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Analysis of Waste Generation and Characteristics; Mamuju Central Market in 2022

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ABSTRACT

The market is one of the waste producers which is classified as complex, so it has great potential as a source of environmental pollution that occurs as a result of buying and selling activities. Market waste in the form of left over vegetables, fruits and other food ingredients which can cause odors and reduce market aesthetics, as well as soil contamination. The aim of the research was to determine the generation, composition, specific gravity and moisture content of waste at the Mamuju Central Market, as well as a plan for proper waste management. This research method uses a quantitative survey approach by taking a number of samples based on SNI 19-3964-1994. Sampling was carried out from 04 August to 11 August 2022. The sample was taken of 30 merchant stalls from a total of 591 kiosks which were carried out for 8 (eight) consecutive days by measuring the volume and weight of waste for each kiosk using a waste measuring box with a volume capacity of 40 liters. then the waste from all the kiosks is put together in a waste measuring box with a volume capacity of 500 Liters. After that, it is separated based on the composition of the waste and weighed based on the type of waste. As many as 2 kg of samples were taken to check the water content of the waste at the Integrated Laboratory of the Mamuju Polytechnic of the Ministry of Health. From the results of this study it was found that the average waste generation at the Mamuju Central Market was 27.34 L/trader/day with the highest waste composition, namely organic type waste of 91.15%. The specific gravity and moisture content of the waste are on average 0.18 Kg/m³ and 36.20%. The appropriate waste management plan based on the data obtained is the composting method, considering the high composition of organic waste in the Mamuju Central Market. For this reason, it is necessary to empower traders to make composters to minimize the organic waste they produce

Keywords: *Waste, Characteristics, generation*

INTRODUCTION

*World Health Organization (*WHO) defines waste as something that is not used, not liked or something that is thrown away that comes from the process of human activities and does not happen by itself.(Hayat & Zayadi, 2018).Handling the waste problem in Indonesia is still an actual topic in line with the increasing population growth which has an impact on the increasing amount of waste produced. Garbage is one thing that cannot be separated from human activity. Most of what we use ends up creating waste (Yanthi, 2018). UU no. 18 of 2008 concerning waste management states that the definition of waste is all the remains of human activities that are carried out daily and or from natural processes that are characterized by solidity. Garbage can be defined as solid waste consisting of organic and inorganic materials which are considered useless and must be managed so as not to endanger the environment and protect development investments.

Based on information from the Ministry of Environment and Forestry (KLHK) in 2019, it stated that the amount of waste generated nationally was 175,000 tons or the equivalent of 64 million tons per year if one assumed

that the waste generated per person per day was 0.7 kilograms. The Ministry of Environment and Forestry explained that the average waste generation per person per day in metropolitan cities (population of more than 1 million people) and big cities (population of 500 thousand – 1 million people) is 1,300 tons and 480 tons, respectively. Judging from its composition, the most dominant type of waste produced in Indonesia is organic waste (food waste and plant residues) by 50%, plastic by 15%, and paper by 10%, other waste is metal, rubber, cloth, glass, and so on. - other. Meanwhile, from the source(BPS, 2020).

Regulations regarding waste management in Mamuju Regency are regulated in Regional Regulation no. 2 of 2017, which contains management procedures and administrative sanctions for violators, but even so, until now it has not been able to solve the waste problem in Mamuju Regency. The volume of waste in Mamuju Regency has increased every year. The volume of waste in 2008 was 57,872 m³/year, and it increased in 2009 to 62,208 m³/year, in 2010 it increased again by 71,280 m³/year, and in 2011 it reached 73,000 m³ /Year. The waste produced every day comes from households (60%), markets (20%), restaurants, restaurants and other areas (10%). Based on this data, it is known that the market is the 2nd (two) largest contributor to waste in Mamuju Regency (James, 2020).

The market is the Mamuju Central Market which has the potential to be a source of environmental pollution through waste generated by buying and selling activities that occur. Market waste in the form of leftover vegetables, fruits and other food ingredients, can rot and cause an unpleasant odor (Sofyan, 2013). The habit of the people who dispose of garbage in the wrong place can also reduce the aesthetic value of the market. In addition, waste can also cause water pollution, soil destruction and media for the spread of disease (Hayat & Zayadi, 2018).

