitate and filter cloth. In the fogging method of dust extraction tool, the media dust catcher is in the form of mist). The various resources, technology, and strategy will reduce the gas and dust emissions and control the issues environment [11].

METHOD

Study sites

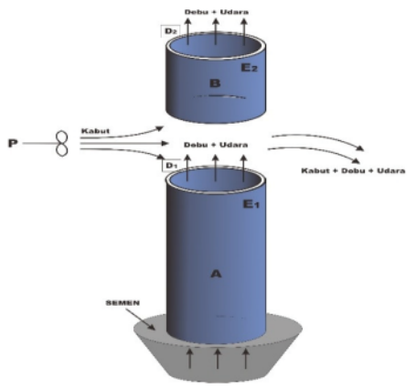
The study location in the village Hargomulyo, Kokap, Kulon Progo, Yogyakarta, namely the mining location of andesite and andesite stone processing industry PT. Indokarya Mitra Sejahtera.

Material and equipment

This study using materials and tools such as water, dust, nozzles, tubes, generating tools fog, and dust gauges.
2.3. The optimization of operating conditions of equipment at a variable distance between the waterer to the tools

Equipment dust catcher fogging method

In this study, the value of temperature, humidity, and air quality changes is an influential factor in the formation of fog. Cement dust extraction equipment misting method can be seen in Figure 1.



Information:
A: Pipes AE: exhauster
B: Pipe BP: Tolkit
D: Dust Collector

FIGURE 1. The circuit schematic tool on the fogging method
(Source: the author, 2020)

Dust catcher laboratory scale test

Material and dust extraction tool fogging method will be tested by a laboratory scale. As the independent variable is the distance between the waterer to the tool (L), while as a fixed variable is the diameter of the nozzle (Dn = 1.50 mm), airspeed in column (Vu = 430 m per min), the distances between the top end of the chimney with the gauge (Z = 100 cm), and the velocity of the water going into the waterer (Va = 110 ml / min).

Data Analysis

The granules are very small mist managed to capture very fine dust. Dust capture rate can be determined by ANOVA analysis with an error rate of less than 5% percent.
The percentage reduction in dust emissions can be calculated as the level of efficiency that is as follows:

$$\% \text{ Reduction (efficiency)} = 100\% - 100 \times \frac{\text{avg. dust caught fog}}{\text{avg. before fogging}}$$

Efficiency indicates the level of performance of these tools are calculated based on the amount particle of dustarrested by the mist.

RESULTS AND DISCUSSION

The working efficiency of cement dust extraction tool misting method can be calculated and shown in Tables 1 and 2.

TABLE 1. Dust Caught by fog on the Tools Dust Catcher fogging method with Variable Distance Sprayer against Tool (L)

No.	Distance sprayer to the tool (m)	The measurement sequence to	Dust mass (g)	
			before misting	before misting
1	3.5	1	19800	8180
		2	19 760	8270
		3	19600	8240
2	3.0	1	19270	7100
		2	19 425	7050
		3	19025	7080
3	2.5	1	18 760	5523
		2	18 915	5530
		3	18 880	5520
4	2.0	1	18650	4970
		2	18 540	4870
		3	18350	4675
5	1.5	1	18600	5525
		2	18 545	5510
		3	18650	5570

Source: Sports Data, 2020

TABLE 2. The dust mass average Caught by fog and working efficiency Dust Catcher Equipment fogging method average with Variable Distance Sprayer to the tool (L)

No.	Distance sprayer to the tool (m)	The measurement sequence to	The dust mass is caught fog (g)	The average mass of dust caught in the fog (g)	Efficiency (%)	Average efficiency (%)
1	3.5	1	11620	11490.00	58.69	
		2	11 490		58.15	58.27
		3	11360		57.96	
2	3.0	1	12170	12013.33	63.16	
		2	12375		63.71	63.22
		3	11945		62.79	

