The Study of Waste Generation and Composition in Lubuk Alung Market in Padang Pariaman Regency

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Abstract. This study aims to determine the generation and composition of the Lubuk Alung market waste, Padang Pariaman regency, West Sumatra. The research problem is the pile of garbage behind and beside the market that causes unpleasant odours and aromas due to the lack of optimal waste management. Determination of market waste generation refers to Indonesian National Standard (SNI 19-3964-1994) as stated in units of weight (kilograms / person / day) and in units of volume (liters / person / day). Market waste composition includes waste from meat stalls, fruit and vegetable kiosks, gold shops, clothing and shoe stores, restaurant, daily needs shops, household appliance kiosks, electronic stores and stationery stores. This type of research is quantitative research with a descriptive approach. The research sample is market waste taken as much as 10% of the total number of facilities (at least 1) available on the market with a total sample of 9 pieces. From the results of the research obtained waste generation in the Lubuk Alung market in weight units found that the average is 0.241 kg / m² / h or 0.053 kg / person / h while the generation in volume units is 1.678 liters / m² h or 0.326 litre / person / h while for the average value of solid waste generation is 12,325 m³ / day, while the average waste composition of Lubuk Alung market is dominated by organic waste (vegetable and fruit waste, fish, chicken, meat and meat) of 75.18% while inorganic waste (plastic waste, canned waste and glass) is 24.81%.

1. Introduction
The market is a place where transactions between sellers and buyers take place, becoming a place for exchanging goods from various places to be distributed to traders and finally to consumers [1,2,3]. One example of a traditional market is the Lubuk Alung local market in Lubuk Alung in Padang Pariaman regency. Lubuk Alung market is a fairly big traditional market in the Lubuk Alung covering an area of ± 15 Ha [4]. The problem of this research is the accumulated market waste and the absence of waste management. According to Ref. [1,5,6,7], the type of waste produced in the form of organic waste, consisting of vegetables that have been damaged or decayed, fruits that have been damaged or decayed and not suitable for resale, fish waste, meat waste, chicken waste, food scraps from restaurants, leftovers - the food of traders and buyers and others and inorganic waste, consisting of glass, iron, plastic food packaging containers, paper, plastic toys, bottles, glass drinks, cans, wood, metal, rubber, cardboard and others. All this waste is obtained from meat kiosks, fruit and vegetable kiosks, gold shops, clothing and shoes stores, restaurant stalls, daily necessity stores, household appliance kiosks, electronic shops and stationery stores. Limitation of this research problem determination of waste generation and the composition of Lubuk Alung market waste refers to SNI 19-3964-1994 [8] concerning the method of taking and measuring sample generation and composition of urban waste. Garbage generation is expressed in units of weight (kilograms / person / day) and in units of volume (liter / person / day).
2. Materials and Methods
The type of research used in this study is quantitative research with a descriptive approach sites this research will be conducted at Lubuk Alung Market, in Padang Pariaman regency in 2018.

2.1. Samples
The number of samples is calculated based on SNI 19-3964-1994. The sample in this study is market waste taken as much as 10% of the total number of facilities (at least 1) available as many as 14 samples.

| No | Location                  | Total number | The number of Samples | Sampling Ratio | PSE         | Survey reliability (in %) |
|----|---------------------------|--------------|-----------------------|----------------|------------|--------------------------|
| 1  | Meat                      | 14           | 1                     |                |            |                          |
| 2  | Fruit and vegetables      | 32           | 3                     |                |            |                          |
| 3  | Gold                      | 14           | 1                     |                |            |                          |
| 4  | Clothes and shoes         | 19           | 2                     | 0.090          | 0.390      | 99.61                    |
| 5  | Restaurants               | 8            | 1                     |                |            |                          |
| 6  | Daily needs               | 21           | 2                     |                |            |                          |
| 7  | Household appliances      | 11           | 1                     |                |            |                          |
| 8  | Electronics               | 9            | 1                     |                |            |                          |
| 9  | Stationery                | 15           | 2                     |                |            |                          |
|    | Total Store/Kiosk         | 143          | 14                    |                |            |                          |