METHOD

Types of research

This research is a quantitative study with an observational design. In this study measurements were carried out to calculate waste generation, composition and specific gravity.

Location and Time of Research

This research is located at the Mamuju Central Market which was conducted for 8 consecutive days from 04 to 11 August 2022, as well as checking the water content at the Integrated Chemical Laboratory of the Health Polytechnic of the Ministry of Health Mamuju. Based on these data an appropriate waste management plan is made.

Population and Sample

The population in this study were stall traders at the Mamuju Central Market. Withdrawal of the number of samples based on SNI 19-3964-1994 (BSNI, 1994) with the following formula:

$$S = C_d \sqrt{P_s} \quad \text{.....1)}$$

dimana:

S	=	Jumlah contoh (jiwa)
C_d	=	Koefisien perumahan
C_d	=	Kota besar / metropolitan
C_d	=	Kota sedang / kecil / IKK
P_s	=	Populasi (jiwa)

S = 1 √591 = 24.3 or 25 stalls. It is known that the number of traders is 591 kiosks, so the number of samples is 25 kiosks. However, with consideration of ensuring sufficient samples during the research, the number of samples was increased to 30 kiosks.

Data collection

Data collection was carried out using several instruments based on SNI 19-3964-1994, including:

a. 40 liter volume plastic bag
b. 40 liter waste measuring box
c. 500 liter waste measuring box

The working procedures of this research namely;

a. Plastic bags that have been marked as a source of waste are distributed 1 day before collection.
b. Record the number of units of each waste producer.
c. Weighing the measuring box which is used as a container during the weight measurement process.
d. Take turns pouring the collected waste samples into the measuring box.
e. Hit the measuring box 3x by lifting the box 20 cm high, then drop it.
f. Weigh and record the weight of the waste in the measuring box.
g. Measure and record the total waste volume.
h. Sort the samples based on the components of the waste composition (organic, paper, plastic, metal, glass, Styrofoam, and others).
i. Weigh and record the weight and volume of each waste component.
j. Take a sample of 2 kg representing all samples every day for 8 (eight) consecutive days, then take it for examination in the laboratory to check the moisture content of the waste.

Processing and analysis of data

a. Data processing

1) Data processing is done by using a computer application.
2) Enter observational data into the observation table
3) To calculate specific gravity, the following formula is used:

$$\text{kind of trash} = \frac{mass \text{ of trash } (kg)}{volume \text{ of trash } (m3)}$$

4) To calculate the volume of waste, the following formula is used:
   $Volume\ Sampah = luas$ box pedestal $x\ tinggi\ sampah$
5) Calculating the components of the waste composition, calculated by weighing the total weight of waste generation first, then the total generation is sorted based on the characteristic components that have been determined, then each type of waste is weighed.
6) Calculating the percentage composition of each waste characteristic, is done by formula as follows:
   $Component$ (%)
   = $mass$ of $component$ (kg) x 100%
   $mass$ of $total$ trash (kg)
7) Calculating the volume of daily waste generation for each kiosk, namely adding up all the weight of waste per day divided by the number of kiosks.
8) Data on waste generation and composition is the basis for calculating waste generation which must be managed for planning purposes of service improvement.

Data analysis

Univariate analysis was used to see the frequency characteristics of the variables presented in tabular and narrative form.

RESEARCH RESULT

The amount of waste generation is obtained by calculating the volume of waste which is calculated using a 40 liter measuring box (33 cm x 33 cm x 34 cm), then calculated to obtain the average generation per day.

