Community behavior and single-use plastic bottle consumption

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Abstract. Since plastic is considered as environmentally hazardous material, various programs aimed at educating the community on the impact of plastics pollution and consumption have been continuously conducted. Furthermore, the relationship between culture and community behavior regarding single-use plastic bottle consumption is important to be investigated for mitigating plastics pollution. The purpose of the current research was to investigate the quantity of single-use polyethylene terephthalate (PET)-based plastic bottles are used daily and how communities are managing them in the waste stream. The data was collected from the family members of 100 households of various educational, social, economic, age, and lifestyle backgrounds. About seven local companies that work in plastic waste collection were also important participants in the data collection regarding plastics consumption. The study showed that almost 80 % of households reported one to four single-use plastic bottles consumed each day while the remaining 20 % used more than four single-use plastics bottles daily. From 88 respondents, only 10 % separated plastic bottles in their trash disposal. The result also showed that the increasing use of single-use plastic bottles are highly influenced by the behavior of the local community in plastics consumption and waste management.

Keywords: Environment, microplastics, plastic pollution, plastic waste, ragpicker.

1. Introduction

Many studies of plastics use and disposal have been conducted, and the negative impact of plastics on the environment have been explained in terms of removing plastics from the environment through recycling and recovery. In recent times, plastics have become ubiquitous in the environment, and the need to mitigate the impacts of plastics pollution has garnered increasing attention [1, 2]. Due to plastic’s durability as packaging for food and beverages and its relatively low cost, its production has increased in line with its consumption. This has resulted in the problems associated with its disposal and accumulation in the environment.

Indonesian society is very diverse economically and educationally. Community understanding of the dangers of plastics and plastics waste is not shared by all individuals. Communities living in urban areas tend to choose a practical lifestyle, and their food and beverage choices, using high volumes of disposable plastic packaging, support their daily activities. This causes the amount of plastic waste to
increase from year to year as the population and the number of new products using disposable plastics increases [3]. In 2016, almost a half of bottles has been collected for recycling but only 7 % of these bottles were transformed into new bottles after recycling. The rest was used as a raw material for making toys and low-value household items [4]. Most plastic bottles produced ended up in landfills or in the ocean. Food and beverage packaging industries are the dominant user of plastic products which almost accounts for 60 % use. Building and household appliances account for 15 %, the automotive sector, 8 %, with other sectors, including agriculture and horticulture, accounting for the remainder [5].

Single-use plastic bottles are an essential part of our society due to their being easy to carry, portable, strong, plentiful in size and shape, inexpensive, and easy to obtain. Most plastic bottles used for mineral water and other soft drinks are made from polyethylene terephthalate (PET) polymer-base material, which is highly recyclable. This type of plastic is recommended for single-use due to the risk of bacterial growth it poses if reused [6]. However, as their use has soared across the globe, since the start of attempts to reducing plastic pollution in the oceans by collecting and recycling the bottles [7], only 20 % of plastic water bottles have been recycled while the rest (80 %) have ended up in landfills [8]. Meanwhile, no other material has been able to replace plastic packaging in single-use, resulting in plastic packaging becoming a vital component in people's lives, undermining market shares of glass or tin.

The key to educating the public about plastics management and consumption is raising awareness of the direct impact of plastics pollution and the health risks of plastic itself. The durability of plastic causes its long-term accumulation in the environment. Furthermore, through their manufacturing process involving various chemical compounds, plastics have the ability to adsorb, release, and distribute pollutants to and from the environment [9]; plastics contamination occurs through degradation and the chemical leaching and fragmentation of macro plastic into micro plastic [1, 10]. Specifically, components of single-use plastic bottles made from PET such as bisphenol A (BPA), phthalates, and brominated flame retardants [11] pose health risks for humans.

Solving the problem of plastic waste in the environment by cleaning up or dumping plastic waste are not the best choices; recycling only increases carbon emissions. A more appropriate way to address the waste issue is to reduce the production and consumption of plastics, especially single-use plastics [13]. The fact that plastics are the least expensive packaging material in various industries should encourage governments to tax them to compel a reduction in their consumption. In 2002, Ireland became the first country to introduce a tax on plastics. Known as a “plastics tax,” this was found to reduce plastic bag consumption by 90 %. On the other hand, in Indonesia, with its exploding rate of bottled water consumption [13], government policy has had no significant impact in reducing single-use plastic bottle consumption. As noted in GBG Indonesia 2014, plastic consumption per capita has increased to over 17 kg yr⁻¹.

Studies on the relationship between people's consumption of plastics and the increase in the amount of plastic waste need to be done to mitigate the increasing pollution of plastic waste. One study that examined cultural factors in a local community’s collective behavior wrote that people's behavior in handling waste is strongly influenced by the habits of the majority, and the community’s level of education and employment, as well as age, types of television programs watched, and even types of social communities formed [14]. The purpose of this research was to further study the relationship between sociocultural influences on people's behavior toward plastics consumption and plastic waste management, using a survey-and-questionnaire distribution method, in order to mitigate the increased use and material waste disposal of single-use plastic bottles with PET-base material.

2. Method
In accordance with waste management law No.18/2008, the Indonesian Government stipulates policies and strategies for reducing waste and landfill space and for the handling of waste that is difficult to decompose naturally, such as plastic. However, the habits and lifestyles of the Indonesian community
are not supported by adequate facilities for waste handling; public awareness and education about the hazards of plastic waste are not adequately supported by government policies.

