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Existence of Plastic Flakes Industries as Samarinda's Polluted Solutions

Achmad Rodzali[1], H. Mat Juri[2], Sudarlan[3]

[1, 2, 3]Lecturer of Politeknik Negeri Samarinda, Kalimantan Timur, Indonesia

Abstract: ***This research will answer whether the Samarinda plastic's flakes industries able to reduce amount of plastic waste meaningfully. Plastic waste become one of the source of pollution at Samarinda city. Data was collected from 21 industries at Samarinda to ensure linkage and impacted between the amount of plastic waste and production of flakes. A simple linear of correlation and regression method is used to obtain the answer. Samarinda plastic's shreds industries is one way to reduce plastic waste. But the price of plastic's flakes sometimes changed unpredictably and industry's located has to move away suddenly, due to the insistence of the inhabitants around. Those obstacles are considered to interfere with the smoothness of plastic's flakes products. Amount of plastic waste did not always linear with plastic's flakes products. Its result of research of relevance between the amount of plastic waste and flakes product in Samarinda is 60%, while average flakes production was 402,785 tons for each industry at 2018. Effect of amount of plastic waste toward flakes production was around 36%. The remaining 64% is due to other factors. Those factors are probably such as; sites of industry, raw materials supply, and prices that sometimes fall unexpectedly.***

Keywords: correlation, flakes product, plastic waste

1. Introduction

Samarinda is the capital of the province of East Kalimantan. It has areal about 718.23 km2. In 2015 it has inhabitants was 812.597 people that within 236,778 households [1]. Those number of households have potential waste products in affect to decline quality of the environment.

Increasing in amount of waste does not balanced with environment management very well. It will have destructed and make environment will be polluted [2]. Number of litter in city greater than rural. This matter is due to numerous people in city with their style and high living standards. As result the wasted like plastic, packaging, iron, the rest of electronics and other inorganic waste find in city easily.

The Government's able to manage waste approximately 40.09% in urban areas and 1.02% in rural areas [2]. The plastic waste is more than 1,871.45 m3 per day in Samarinda. It means 56,143.50 m3 of plastic's garbage for 1 months.

Plastics are difficult material to break down (non-biodegradable) compared to other garbage.

According to sanitation and gardening office (DKP) number of waste of Samarinda was 187,41 tons daily and equivalent to 5,622.30 tons per month.

Plastic waste that were disposed by every household around 9.3% of the total waste weight [3]. Those plastic waste were come from daily necessities, households, offices and shops. Amount of waste will grow as same as its population.

Plastic recycling business were established by a group. This groups have a share in not only an effort to save the environment, but also rise up economy aspects. This groups are people who are collect used goods in their daily. The goods were collected by the scrapers came from certain types of waste such as iron, paper, plastic and others. An encourage makes they do this work is earning money to overcome their family necessities.

Plastic flakes are processing of a waste such as; bottles, glasses and other plastic's material to be crushed into small pieces of clean plastic. This type of product as raw materials to make pellets or plastic seeds before they will have formed into various kinds of plastics products.

Primary issue of this research whether amount of plastic waste in Samarinda proportional to the number of plastic flakes product. Because there are many obstacles when the producer run their business. The obstacles such as; price of plastic flakes often changed unpredictably, uncertain place to run production, because the complaints surrounding communities who feel disturbed their environment. From those reasons certainty of sustainable of product plastic flakes will be disrupted, although used plastic materials are available.

This research is expected to recognize plastic's waste in Samarinda. And how they were recycled. So it makes awareness for publics to reduce use goods that made from plastic. For these it will be expected to be the basis of policy making or model for the city government in the management of municipal solid waste.

Based on the description above, the question for this research whether there a positive influence of amount of plastic waste with the quantity of plastic shreds production in Samarindacity?