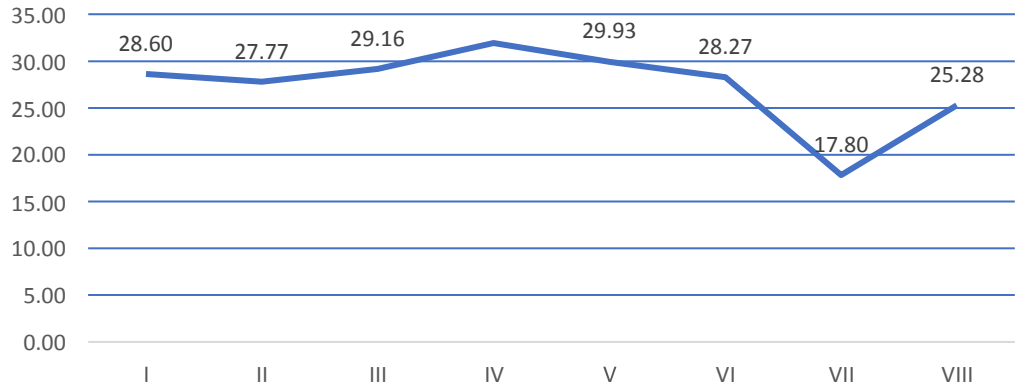

Figure 1 Diagram of Average Daily Waste Generation in the Market Central Mamuju in 2022

Table 1 Average Volume of Garbage Generation Per Day at Mamuju Central MarketYear 2022

	Day To Volume - (Liters)									
Sample Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Amount**	**Daily Average (L)**
001	3,43	33.08	39,20	41.65	14.70	0.00	3.68	31.85	167.58	20.95
002	29,40	50,23	39,20	37.98	30,63	39,20	33.08	31.85	291.55	36,44
003	17,15	39,20	36.75	35,53	30,63	39,54	39,20	39,20	277,19	34.65
004	14.09	37.98	66,15	31.85	42.88	39,20	37.98	39,20	309,31	38,66
005	53.90	29,40	23,28	41.65	39,20	35,53	19.60	22.05	264.60	33.08
006	33.08	30,63	36.75	46.55	29,40	36.75	39,20	39,20	291.55	36,44
007	31,24	36.75	39,20	28,18	15.93	0.00	23,28	33.08	207,64	25.95
008	53,29	35,53	35,53	42.88	39,20	35,53	23,28	39,20	304,41	38.05
009	18,38	0.00	0.00	19.60	26.95	0.00	0.00	0.00	64,93	8,12
010	39,20	30,63	26.95	35,53	36.75	39,20	18,38	17,15	243.78	30,47
011	37.98	0.00	18,38	23,28	20,83	19.60	0.00	23,28	143,33	17,92
012	22.05	35,53	15.93	78,40	33,69	33.08	11.03	22.05	251.74	31,47
013	47,78	0.00	17,15	18,38	33.08	73.50	17,15	28,18	235,20	29,40
014	14.70	0.00	33.08	29,40	31.85	11.03	22.05	14.70	156.80	19.60
015	53.90	14.70	26.95	32,10	39,20	22.05	23,28	0.00	212,17	26,52
016	51.45	0.00	0.00	26.95	24.50	31.85	0.00	0.00	134.75	16.84
017	36.75	17,15	23,28	42.88	35,53	35,53	0.00	13.48	204.58	25,57
018	45,33	39,20	29,40	33.08	37.98	17,15	1.23	34,30	237.65	29,71
019	26.95	25,73	36.75	10.05	28,18	7.35	2.45	51.45	188.90	23,61
020	34,30	34,30	31.85	36.75	26.95	0.00	6,13	14.70	184.98	23,12
021	19.60	39,20	25,73	39,20	26.95	39,20	37.98	37.98	265.83	33,23
022	20,83	36.75	26.95	11.03	28,18	8.58	18,38	33.08	183.75	22.97
023	34,30	51.45	39,20	33.08	29,40	36.75	0.00	0.00	224,18	28.02
024	34,30	46.55	37.98	23,28	39,20	45,33	22.05	37.98	286.65	35,83
025	66,15	7.35	31.85	12.25	37.98	39,20	12.25	24.50	231.53	28.94
026	18,38	9.80	23,28	18,38	39,20	9.80	23,28	36.75	178.85	22,36
027	0.00	39,20	29,40	40,43	30,63	31.85	20,83	30,63	222.95	27,87
028	0.00	36.75	11.03	11.03	31.85	31.85	23,28	0.00	145.78	18,22
029	0.00	39,20	39,20	39,20	16.54	42.88	26.95	36.75	240.71	30.09
030	0.00	36.75	34,30	36.75	0.00	46.55	28,18	25,73	208.25	26.03
Average per Trader										27,34

Table 1 shows that the average waste generation per trader in Mamuju Central Market is 27.34 L/day.