To obtain a real-time sampling of the consumption of single-use plastic bottles with PET-base materials, plastic garbage collection locations were surveyed, interviews were conducted with stakeholders who work as plastic waste collectors, and questionnaires were distributed to respondents of various ages groups, of similar economic and educational background. The aim of the questionnaire was to obtain data on the use and handling of single-use plastic bottles, wherein each respondent would represent the amount of consumption by one family of three to five members. The questionnaire consisted of ten questions divided into three parts, relating to background information, plastics consumption behavior, and plastic waste management. Most questions focused on single-use plastic bottles, the focus of this research. Stakeholders selected in the survey were plastic waste collectors who have worked in the industry for more than 1 yr and who have collected relatively large quantities of single-use plastic bottles. Each area in Semarang, Indonesia was represented by its own unique group of stakeholders. This was expected to provide an overview of single-use plastic bottle consumption by the surrounding communities and a fair estimation of the number of bottles that do not enter the global environment.

3. Results and discussion

Government intervention to reduce single-use plastic waste has already been attempted in Indonesia, including through education, facilitation, and some regulation; however, results have been less than expected [12]. The greatest obstacle to changing community habits and behavior with single-use plastics involves social culture. Therefore, to analyze people's behavior in the consumption of single-use plastic bottles, an investigation was conducted using questionnaires distributed to 88 respondents. From the 88 respondents, all of whom were of similar economic and educational background, and for whom age was the independent variable, the results showed (figure 1) that, in the age ranges of 25 yr to 35 yr and 36 yr to 45 yr, most respondents used around two to four plastic bottles per day, as supported by data seen in figure 3.2, where age was the independent factor.

![Figure 1. Single-use plastic bottle consumption by age group.](image)
A plurality of respondents (43.18%) said they used about two to four plastic bottles per day, with 36.36% using fewer than two pieces per day and 20.45% using more than four pieces per day. Results showed that almost 80% used single-use plastic bottles not more than four but not less than once per day in their households. For this study’s purposes, if one household consumed about four pieces per day or less for all family members, then, in the case of a family of three to five members, for example, each family member will be assumed to have consumed only one plastic bottle or less per day.

Figure 2. Number of single-use plastic bottles used per day by all respondents, by percentage.

One plastic bottle has an average volume of 330 mL to 500 mL. This volume is not sufficient to satisfy the daily hydration needs of the average individual; therefore, it can be argued, single-use plastic bottles are not needed to supply daily water needs. Hence, replacing single-use plastic bottles with reusable bottles can and should be socialized into, and practiced by, the community. Moreover, it can be concluded with certainty that consumption behavior patterns with single-use plastic bottles can be changed into those that are more environmentally beneficial [12].

The data for single-use plastic bottle consumption was supported by the survey results from seven respondents who work as plastic waste collectors (Pengepul sampah). Survey results can be seen in Table 1.

Table 1. Survey data of single-use plastic bottle consumption, obtained from seven plastic collection companies.

| Age of respondent (yr) | Age of plastic collector company (yr) | The most collected plastic waste | The amount of plastic bottle (kg day⁻¹) |
|------------------------|-------------------------------------|---------------------------------|---------------------------------------|
| 65                     | 27                                  | - Single-use plastic bottles    | 20 kg                                 |
|                        |                                     | - Plastic carrier bags          |                                       |
| 54                     | 20                                  | - Single-use Plastic bottles    | 100 kg                                |
| 35                     | 6                                   | - Single-use plastic bottles    | < 10 kg                               |
|                        |                                     | - Plastic carrier bags          |                                       |
| 27                     | 3                                   | - Single-use plastic bottles    | 300 kg to 400 kg                      |
|                        |                                     | - Plastic carrier bags          |                                       |
| 28                     | 3                                   | - Single-use plastic bottles    | 100 kg                                |
|                        |                                     | - Plastic carrier bags          |                                       |
| 69                     | 22                                  | - Single-use plastic bottles    | 100 kg                                |
| 25                     | 2                                   | - Single-use plastic bottles    | 400 kg                                |
Accurate analysis of single-use plastic bottle consumption must be supported by data from plastic waste collection facilities such as ragpicker (Pemulung). Through interviews with the seven aforementioned plastic waste collectors, the study showed that, on average, 100 kg of plastic waste per day is collected, mostly in the form of single-use plastic bottles with PET-based material. Most of these bottles are claimed from households, offices, and public areas (per ragpicker), and only a few are collected from households having separate plastic waste bins in their houses. This shows that public awareness regarding separating out plastic waste is still below expectation. Companies such as Ragpicker still do the bulk of the separation at the landfills.

4. Conclusion
To overcome the plastic waste problem, cooperation among all parties, including government and the private sector, is required. The most important aspect of the task at hand is to change the paradigm that the amount of environmental plastic waste, especially single-use plastic bottles, decreases in line with consumption of plastic itself. In fact, recycling and biodegradation processes ought to be the next focus in proper plastics waste management. For example, strategies to change community behavior from high consumption of single-use plastic bottles to more use of reusable plastic bottles, and introducing a plastics consumption tax, might be suitable solutions. Meanwhile, better community awareness programs about plastics consumption and disposal are warranted.

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