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Recycling Waste Practice in Campus towards a Green Campus and Promotion of Environmental Sustainability (Amalan Kitar Semula Sampah di Kampus ke Arah Kampus Hijau dan Promosi Kelestarian Alam Sekitar)

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ABSTRACT

A study has been conducted to determine the amount of recycle waste and the effective method of recycling management at Faculty of Engineering, Universiti Pertahanan Nasional Malaysia (UPNM) using the recycling bins system to reduce waste disposal at landfills. The primary data were collected through daily waste collection in Faculty of Engineering, UPNM. Several recycle waste bins have been located at specific areas to ease student and staff the throw the recycle waste. The result showed that the recycling bin system successfully recovered recycle waste item by 3 000 to 5 000 gram. Thus, it is believing that the implementation of waste separation at source can improve the current waste management system in UPNM and helps to support the sustainability and green campus environment campaign.

Keywords: Recycle; sustainability; Green Earth Campaign

ABSTRAK

Satu kajian telah dilakukakn untuk menentukan jumlah sampah kitar semula dan kaedah pengurusan kitar semula yang berkesan di Fakulti Kejuruteraan, Universiti Pertahanan Nasional Malaysia (UPNM). Tong sampah khas kitar semula telah di gunakan untuk mengasingkan sampah kitar semula mengikut jenis sampah. Ini bertujuan untuk mengurangkan pembuangan sampah di tapak pelupusan. Data primer telah dikumpulkan melalui pengumpulan sampah harian di Fakulti Kejuruteraan, UPNM. Beberapa tong samapah telah di disediakan di kawasan yang telah dikenalpasti dan sesuai untuk memudahkan pelajar dan kakitangan untuk membuang sampah kitar semula. Hasil kajian ini menunjukkan bahawa sistem tong sampah kitar semula berjaya mengumpul sampah kitar semula sebanyak 3 000 gm hingga 5 000 gm. Oleh itu, perlaksanaan mengasingkan sampah menggunakan tong samapah kitar semula dapat meningkatkan mutu sistem pengurusan sampah di universiti dan ini boleh menyokong kelestarian dan kempen bumi hijau.

Kata kunci: Kitar semula; kelestarian; Kempen Bumi Hijau

INTRODUCTION

Increasing in waste and pollution worldwide is a growing concern and can affect the environment in different ways. Statistically, the waste produced in Malaysia was 19 000 tonnes per day in 2005 and the amount increased to 38 200 tonnes per day in 2016 (JPSPN 2013). Food waste is a major component of waste produced and contains high organic compound. Due to unseparated waste, nearly 30%

of recyclable materials such as paper, plastic, aluminium, and glass are immediately disposed in the landfill. It is expected that Malaysians are projected to produce 16.76 million tonnes of waste in 2020 (Jasmin & E Kin 2019). In Malaysia, concern has been rising as many landfills hits their maximum capacity point (Aja & Al-Kayiem 2013). However, landfills are not sustainable solution due to rising cost, land scarcity, and other constraints.

In 2001, Ministry of Housing and Local Government re-launched another 3Rs programmed to improve the recycling rate in Malaysia. The objective of the program is to reduce the generation of solid waste by reduce, reuse, and recycle. A European Environment Agency 2013 report revealed that recycling rates are highest in Austria at 63%, followed by Germany (62%), Belgium (58%), the Netherlands (51%), and Switzerland (51%). It shows that Malaysia is very much behind compared with other developed countries. Malaysia should follow the footsteps of the people in developed nations where recycling has become a way of life.

Recycling is the method in which products are recycled and reused instead of throwing away as waste for a new production. Recycling eliminates emissions system in a good shape and sustainable for future generations. In addition, it benefits the economy by energy saving, natural resource conservation, and job creation. Waste sorting is one step towards recycling. The prelude to recycle is waste sorting. This is the phase where the general waste is removed from various material such as glass, paper, wood, metals, and plastic.

Comprehensive understanding on waste generation and composition will help on the decision making that will lead towards better disposal of solid waste in campus. An effective waste management system needs an accurate data on the generation and production of waste (Thenmozhi & Hameed 2014). It is necessary to upgrade a solid waste management system (SWMS) in campus based on the waste consistency, quantity, and composition.

Green campus campaigns should be supported by all campus community in universities. To support the campaign, Othman et al. (2020) has made preliminary research on the performance of constructed wetland to treat waste water in UPNM. The waste generation in UPNM is increasing from time to time, especially when there are occasions or events held such as programs organized by the faculty, academic affairs, administration, college etc. With the growing number of students in UPNM, the population of each faculty is significant and generate waste that causes adverse impact to the environment. Waste management in UPNM deal with about 150 kg of waste per day. By realizing the importance of preserving our environment, the recycling practices need to be adopted among the UPNM citizens. Besides that, it gives an opportunity to generate income for the organizing by practicing recycling. On the other hand, perhaps this will give positive impacts for the organization and have an influence in reducing the waste generation towards meeting the green campus life.