Plastic's waste was found in drainages around roads, like Juanda, Antasari, M. Yamin and Ahmad Yani on March 2018 by Kantor Bina MargaSamarinda (Samarinda Highways Office). Plastic waste also pollute around the city park environment, destructed plants and courtyards of Samarinda city park. (Darmawan 2018). According to the Samarinda Environment Agency (2016) the amount of plastic waste reached 366.02 m3 volume or 9.68% of all of Samarinda's Waste.

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For those description above, although plastic waste has been produced to be plastic flakes, but they still filled the city environment. Presence of craftsmen of plastic flakesdid not merely to reducedplastic waste at Samarinda.

2. Theoretical Basis

Some types of plastics were generally classified as numbers 1 to 7. Many plastic flakes of Samarinda were produced from PP, PET and HDPE. Plastic type of PP is a plastic material related to food and drink storage. Example; baby drinking bottles. PET is a clear plastic material for disposable beverage packaging. For example, bottles or glasses of mineral water. HDPE type plastic is mostly white plastic material and is recommended to be used once. Examples: shampoo bottles [16].

If plastics waste were left on the ground, it would become a pollutant and if burned it would increase level of greenhouse gases at the atmosphere. Availability of raw materials in the form of plastic waste and sum of plastic flakes produced would be analyzed through Pearson correlation [4], as follows:

$$r = \frac{S_{XY}}{\sqrt{S_X S_Y}} = \frac{Cov.(X,Y)}{[Var.X\,Var.Y]^{1/2}} \quad [9]$$

However, as a first step it was necessary to pay attention to the simplification of the data to be observed easily. So it needed to be arranged in the form of absolute and categorical frequency distributions [4]. Formula of class structure as written by H.A Sturgess was K = 1 + 3,322 log n [9]. To define of value average between variable linkage x (the amount of plastic waste) and the variable y (product flakes) was used average deviation formulas;

$$AD = \sqrt{\frac{(D-\bar{D})^2}{n-1}} \quad [14]$$

To determine how much influence was determined by coefficient r2, where it was a comparison between sum square of regression (SSR) and total sum of square (SST) [14]. Dajan says r2 was the relationship between coefficients of influence and linkages with formulas;

$r^2 = b.b'$, where was

$$b' = \frac{n\sum x_i y_i - \sum x_i \sum yi}{\sum y_i^2 - (\sum y_i)^2} = \frac{S_{XYi}}{S_{Yi}^2}. \text{ Whereas;}$$

$$b = \frac{S_{XYi}}{S_{Xi}^2} \quad [9].$$

Through the Act number 18 of 2008 concerning waste management, there were articles that were sufficient enough so that recycling activities can took place as a solution to overcome pollution caused by plastics waste in Samarinda. The articles relating to the issue of plastics garbage were; articles 20, 25, 28 and so on.

3. Methodology

Plastic's data were collected randomly by POLNES accounting students when it was statistical assignments. They were collected from various sub districts at Samarinda. Plastic shredding was carried out by the industries. Most of raw material made of plastic waste that the types PP, PET and HDPE. PET or PETE (Polyethylene Terephthalate) type of these plastic was labeled with the number 01 in the triangle shape. This raw material is mostly obtained from mineral water packaging waste found in Samarinda. HDPE (High Density Polyethylene) labeled number 02 in triangle shape . This type of plastic waste in Samarinda is often found in the form of oil bottles. PP (Polypropylene) labeled number 05 in a triangle shape, this types were mostly formed into cups [13].

After plastics waste was collected by scavengers and collectors. And then stages how they were recycled as written by Sharp New Technology. [12]

Main role of this industrial activities was scavengers and collectors. They interacted in determining price of used plastic waste. Collectors collected used plastic from scavengers as suppliers of Samarinda's plastic raw material industries.