No.	Distance sprayer to the tool (m)	The measurement sequence to	The dust mass is caught fog (g)	The average mass of dust caught in the fog (g)	Efficiency (%)	Average efficiency (%)
3	2.5	1	13237	13327.33	70.56	
		2	13 385		70.76	70.69
		3	13360		70.76	
4	2.0	1	13 680	13675.00	73.35	
		2	13670		73.73	73.87
		3	13675		74.52	
5	1.5	1	13075	13063.33	70.30	
		2	13035		70.29	70.24
		3	13080		70.13	

Source: Sports Data, 2020

Based on experimental data results of variable distance sprayer to the tool it can be graphed to look at the relationship between, it can be graphed to see the relationship between the tendency of the effectiveness of catching dust by fog.

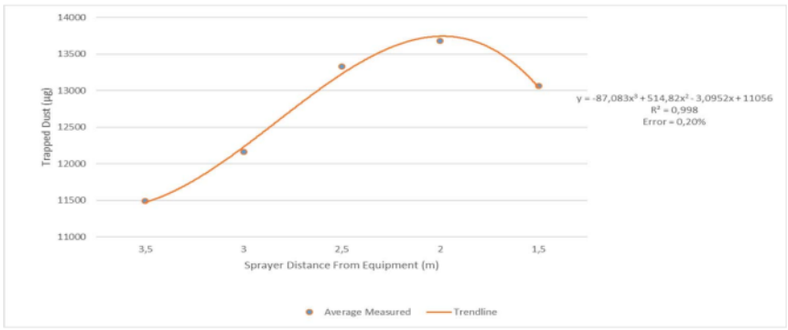


FIGURE 2. The relationship between the distance waterer to the tool with the dust caught in the fog

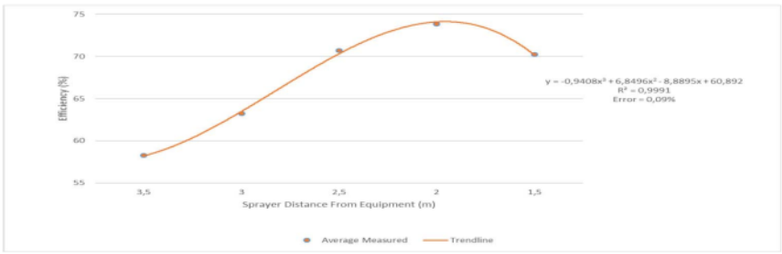


FIGURE 3. The relationship between the distance waterer to the tool with the efficiency of the dust catcher tool fogging method

Based on the graph above it can be seen that the shorter the distance sprayer to the tool, the more the mass of dust that can be captured by the mist generated in the dust catcher tool fogging method. Optimal conditions occur at a distance of 2.0 m sprayer to the tools with average dust mass that can be caught by the mist that is13675.00 g but at a distance sprayer to a small tool which is 1.5 m, it is the mass of the dust is caught will be less. This condition will affect the efficiency of the dust extraction tool fogging method. The shorter the distance sprayer to the tool, the higher the efficiency of dust extraction tool fogging method. Optimal conditions occur at a distance of 2 m sprayer to the tool with the efficiency of 73.87%, but at a distance sprayer to a smaller appliance which is 1.5 m, it is the efficiency of the tool will be decreased.

While analysis of the quality of sprayed mist sprayer associated with a variable distance to the instrument are as follows:

a. 3.5 m : Mist will not be sprayed to the tool so that no dust catcher catches dust in the dust catcher. Heavy dust at the bottom and measurement measurements will be relatively similar so that the weight difference obtained will be very small.

b. 3.0 m : Mist will not be sprayed to the tool so that no dust catcher catches dust in the dust catcher. Heavy dust on the bottom and measurement measurements will be relatively similar so that the difference in weight obtained is very small.

c. 2,5 m : Fog that is not sprayed completely into the appliance so that the dust extraction process is not optimal. Heavy dust on the bottom of the measurement and measurement is different but a lot to allow the difference in weight obtained will be small.

d. 2.0 mm : Mist is sprayed according to dust extraction equipment which produces dust-retaining particles in the optimal dust extraction tool. Thick dust at the bottom and measurement measurements will be very much different or can be not the same, so that the difference in weight obtained is also large.

e. 1,5 m : The mist to be sprayed does not reach the particles so it will be distributed to the maximum dust so that less dust will be captured

Based on the above analysis, the optimal conditions for the variable sprayer distance to the 5 kinds of tools occur at 2.0 m with an average dust mass that can be caught by the fog of 13675.00 µg and an average efficiency value of 73.87%.