A few studies have examined the effectiveness of solid waste management system and providing baseline data on the solid waste for increasing recycling in campus (Tiew

et al. 2011; Elfithri et al. 2012; Mohd Rodzi et al. 2019; Utami et al. 2019). In particular, placing recycling bins around the campus greatly recovered the recycling item to reduce waste disposal at landfills (Tiew et al. 2019). However, many of these interventions require a good planning and expense that make them unattractive options for institutions with limited resources. Tiew et al. (2011) used 2-bins recycling system at Universiti Kebangsaan Malaysia (UKM) to reduce waste disposal at landfills. The results indicated that the system recovered 49.5% recycle items in the campus

This study was conducted in order to propose better handling and management alternatives for the generated MSW in campus. In addition, this study was conducted with the intention to provide baseline data to help in the improvement of solid waste management system.

METHODOLOGY

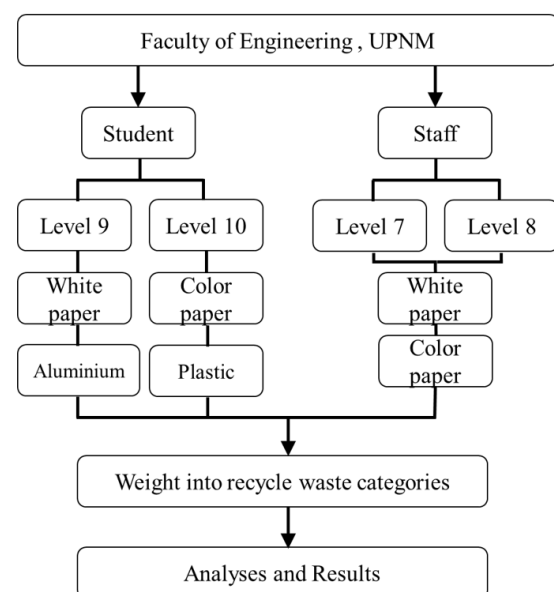


FIGURE 1. The methodology of the study using recycle bin system at Faculty of Engineering UPNM

The objective of this study is to investigate the amount of recyclables materials produced in UPNM. The study was conducted in the Bestari building of Faculty of Engineering UPNM. The main focus was in the student classroom level and main office. This study also helps to determine the effectiveness of recycling bin system as part of solid waste management. The recycle bin was used to collect the recycle waste in the Faculty of Engineering UPNM. Figure 1 shows the methodology used in this study. The recycle waste for each station consists of two bins for white paper and mixed paper at office. The bins were placed nearby a printer machine area in the main offices at Level 7 and 8

for administration staff and lecturer easy access as shown in Figure 2. Another recycle waste stations were located at Level 9 and 10 near the lift area for students as shown in Figure 2. The stations consist of three bins for paper (white and color), aluminum can, and plastic. Each bin is labelled with different type of waste sticker. The information about the recycling also provided on the display board to help student on the separating the waste accordingly.



FIGURE 2. The recycle waste station at Level 7 and 8 located near printing machine in the office (left) and Level 9 and 10 located near the lift (right).

RESULT AND DISCUSSION

The analysis of the waste composition estimation was carried out to calculate the disposal rate for the recyclable waste in grams per day at the Faculty of Engineering UPNM. From the results, the recycle waste collection shows that the recycle bin system for recyclable waste collection is adopted by the staff, lecturers, and students since the rate of recycled waste collection is gradually increasing as shown in Figure 3. The highest waste collection in Week 1 for level 7 and 8 (for staff and lecturers) which was is 5 255 g. The highest collection is due to the introduction of the recycle bin at each of the level in the building. Meanwhile, the total collection of the recycling material at level 9 and 10 also show weekly increment. Level 9 and 10 show the average of 1 000 g collected recycled waste for the period of 6 weeks.

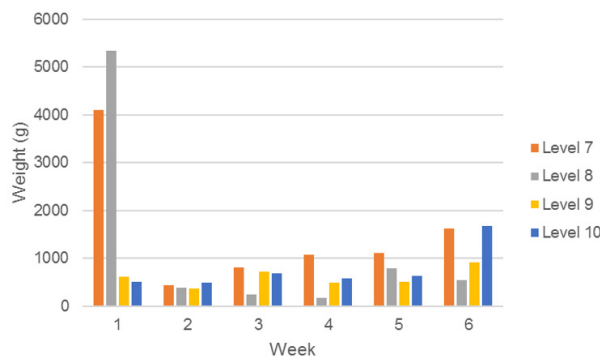


FIGURE 3. Recycle waste collection by week at Faculty of Engineering UPNM

Based on Figure 4, it was found that 87% of the recyclable waste collection at Level 7 is white paper, while 7% is mixed paper, 5% is plastic, and 1% is aluminium can. The similar amount of recycle waste collected at level 8 shown in Figure 5. More than 50% of the white paper collection is due to the usage of white paper in office among administration staff and lecturers.