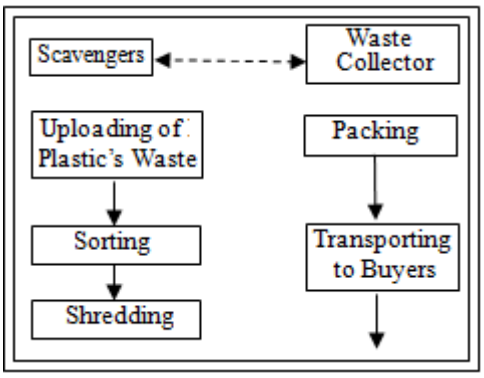


Figure 1: Samarinda Plastic Flakes Processing

After plastic waste were unloaded stage from a truck, they were sorted to make sure thickness and sharpness the blade that would be installed on the machine. Sorting was done to separated results of flakes as well. Samarinda's flakes in are generally known as clear, white, blue, and green flakes as well as mix. After grinded or crushed processing, the flakes were washed. Finally, packaging stage is done when the flakes were wet conditions. Nevertheless, there are also industries that were drying them before their product were packaged into sacks and was given them codes such as PP, PET, HDPE and so on.

Delivery of flakes products did not send spontaneously to buyers. Because buyers were beyond of Kalimantan and delivery cost was not cheap, so Samarinda's flakes producer shared to payed it. These Plastic flakes would be made plastic's pellet by industries in Surabaya, Java island. From this product they would be made various of house hold appliances.

4. Discussion

In order to get the above description, the authors obtained data collected from 21's of plastic's flakes manufacturers for 1 year in Samarinda.

The following graph explained between sum of plastic waste and production of flakes as figure 2 below;

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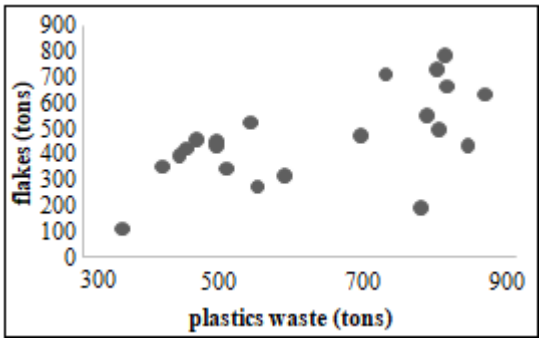


Figure 1: Sum of Plastic's Flakes and Waste in Samarinda
Source: data processed.

As a graph above points extend upward right, as revealed by Irianto (2006: 134). But the point to the right tended to widen or scatter. This showed that increased in plastic waste was not linear with the increase in production as shown in Table 1.

Table 1: Samarinda Plastic Waste Frequency Distrbution2018

Class	Interval (TON) X_i	Frequency	Class Mark
1	355,61 - 456,47	4	406,04
2	456,49 - 557,35	6	506,92
3	557,37 - 658,23	1	607,8
4	658,25 - 759,11	2	708,68
5	759,13 - 859,99	8	809,56
	Total	21	

Source: data processed

As table.1 explained that plastic waste available in Samarindawas around 809.56 tons during 2018 with a population of around 812,597 people. Average of plastic waste in 2018 taken as production material by each Samarinda industry was around 627.02 tons. While average of plastic's flakes production was around 402,785 tons as shown in Table 2.

Table 2: Samarinda Flakes Production Frequency Distribution.

Class	Interval (TON) Y_i	Frequency	Class Mark
1	116,04-420,61	7	268,325
2	220,62-525,19	7	372,905
3	325,20 -629,77	2	477,485
4	429,78-734,35	4	582,065
5	534,36-838,93	1	686,645
	Total	21	

Source: data processed

From table above Samarinda's majority of plastic flakes industries produce between 268,325 to 37,905 tons in 2018. From the table 1 and 2 the frequency values in each class appear disproportionate. This means that supply of plastic waste did not match toward by sum flakes production in Samarinda. Whereas the class mark of both distribution tables above was showed by figure 2.