To get a representative sample, the method SNI 19-3964-1994 [8] is used regarding the determination of non-residential waste generation, namely:
\[ S = C_d \sqrt{T_s} \] (1.1)

Where:
- \( S \) = number of each type of shop
- \( C_d \) = coefficient of housing construction = 1
- \( T_s \) = number of non-residential buildings

Based on SNI 19-3964-1994 [8], the determination of quantity / generation of waste per day uses the equation:
- Volume determination of waste/day = \( \frac{V_s}{u} \) (1.2.)
- weight determination of waste/day = \( \frac{B_s}{u} \) (1.3)

Where:
- \( V_s \) = volume of measured waste (liters)
- \( B_s \) = weight of the measured waste (kg)
- \( u \) = number of waste generating units (units)

Correction factors are obtained from:
\[ q_r \left( \frac{q_1 + q_2}{2} \right) \] (1.4)
\[ f_k \left( \frac{q_r}{q_1} \right) \] (1.5)

Where:
- \( q_1 \) = sampling data for the first day
- \( q_2 \) = sampling data last day
- \( q_3 \) = average sampling of the first and last days
- \( f_k \) = correction factor
2.1.1. Compaction factor.

The compacting factor is used to determine the amount of solidification of waste by using the formula:

\[
\frac{\text{Volume after compaction}}{\text{Volume before compaction}}\] (1.6)

Determination of the composition of waste based on SNI 19-3964-1994 uses the equation below:

\[
\% \text{ The Composition of waste} = \frac{B}{BBS} \times 100 \% \] (1.7)

Where:
- \(B\) = weight of the waste component (kg)
- \(BBS\) = the total weight of the measured waste (kg)

2.2. Variables

The research variable is calculating the generation and composition of market waste based on the SNI 19-3964-1994 method \[8\] and what affects it is the number of shops / kiosks, the number of traders and the weight of waste generation.

2.3. Data Sources

a. Primary data. In the form of generation data and composition of secondary data market waste

b. Secondary data. In the form of a general picture of the market covering the area and boundaries, number of traders, and market maps.

c. Literature / Literature Study. Obtained from various relevant sources, namely textbooks, journals and articles from the internet, relevant research reports, and SNI Decrees \[9\]

2.4. Calculation of waste generation

Garbage generation can be expressed in units of weight (kg / person / day, kg / m\(^2\) / day, kg / tt / day) and volume units (liters / person / day, liters / m\(^2\) / day, liters / tt / day) \[9,10\]. Average institutional growth is obtained from:

\[
t_{\text{market}} = \frac{t_1+t_2+t_3+...+t_{15}}{n} \] (2.1)

Where:
- \(t\) = Waste generation (l / h)
- \(n\) = Number of sampling sources

The calculation of waste generation is also taken into account the correction factor to get waste generation per day. Sampling conducted 8 consecutive days gets two data for the same two days. Correction factors are obtained from Ref. \[9,10\]:

\[
f_k = \frac{\bar{x}}{\bar{x}_1} \] (2.2)

\[
\bar{x} = \frac{x_1+x_2}{2} \] (2.3)

Where:
- \(x_1\) = sampling data for the first day
- \(x_2\) = sampling data last day
- \(\bar{x}\) = average sampling of the first and last days
- \(f_k\) = correction factor

3. Results and Discussions

The sample in this study there are 14 samples where the generation unit for each facility in the study is the unit of area (kg / m\(^2\) / h) or (l / m\(^2\) / h) and in units of person namely (kg / p / h) or (l / p / h) which aims to facilitate data analysis. For the unit area, the amount of each debit is divided by the area of each source, while the unit of person for waste generation is divided by the number of shops and kiosks, the number of traders and visitors from each source. Waste generation data is obtained from meat kiosks,
fruit and vegetable kiosks, gold shops, clothing and shoes stores, restaurant stalls, daily material stores, household appliance kiosks, electronic shops and stationery stores.