At the stage of measuring the composition of the waste, the samples that have been weighed and the waste generation calculated are put into a waste measuring tank with a volume of 500 liters. After that, it is spilled onto the tarpaulin to be sorted by type of waste. Each type of waste is weighed using a sitting scale with a capacity of 150 kg. Waste composition is expressed in Kilograms (Kg).

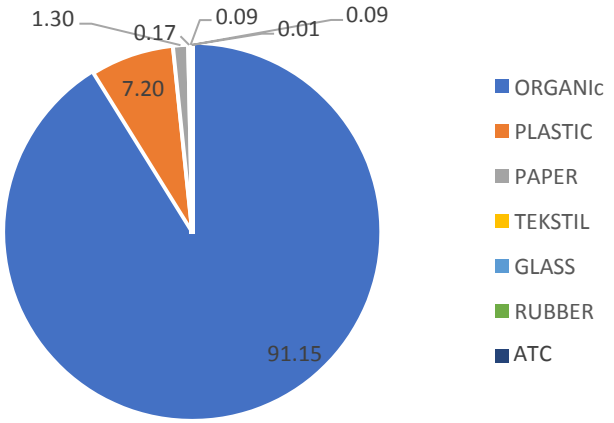

Figure 2. Percentage Diagram of Central Market Waste Composition Mamuju in 2022

To find out the specific gravity of the waste, the volume of waste / generation and the weight of the waste are measured first. The specific gravity of waste is expressed by the weight of waste per unit volume (Kg/m2). The weight of the waste divided by the volume of the waste produces the specific gravity of the waste.

Table 2 Density of Mamuju Central Market Waste in 2022

Days to-	Garbage weight (Kg)	Waste Volume (m^3)	Specific Gravity (Kg/m^3)
1	182.6	857,87	0.21
2	69,4	833.00	0.08
3	177	874.65	0.20
4	188.7	957,22	0.20
5	156	897,93	0.17
6	164.4	848.04	0.19
7	128.8	534.10	0.24
8	90,2	758,28	0.12
Average			0.18

To determine the water content of the waste at the Mamuju Central Market, 2 (two) kg of organic waste samples were taken every day for 8 (eight) consecutive days in accordance with the procedure of SNI 19-3964-1994 regarding the method of taking and measuring samples of urban solid waste generation and composition. , then examined the water content of the waste in the laboratory. The water content of the waste uses % (percent) units.

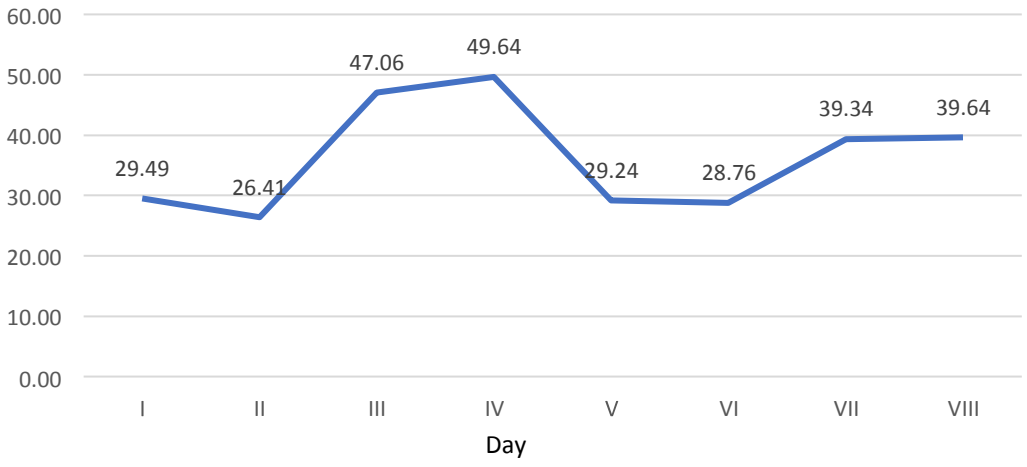

Figure 3 Percentage diagram of the water content of waste in the Central Market Mamuju in 2022 Mamuju Mamuju Tahun 2022

Based on the data on generation, composition, specific gravity and water content of waste, an appropriate waste management plan can be made, thereby ensuring the comfort and health of traders, visitors and the surrounding community at the Mamuju Central Market. In addition, waste management is a form of business in protecting the environment (water, soil and air) from pollution which results in a decrease in environmental quality. So it is necessary to plan proper waste management starting from sorting to the transportation stage.

a. Waste Reduction

1) Reuse

Reuse activities are efforts to minimize waste by reusing leftover items from activities. By carrying out reuse activities, traders can save more in terms of expenses, because they reuse the results of their activities so they don't need to spend money.