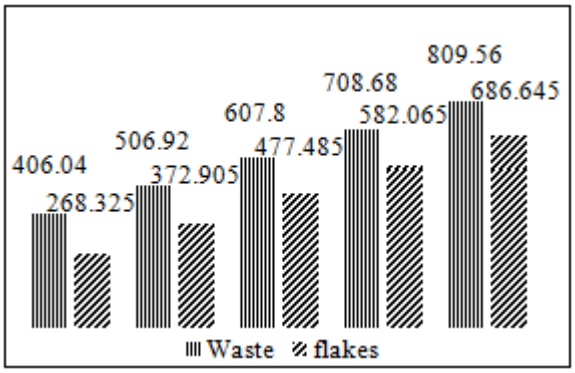


Figure 2: Relevance of Plastics Waste and Its Production, Samarinda 2018

From figure 1 sum of plastic waste and plastic flakes products was interrelated where the average linkage value is 75% with the average deviation value of 0.18 while coefficient of deviation on the average is 0.25 or 25%. This means that presence of Samarinda's plastic waste was processed to become plastic flakes reached approximately 75%. The magnitude of the linkage value between variables Xi (the sum of plastic waste) and Yi (the number of plastic flakes products) can be seen in figure 2.Interval data to calculate the correlation / correlation using Pearson or Product Moment Correlation [4]. And result of r = 0.60. values of r were various from 0 to 1 which symbolizes linkages from very weak to very strong [9]. With r = 0.60 this means that between plastic waste and the production of the flakes were positive relationship. Value of r2 which is to determine how much influence the amount of plastic waste on the production of the flakes and value of this matter was b'=7345110/12718849=0,577 and b=7345110/ 11800030=0, 622. So the result (r2) was b' multiplied b equal to 0,36.

It had been founded that r2 value was 0.36 or 36%. This means that plastic waste was not factor that mostly influences the ups and downs of the amount of plastic flakes production in Samarinda. But other factors affected the number of the flakes products in Samarinda around 64%.

Raw materials of form plastic glass and bottles were not always relatively stable. However, it always changes according to the situation and conditions. Therefore, production was not always smooth. If this happens, an industry would to process were carried out for materials other than PP, PET and HDPE. The worst possibility there was no plastic waste available in due to rainy weather. The average location of the plastic flakes industries was in area not many inhabitants, where it roads were inadequate. So that, plastics glasses and bottles were relatively difficult to obtained. While Samarinda small scale plastic entrepreneurs generally like plastic's type of PP, PET and HDPE.

Generally, the plastic craftsmen the flakes lived in the suburbs with rent status from landlord and are far from settlement. But gradually they will be pushed out area by inhabitants, because reasons of disturbing the environment.

The results of observations explained that leasing of the land for their business long period at least ranged from 5 to 10 years. Searching for new business locations is not an easy job. Because they have to consider the road to or out of the

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industry. Another result is the accumulation of plastic waste in the old location because it is not transported by the industry concerned. This reason is one of the causes of Samarinda's plastic flakes business "patahtumbuhhilangberganti", expression. This means it's easy for someone to open a plastic flakes business in Samarinda. However, the business will not last long, one of them was due to the relocation factor. Generally, entrepreneurs are still weak in managing industrial work environments both inside and outside the company. Sufficient environmental studies are needed, given the material they process is the source of environmental pollution.

Samarinda's plastic flakes industry was a business chain. Scavengers are the economic drivers of this business. From this activity it was able to created other business such as; freight forwarding business, local workers, stall businesses and so on. The above phenomenon has been described by previous researchers, Firman L Sahwan with the conclusion "Plastic recycling activities has two advantages are reducing potential damage of environment and creating job opportunity forpeople" [15].

5. Plastic Flakes Production as Solutions for Environmental Pollution in Samarinda

Plastic waste has a negative impact on the environment, because wasted plastic caused to disasters such as floods, soil and air pollution. The nature of plastic that was not easy torn and broken which then accumulates at several drainage doors and it would trigger city flooding. It took 1000 years to decompose soil. When decomposed, plastic particles would contaminate soil and ground water. [5]. Plastic waste in soil growth resulted in a bhispenol-A reaction that contaminated groundwater. The impact when humans drank causes damage to the body's hormonal system[6].

Plastic burning produces dioxin, a compound that causes cancer, swelling of the liver, nervous system disorders when inhaled by breathing. Destruction of waste by combustion methods was not recommended even though there may be some waste that must be burned to destroy it [7].