Table 2. Amount of Waste Accumulation Based on Waste Source

| No. | Waste source component       | Unit               | Volume (litre) | Weight (kg) |
|-----|------------------------------|--------------------|----------------|-------------|
| 1   | Permanent house              | Per person/day     | 2.25-2.50     | 0.350-0.400 |
| 2   | Semi-permanent house         | Per person/day     | 2.00-2.25     | 0.300-0.350 |
| 3   | Non-permanent house          | Per person/day     | 1.75-2.00     | 0.250-0.300 |
| 4   | Office                       | Per employee/day   | 0.50-0.75     | 0.025-0.100 |
| 5   | Store/shop                   | Per officer/day    | 2.50-3.00     | 0.150-0.350 |
| 6   | School                       | Per student/day    | 0.10-0.15     | 0.010-0.020 |
| 7   | Secondary arterial road      | Per meter/day      | 0.10-0.15     | 0.020-0.100 |
| 8   | Secondary collector road     | Per meter/day      | 0.10-0.15     | 0.010-0.050 |
| 9   | Local road                   | Per meter/day      | 0.05-0.10     | 0.005-0.025 |
| 10  | Market                       | Per meter²/day     | 0.20-0.60     | 0.100-0.300 |

Source: Ref. [6]

Table 3. Lubuk Alung Market Waste Recapitulation

| No | Location                  | Litre/m²/day                  |
|----|---------------------------|--------------------------------|
|    |                           | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| 1  | Meat                      | 0.522  | 0.490   | 0.903     | 0.354    | 0.381  | 0.685    | 0.403  |
| 2  | Fruit and vegetables      | 3.384  | 6.245   | 2.552     | 2.381    | 2.172  | 2.552    | 2.150  |
| 3  | Gold                      | 0.158  | 0.168   | 0.025     | 0.012    | 0.017  | 0.049    | 0.049  |
| 4  | Clothes and shoes         | 0.068  | 0.122   | 0.062     | 0.029    | 0.033  | 0.068    | 0.089  |
| 5  | Restaurants               | 0.381  | 0.468   | 0.324     | 0.347    | 0.360  | 0.318    | 0.318  |
| 6  | Daily needs Household appliances | 0.106 | 0.106  | 0.207     | 0.089    | 0.098  | 0.119    | 0.147  |
| 7  | Electronics               | 0.040  | 0.068   | 0.020     | 0.024    | 0.028  | 0.028    | 0.040  |
| 8  | Stationary                | 0.164  | 0.059   | 0.220     | 0.048    | 0.022  | 0.037    | 0.070  |
|    | Average                   | 0.605  | 0.859   | 0.480     | 0.365    | 0.346  | 0.429    | 0.364  |

Source: Results of the researcher

The biggest generated waste from the meat stall is 0.903 l / p / h. This is due to the large number of traders and buyers when compared to normal and smallest days 0.354 l / p / h. Garbage generation for fruit and vegetable kiosks 6.245 l / p / h and the smallest 2.150 l / p / h because there are not so many buyers and holidays. The largest gold shop waste generation is 0.168 l / p / h and the smallest is 0.012 l / p / h. The largest waste generation for clothing and footwear stores is 0.122 l / p / h and the smallest is 0.029 l / p / h. The occurrence of the largest restaurant house kiosk is 0.468 l / p / h and the smallest is 0.318 l / p / h. Garbage generation for daily material needs is almost evenly distributed from Monday...
to Sunday, the largest is 0.207 l / p / h and the smallest is 0.106 l / p / h. The biggest household waste increment is 0.0681 / p / h and the smallest is 0.0201 / p / h. The biggest electronic store waste generation is 0.0171 / p / h and the smallest is 0.0041 / p / h. The biggest stationery waste generation is 0.220 and the smallest is 0.022. This means the size of market waste is caused by the number of traders, the number of buyers and the activities carried out in the market. The longer the activity carried out in the market, the more waste is produced, and vice versa, the activities in the gold shop, clothing and shoes shop, household appliance kiosk, electronic shop and stationery shop are shorter and do not continue to produce more waste little compared to activities in meat kiosks, fruit and vegetable kiosks, restaurant kiosks and daily necessity stores.