CONCLUSION

Optimum operating conditions in the dust extraction method occur at the size of the sprayer distance to the tool at 2.0 m with an average dust mass that can be caught by the mist of 13675 and an average efficiency value of 73.87%. Under these operating conditions, the fogging method of dust picking can capture fine dust optimally. This can reduce the spread of dust to the environment so that it can improve air quality.

ACKNOWLEDGMENTS

The fogging method used in this dust catcher is the latest environmentally friendly innovation tool that can be developed from both the operating variables and the equipment to get better product efficiency results.

REFERENCES

[1] Adedeji, O., Reuben, O., Olatoye, O.,2014, Global Climate Change, *Journal of Geoscience and Environment Protection*, 2, 114-122.

[2] Brabec, D.L., Maghirang, R.G., Casada, M.E., 2004, Effectiveness of a high-pressure water-fogging system in controlling dust emissions at grain receiving, *Trans, ASAE*, 47 (2), 505-511.

[3] Caffrey, Mc., 2002, Climate change and the cement industry. GCL: Special issue environment, 22 May 2002, London, United Kingdom.

[4] Fityatur, R., 2015, Dampak Sosial-Ekonomi Pabrik Semen Puger Di Kecamatan Puger Kabupaten Jember, Jember.

[5] Grudnig, P.W., and Wang, Z., 2006, Influence of air humidity on the suppression of fugitive dust by using a water-spraying system, China Paticuology, 4 (5), 229-233.

[6] Khattak, Z., Ahmad, J., Ali, H.M., and Shah, S., 2013, Contemporary dust control techniques in cement industry, Electrostatic Precipitator - a case study, World Applied Sciences Journal 22 (2) pp.202-209, Pakistan.

[7] Kinsey, J. S., 1987, Lime and cement industry particulate emissions : source category report *Cement Industry, Air and Energy Engineering Research Laboratory Research Triangle Park*. Volume II.

[8] Martin, C.M., 1981, Characterization of grain dust properties, *Trans, ASAE*, 24 (3), 738-742.
[9] Otaru, A.J., Odigure, J.O., Okafor, J.O., and Abdulkareem, A.S., 2013, Investigation into particulate pollutant concentration from a cement plant: a case study of Obajana Cement Plc, Lokoja, Nigeria, IQSR Journal of Environmental Science, Toxicology, and Food Technology (IQSR-JESTFT), Volume 3, Issue 2, pp.89-96, Nigeria.
[10] Saraswati, , 2000, Penerapan RKL dan RPL Pada Industri Semen (Studi Kasus PT. Semen Gresik (Persero) Tbk Pabrik Tuban I, II, III, Jawa Timur, Tuban.
[11] Sjølie, H. K., 2012, Reducing greenhouse gas emissions from households and industry by the use of charcoal from sawmill residues in Tanzania, *Journal of Cleaner Production, 27*(0), 109-117.
[12] Thaib, Y.P. dkk, 2014, Hubungan Antara Paparan Debu Dengan Kejadian Gangguan Saluran Pernafasan Pada Masyarakat Kelurahan Kairagi Satu Lingkungan 3 Kota Manado, Universitas Sam Ratulangi, Manado.
[13] Zimwara, D., Mugwagwa, L., and Chikowore, T.R., 2012, Air pollution control techniques for the cement manufacturing industry: a case study for Zimbabwe Town South Africa CIE42 Proceedings 16-18 July 2012 37-1 until 37-13.

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