Combustion of plastic types of waste produces various compounds that were harmful to health and the environment. In addition, this type of waste burning will only increase the type of pollution that exists.In the Indonesian National Standard SNI, in an effort to reduce the volume of waste or change the form becomes more useful, one of which was done by recycling[11]. Existence of plastic flakes industry in Samarinda had been around 15 years ago. Marked by emerging and sinking this home industry. In general, the raw materials used as plastics are derived from PET (Polyethylene Terephthalate), PP (Polypropylene) and HDPE (High Density Polyethylene).

The presence of plastic flakes craftsmen can reduce plastic waste generated by the Samarinda community consumption activities. This waste reduction is certainly in accordance with the provisions referred to in Article 20 of Law No. 18 of 2008, namely reducing waste through recycling activities [8].

From this matter, the city government should keep the plastic flakes industry activities kept continuing so that plastic waste did not interfere withcity's environment. This was in line with the mandate of Law 18 of Article 20 paragraph 2 [8].

In Thailand, smooth supply of plastic waste was due to the franchise waste system that they apply with classes such as; low, small, medium and large. Result of those classes would be exchanged for money and training.

Through Article 20 of Law No. 18, 2008, the government is obliged to facilitate its production and marketing [8]. However, this has not yet been felt by Samarinda plastic chopped business people. The results of the field research explained that flakes price have sometimes resulted in instability, which was purchased by the factory and changed for various reasons. For this reason, the plastic craftsmen/ entrepreneurs in Samarinda wished for business protection through this Act No. 18 [8].

Related to the land used by plastic flakes entrepreneurs. It was expected to that there would be continued business surely, so that the production of chopped plastic as one of the contributions to Samarinda's environmental pollution solution can take place smoothly. Compensation which includes relocation, restoration of the environment, health and treatment costs, and / or compensation in other forms as stated in Article 25 paragraph 2 of Law No. 18, 2008 [8], should be realized in implementation of plastic flakes industry in Samarinda.

In the end, the role of the solution to overcome environmental pollution is not only done by small scale plastic craftsmen. But with the community through the program called Bank "Ramli" Samarinda. Environmentally friendly bank in Samarinda needs to be realized in a more targeted program, as Thailand has formed Waste Bank [15]. The legal basis was clear as Article 28 of Law No. 18 of 2008. [8], which stated role of the community in managing the environment to reduced environmental pollution.

This was form of one of the approached to waste management through a "circular economy" approach which currently KLHK was making three pilot projects for packaging waste development involving several parties, including the government, producers, waste banks, recycling industries, communities, informal sectors (scavengers and collectors. (NurulFadilah) [10]

Compensation which includes relocation, restoration of the environment, health and treatment costs, and compensation in other forms as stated in Article 25 paragraph 2 of Law No. 18, 2008 [8], should be realized in the implementation of plastic flakes industry in Samarinda.

6. Conclusion

The average amount of plastic waste taken by Samarinda's plastic waste industry was around 627.02 tons and its products were around 402,785 tons. The amount of plastic waste around 75% was processed into plastic flakes by craftsmen / industry in Samarinda. While the value of the

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relationship between the amount of plastic waste and Samarinda plastic product is r = 0.60, where the amount of plastic waste and flakes production has a positive correlation or correlation. While the amount of plastic's flakes products caused by sum of plastic's waste in Samarinda was about 36%, while remaining 64% was due to other factors. Possible factors include; place or location of business, supply of raw materials and prices that sometimes fall unexpectedly.

Both variables Xi (the sum of plastic waste) and Yi (the number of plastic flakes products) did not enough distributed well, so it is necessary to collected them precisely within obtaining data in future.Through the Law number 18, 2008 the local government was actually more free to act to regulate the plastic waste industry in Samarinda for the purpose of public welfare. Reinforcement of the idea of an environment friendly bank (bank ramli) which had been initiated by the Samarinda city government and run by community.

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