Table 4. Lubuk Alung Market Determination Waste Recapitulation based on location, in Unit Weight and Volume

| No | Location          | Waste generation in a weight unit | Waste generation in a volume unit |
|----|-------------------|-----------------------------------|-----------------------------------|
|    |                   | kg/m²/h                           | kg/o/h                           |
| 1  | Meat              | 0.534                             | 0.095                             |
| 2  | Fruit and vegetables | 1.021                             | 0.132                             |
| 3  | Gold              | 0.069                             | 0.046                             |
| 4  | Clothes and shoes | 0.034                             | 0.046                             |
| 5  | Restaurants       | 0.359                             | 0.019                             |
| 6  | Daily needs       | 0.062                             | 0.099                             |
| 7  | Household appliances | 0.035                           | 0.012                             |
| 8  | Electronics       | 0.008                             | 0.016                             |
| 9  | Stationery        | 0.044                             | 0.017                             |
|    | Average           | 0.241                             | 0.053                             |

Table 5. Lubuk Alung Market Determination Waste Recapitulation

| No | Location          | Size (m²) | Customer (Person) | Waste generation in a Unit (litre/day) | Based on Size | Based on Customer | Average (litre/day) |
|----|-------------------|-----------|------------------|---------------------------------------|---------------|------------------|--------------------|
|    |                   | 126       | 840              | 5.762                                 | 726.012       | 725.76           | 725.88             |
| 2  | Fruit and vegetables | 864      | 8.320            | 15.32                                 | 13.236.48     | 4051.84          | 8.644.16           |
| 3  | Gold              | 168       | 420              | 0.707                                 | 118.766       | 118.86           | 118.818            |
| 4  | Clothes and shoes | 1.159    | 2.375            | 0.897                                 | 1.039.623     | 593.75           | 816.686            |
| 5  | Restaurants       | 384       | 1.600            | 0.625                                 | 240.000       | 320.000          | 280.000            |
| 6  | Daily needs       | 672       | 4.620            | 1.965                                 | 1.320.48      | 706.86           | 1.013.67           |
| 7  | Household appliances | 220    | 935              | 0.706                                 | 155.32        | 155.21           | 155.26             |
| 8  | Electronics       | 432       | 315              | 0.286                                 | 123.552       | 123.48           | 123.516            |
| 9  | Stationary shop   | 540       | 2.025            | 0.959                                 | 517.86        | 376.65           | 447.225            |
|    | Total             | 17.478.093| 7.172.41         | 12.325.215                            |               |                  |                    |

The results showed that the generation of Lubuk Alung market waste obtained on average daily yield in units of weight was 0.241 kg / m² / h or 0.053 kg / p / h while the generation in units of volume was 1.678 l / m³ / h or 0.326 l / p / h. This proves that the activities of traders and buyers affect the amount
of waste generation. The more activities of traders and buyers, the more waste is produced, and vice versa.

Overall the composition of waste produced in the Lubuk Alung market consists of waste from the remains of meat, fruit and vegetables, food scraps, and wood for organic waste components. Whereas for the component of dry waste consists of plastic, cans and glass.