The results from the recyclable waste collection at level 9 (Figure 6) show that 50% of the collection is white paper, while 6% is from aluminium can. The 20% of the mixed paper including food wrapping, new paper, and color paper. The plastic waste collection amount is 24% and most of the waste is from bottles and food wrappings. More plastic waste collection found at level 10 (38%) and other types of waste show nearly similar amount of collection shown in Figure 7. This result shows that the student at level 9 and 10 used less paper compared to staff level, but more plastic consumptions were found from student level.

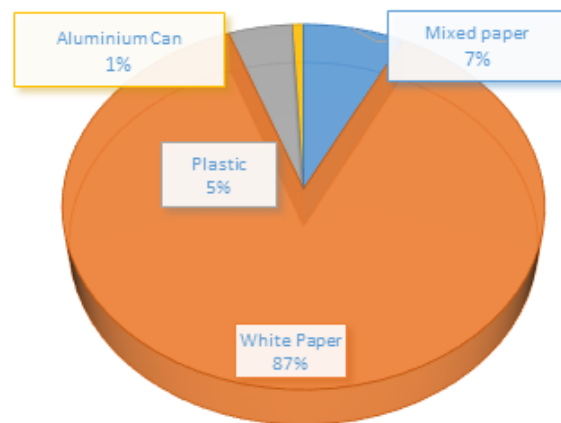


FIGURE 4. Recycle waste collection at Level 7 based on the types of waste

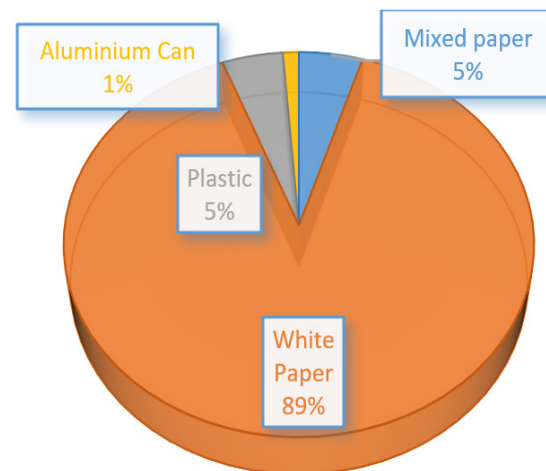


FIGURE 5. Recycle waste collection at Level 8 based on the types of waste

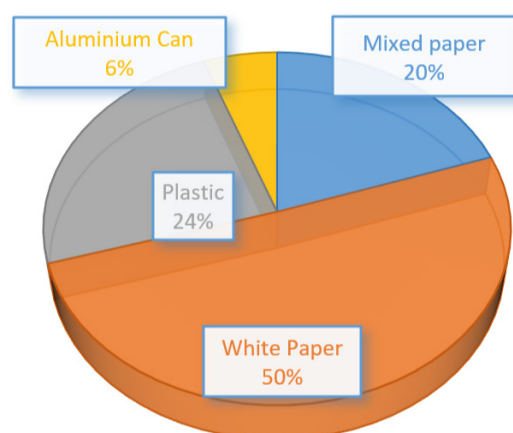


FIGURE 6. Recycle waste collection at Level 9 based on the types of waste

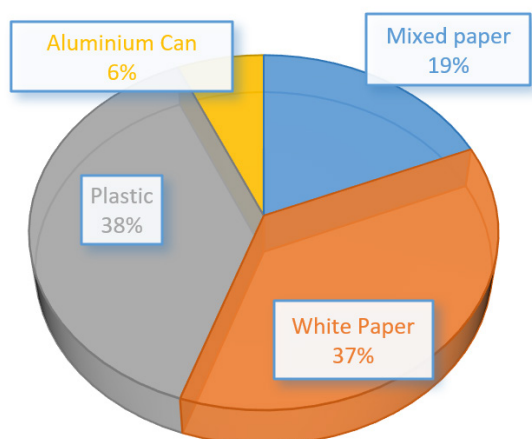


FIGURE 7. Recycle waste collection at Level 10 based on the types of waste

The recycle bin system could be a good option to ensure students and staff to separate the recyclable waste because many research showed that the compliance is increasing when recycle bins are placed closer to users (Duffy & Verges 2009). If the staff and students were ignorant, the institutions must either appoint staffs to separate the recyclable items from source or eliminate recycling program altogether.

CONCLUSION

The study has utilized the recycle bin system indicated a sustainable method of reduce and separation of waste disposal in faculty and university. The system will be proposed for better handling and management alternatives for the generated MSW in campus. The total collection of recycle waste from staff and students in Faculty of Engineering reached to 3 000 to 5 000 g per week. If the

recycle bin could be implemented in UPNM or other universities, at least most of the recyclable items could be diverted rather than dumping into landfill. Future studies on this program will promote an environmental behaviour among staff and students as an important step for UPNM toward “Green Campus”. In addition, this study was conducted with the intention to provide baseline data to help in the improvement of solid waste management system

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DECLARATION OF COMPETING INTEREST

None.

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