In direct monitoring in the field, there are a number of mixed traders who reuse cardboard product packaging to package consumer purchases. The rest, there are still many who have not reused their waste in the form of plastic bags, product cartons, etc.

For the reuse stage, screening should be carried out first by the traders themselves, reusing waste that according to them can be reused to make it more effective.

2) Reduce

This reduce effort can be done by limiting the generation of waste or reducing waste or in the sense of the word behavior patterns that reduce consumption of goods that have the potential to generate waste.

Sources of waste aside from traders, also come from visitors to the Central Mamuju market. In the observation activities carried out at the Mamuju Central Market, it was seen that mixed traders changed tempeh packages to banana leaves, so they did not use plastic as their packaging.

One of the efforts that can be made to reduce waste production at the Mamuju Central Market is that traders are committed not to provide plastic bags for consumers, so that traders can minimize the use of plastic in the market environment. In addition, it needs to be supported by a Regional Regulation regarding the prohibition of the use of plastic bags for traders, especially in markets.

3) Recycle

The concept of recycling (recycle) implies the maximum possible utilization of residues through processes, either as raw materials for similar products as they originate, as raw materials for different products, or utilizing the energy generated from the recycling process.

Based on a brief interview with the Head of the Mamuju Central Market, traders have not carried out recycling activities in order to reduce waste generation. Waste components that have the potential to be recycled include: plastic bags, plastic packaging, glass bottles, etc.

b. Waste Handling

1) Sorting/Housing

Waste sorting is the activity of classifying waste based on its type or nature. This activity aims to facilitate further waste processing, so that the processing is more environmentally friendly. In addition, the purpose of segregating waste between organic, inorganic and B3 is so that waste does not mix with one another resulting in a foul odor by organic waste that does not decompose properly. When this organic waste is not managed properly, it will invite vectors to nest and cause disease in humans. Likewise inorganic waste, if it is not treated properly it will cause more and more generation.

Condition waste handling at this sorting stage is not going well or in other words it is not implemented. Seeing the conditions on the ground, the traders just put all the waste they produce together in plastic bags without separating the type and container. In this condition, it is necessary to educate traders to participate in sorting their waste, so that it makes it easier for waste management to handle it.

2) Collection

The garbage collection stage is the stage where the waste has been collected sorted and stored separately based on type and nature, then taken to a temporary disposal site to be transported by TPA (final disposal site) fleet. This collection makes it easier for waste management officers, thus streamlining the time and energy of waste transporters to the TPA.

The results of interviews with the head of the Mamuju Central Market said that The garbage collection method is carried out by DLHK (Environmental and Sanitation Service) officers of the District, Mamuju by taking it directly from the kiosk to the kiosk of the traders using a fleet of three-wheeled motorbikes, then the garbage is collected in a TPS container (temporary disposal site) located in the Mamuju Central Market area. This stage has been going well, but further research is needed on the adequacy of TPS quantity in accommodating waste. In addition, organic and inorganic waste should be separated by TPS facilities to facilitate its management at the TPA later.

3) Garbage transport

Garbage transportation activities are stages carry waste from a temporary waste transfer location at a location to the final disposal site (TPA). Garbage transportation to the TPA usually uses a four-wheeled fleet with a daily or weekly frequency that varies according to the needs and conditions of the TPS, so that it is hoped that there will be no accumulation of waste at the TPS.

The stages of waste transportation at the Mamuju Central Market are carried out by DLHK Kab. Mamuju uses a fleet of open dumping trucks with a capacity of 6000 Liters with a frequency of 1 x a day every 19.00 - 22.00 WITA except on Sundays, meaning that there is accumulation of garbage at TPS on Sundays. For the quantity of the garbage transport fleet at the Mamuju Central Market it is sufficient, but it is better if the truck fleet is equipped with a partition between organic and inorganic waste so that it can be managed properly at the TPA.