Table 6. Lubuk Alung Market Composition Waste (Organic and Inorganic)

| Component waste               | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday | Monday | Average |
|-------------------------------|--------|---------|-----------|----------|--------|----------|--------|--------|---------|
| Vegetable and fruit           | 19.28  | 11.10   | 12.17     | 12.31    | 11.92  | 10.63    | 11.38  | 10.75  | 12.44   |
| Fish, chicken, meat           | 0.93   | 9.38    | 8.70      | 10.26    | 8.89   | 9.88     | 10.21  | 8.94   | 8.40    |
| Food waste                    | 21.36  | 32.78   | 21.07     | 32.69    | 31.39  | 25.81    | 26.38  | 27.25  | 27.34   |
| Paper                         | 27.13  | 27.14   | 26.78     | 22.59    | 26.67  | 29.97    | 28.88  | 26.94  | 27.01   |
| Total organic waste           | 68.69  | 80.40   | 68.73     | 77.85    | 76.87  | 76.28    | 76.85  | 73.88  | 75.19   |
| Plastic                       | 28.79  | 17.81   | 26.68     | 19.16    | 20.80  | 22.75    | 22.78  | 25.40  | 23.02   |
| Garbage                       | 1.22   | 1.79    | 4.25      | 2.65     | 0.00   | 0.59     | 0.37   | 0.36   | 1.40    |
| Glass                         | 1.30   | 0.00    | 0.34      | 0.34     | 0.33   | 0.37     | 0.00   | 0.36   | 0.38    |
| Total inorganic waste         | 31.31  | 19.60   | 31.27     | 22.15    | 21.13  | 21.13    | 26.12  | 26.12  | 24.81   |
| Total                         | 100.0  | 100.0   | 100.0     | 100.0    | 100.0  | 100.0    | 100.0  | 100.0  | 100.0   |

4. Conclusions

Waste generation in Lubuk Alung market in weight units is found that the average is 0.241 kg / m² / h or 0.053 kg / p / h while the generation in volume units is 1.678 litre / m³ / h or 0.326 litre / p / h. while that average determination waste is 12,325 m³/day. The composition of waste in the Lubuk Alung market is dominated by organic (vegetables and fruit, fish, chicken, meat) 75.18 % and while for inorganic waste (plastic, canned garbage, glass) 24.81 %. In accordance with SNI 19-3964-1994 waste generation and composition data needs to be reviewed at least every five years, so that in the Lubuk Alung market, solid waste planning, management and processing can be carried out in accordance with conditions and requirements. It is necessary to separate waste at the source to support recycling and composting waste processing.

References

[1] S. Efendi, Marsyah, B Brata, 2012. Strategy for Waste Management in Ampera Market, Pasar Manna District, South Bengkulu Regency. Naturalist Journal, Volume 1, Number
[2] J. Djafar, S Ainun, 2014. Identification of Waste generation at Caringin Bandung Market. Journal of the National Institute of Technology, Volume 2, Number 1.
[3] W Hermawati, Hartining Sri, et al. Waste management at the Sunggu Binasa Central Market, Somba Opu District. Alauddin Makasar State Islamic University.
[4] Statistics of Padang Pariaman Regency, 2010. Padang Pariaman Regency In Figures 2010. BPS Kabupaten Padang Pariaman
[5] A Ramadhani, Ahmad Perwira Mulia Tarigan. Study of Market Waste Management in Medan City, University of North Sumatra, Medan.

[6] E Damanhuri and Tri Padmi. 2010. Dictation of the Lecture on Waste Management, Bandung Institute of Technology.

[7] S Hadiwiyoto. 1983. Management and Utilization of Waste. Idayu Foundation. Jakarta.

[8] SNI 19-3964-1994. Concerning the Method of Collection and Immediate Measurements for Examples of Emissions and Composition of Urban Waste.

[9] Y Ruslinda, S Indah, W Laylani, 2012. Studi Timbulan, Composition and Characteristics of Domestic Waste, Bukittinggi City, Journal of Environmental Engineering Unand, Volume 9, Number 1.

[10] Sumiati. 2011. Traditional Market Environment Management Strategy Based on the Berseri Market Program (Case Study of the Semarang City Fur Market), Diponegoro University. Semarang.