DISCUSSION

In figure 3 sample number 004 has the highest daily average waste generation, namely 38.66 L. Respondents from sample number 004 are vegetable and fruit traders whose waste is in the form of leftovers - rotten vegetables and fruit (organic waste). Meanwhile, respondent number 009 has a low average waste generation of 8.12 L/day. This is because respondent number 009 is a clothing seller whose only waste is plastic clothing packaging.

Based on Figure 1 it can be seen that the most waste generation occurs in the 4th day with an average value of 31.91 liters. Unlike the waste generation on the 7th day which was only 17.80 liters. According to Tchobanoglous (1993) there are several factors that influence waste generation, namely as follows: 1. Natural factors: a. Rainy season and summer b. Climate, rainy area c. Geographical location 2. Human factor: a. daily activities b. house condition c. Type of waste d. Economic condition e. Treatment of waste(Raima, 2020).On the 4th day there was an increase in waste generation due to the treatment factor for waste by piling up waste for 2 (two) days, because on Sundays the garbage collectors had a day off to pick up trash.

Based on Figure 2, organic waste dominates all types waste in the Mamuju Central Market, namely 91.15%. The results of this research are in line with research conducted by Wahyuddin (2018) concerning the Study of Market Waste Management Systems in the Pagesangan Traditional Market, Mataram City. In the results of univariate analysis it was found that organic waste dominates or is more abundant than inorganic waste (Revelation, 2018). The same research on the Study of Generation, Composition and Planning for Market Waste Management (Case Study at the Market in Sleman Regency, Yogyakarta) found that the composition of the waste was dominated by organic waste, namely fruit and leaf vegetable waste. (Iswidianto, 2018).

Specific gravity plays an important role in the process of waste management, especially

in estimating the total mass and total volume of waste that must be handled, so that the data is needed in determining the waste management process, namely transportation and final disposal capacity. In research on the study of waste density studies at the Jalupang TPA, Karawang Regency, it was found that waste from non-domestic market sources has a higher density value than domestic sources.(Adnan, 2018).

In table 4.4 it was obtained that the average water content in the waste at the Mamuju Central Market was 36.20%. The majority of the composition of waste at the Mamuju Central Market is dominated by organic waste in the form of food waste, vegetables which have a high water content. In addition to reducing waste generation, recyclable waste can be an additional source of income when it is processed into goods of economic value.

Clear regulations by the Regional Government of Mamuju Regency are contained in the Regional Regulations of the Regency. Mamuju No. 2 of 2017 article 14 that business actors are required to reduce waste from their business activities (Mamuju Regency Government, 2017).

Estimated waste generation is needed to determine the amount of waste that must be managed. The study of data regarding waste generation is the first step in waste management (Masrida R, 2017). Data on the composition of waste at the Mamuju Central Market shows organic waste as the type of waste with the highest percentage, namely 91.15%, so it needs to get good treatment in order to reduce waste generation which damages market aesthetics and invites the existence of disease vectors such as rats and flies. This should make traders to pay more attention in making efforts to minimize waste generation. At this stage, in order to reduce waste, it is better to program integrated waste recycling training for traders.

To carry out recycling activities requires creativity and innovation, so it needs to be provided. One effort that can be done is the composting method. According to research on the effect of water content on the results of organic composting using the Windrow method, it was concluded that water content affects the temperature and rate of compost decomposition in waste composting. In addition, the optimum water content results in organic waste of 60% (Kurnia, 2017). The research conducted at the Mamuju Central Market obtained an average water content of 36.20%, so it is necessary to add water or other treatment to make the composting method effective as an effort to reduce organic waste generation at the Central Market.Mamuju.

CONCLUSIONS AND RECOMMENDATIONS

The average waste generation in Mamuju Central Market is 27.34 l/trader/day. The highest composition of waste in Mamuju Central Market is organic with a percentage of 91.15%. The average specific gravity of waste at the Mamuju Central Market is 0.18 Kg/m³. The average waste water content in Mamuju Central Market is 36.20%. An appropriate waste management plan based on data on waste generation, composition, specific gravity and moisture content at the Mamuju Central Market, namely; reduce organic waste using the composting method and arrange a schedule for garbage transportation by the DLHK of Mamuju Regency so that no garbage stays overnight in the TPS.

Declaration by Authors

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