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THE POTENTIAL OF IMPLEMENTING FOOD WASTE COMPOSTING AT SOURCE USING BIOSENSE SCHEME

ROKIAH HASSAN[1], FADZILAH ADIBAH ABDUL MAJID[2] & AZMI AB. RAHMAN[3]

[1,2]Department of Bioprocess Engineering, Faculty of Chemical Engineering, Universititeknologi Malaysia, Johor, Malaysia

[3]Perdana School of Science, Technology and Innovation Policy, Utm Perdana School, International Campus Universititeknologi, Malaysia, Jalansemarak, Malaysia

ABSTRACT

The rapid growth of population leads to generation of waste especially in developing countries. Various strategies and procedures have been employed towards waste minimization but public behaviors remain unchanged. Recycling of food waste is one of practical solution to minimize waste at source since recycling is the highest level of waste management hierarchy, thus more preferable option rather than landfilling. This paper presents the potential of food waste composting at source using Biosense Scheme. The scheme introduced E-learning and Green Ambassador as the main tools of education for public towards waste minimization. The concept of fun learning features such as animation story, video presentation, pictures and testimonies triggers people to practice food waste composting. Green Ambassador as a role model inspired people to learn and understand the important of composting as part of conserving the environment. This paper describes the response of community in Seremban, Malaysia towards Biosense Scheme in promoting food waste composting. A survey for questionnaire analysis has been carried out to 231 respondents consist of students from primary and secondary schools, teachers, government staff, private staff and non-government organization (NGO) staff in Seremban. The survey activity supported by Heritage Biotech (M) SdnBhd, Seremban Municipal and Solid Waste Management and Public Cleansing Corporation, Malaysia. The significant factors such as demographic profile, knowledge and intention to practice composting were determined, as indicators of respondent's attitudes towards waste management in Seremban Municipal Territory.

KEYWORDS: Food Waste Composting, Green Ambassador, E-Learning, Biosense Scheme

1. INTRODUCTION

Population and urbanization growth have increased the standards of living and also waste generation. In most developing countries, improper waste management leads to various environmental issues such as fly production, bad odour, leachate and other bad possible effects (Salhofer et al, 2008). The changing of lifestyle is one of the factors contribute to the increasing of solid waste production as a result of changes in consumption habits as well as the increasing affordability of consumer goods.As one of developing countries, Malaysia is not excluded from having a high volume of municipal waste generated. It was reported that in 2003, the amount of solid waste generation per capita per day ranged between 0.5 up to 0.8 kg but recent past ranged had increase to between 0.5 to 2.5 kg, especially in the major city such as Kuala Lumpur and Petaling Jaya (Johari et al, 2014). As summarizing in table 1, it shows the quantity of solid waste generated per day among the states in Malaysia for period 1996 to 2009. Comparing the amount of solid waste generated

overall, we can see that there is an increasing pattern on the total solid waste generated for everyday as the year going up. In 1996, it was recorded that total waste generated is about 13,069 tons per day but in 2009, the amount was recorded more than two times the value recorded in 1996, which is27,283 tons per day. According to Tarmadi et al (2009), five factor that contribute to increase in Municipal Solid Waste (MSW) in Malaysia, that is due to population growth, rapid urbanization process, age structure population, and rapid economic growth.

As a fact, population in Malaysia during 1990 is 18.211 million and it continue to increase up to 29.716 million in 2013, which is threefold to the number of population as recorded in 1980 (13.833 million). It is expected to increase up to 70 million by year 2020. In year 1980, the Malaysian life expectancy was recorded at 68 years, while in year 2014, was increase to 74 years. As the number of population especially in urban areas and their expectancy continue to increase, thus it will led to higher amount of solid waste produce (Tarmadi et al, 2009).Pollution by solid waste and its management is an endemic problem that the municipal had tried to tackle over but not yet under control. Currently, most municipal use landfill method to dispose food waste where most of the sites are open dumping area (Manaf et al, 2009).

As shown in Table 1, food waste and organic material are found to have highest portion in solid waste generated in Malaysia which is ranged between from 32% to 68.4%. While reused and recycle product such as plastic, paper and glass contribute about 11.8% to 25.2%, 6.3% to 29.5% and 1.4% to 5.5% each. Food waste composting can be considered as one of the most suitable approaches for treating biodegradable waste components (Pereira Neto 1989, Green 1999, DSWA 1999). The application of organic compost onto soil will increase the amount of organic matter where can be used to restore and preserve the environment (Stentiford, 1987). In many municipalities, home composting is encouraged as part of policy that want to reduce the waste collection fee (Refsgaard 2010), to avoid greenhouse gas (GHG) emissions by a significant amount compared to land filling without energy recovery (Mohareb 2004). Moreover, composting produces useful by-product that can be used as soil conditioner which approximately 300 to 500 kg of compost can be produced from 1 ton of food waste (Brunt et al., 1985). Although there is a lot of benefit that can be gain from food composting, however statistics provided by MHLG shows that the demand for composting increase only at 1% after four years of proposed.

Table 1: The Material Composition of Municipal Solid Waste Obtained from Various Studies and Site[1] (Chua Et Al, 2001)

Components	2001[a]	2001[b]	2002[c]	2003[c]	2004[d]	2005[e]	2005[f]	2007[g]	2010[h]
Food waste & organics	68.4	32	56.3	37.4	49.3	45	47.5	42	43.5
Mix Plastic	11.8	16	13.1	18.9	9.7	24	NA	24.7	25.2
Mix Paper	6.3	29.5	8.2	16.4	17.1	7	18.5	12.9	22.7
Textiles	1.5	3.4	1.3	3.4	NA	NA	2.13	2.5	0.9
Rubber and Leather	0.5	2	0.4	1.3	NA	NA	NA	2.5	NA
Wood	0.7	7	1.8	3.7	NA	NA	4.41	5.7	NA
Yard wastes	4.6	NA	6.9	3.2	NA	NA	2.72	NA	NA
Ferrous	2.7	3.7	2.1	2.7	2	6	NA	5.3	2.1
Glass	1.4	5.5	1.5	2.6	3.7	3	NA	1.8	2.6
Pampers	NA	NA	NA	5.1	NA	NA	NA	3.81	NA
Other	2.1	1.9	8.4	5.3	18.2	15	21.93	2.6	1.8
Total	100	100	100	100	100	100	100	100	100

Note: NA - Not available.

This indicate that either the weakness of the knowledge and skill among the public about the potential of food composting or the policy itself. (Dinie and Mashitah, 2009). Thus it is necessary to identify core problem that influence the acceptance and practicality of food decompose among the Malaysian. Public basically has positive intention to participate in food composting if the opportunities, facilities, and knowledge on waste separation at source are adequately provided by representative local authorities (See Siwar, 2011 and Karim et al, 2013). Thus there are need to create, develop and test a new scheme in which can capture all these factors (opportunities, facilities, knowledge, good moral values and situational) so that we can change the culture and sustainably implement composting as a daily activity.

Biosense Scheme with two main components providesa potential method to educate public and school children with approachable and convenient techniques, where people will be guided by Green Ambassadors and 'BonusHijau' as one of Computer-Supported Collaborative Learning. Biosense Scheme will raise the citizens' awareness with regard to waste and to form new links and partnerships between community members, local authorities, and private sectors. This is different approach compared to recycling programme which traditionally imposed top–down by the municipal authorities without taking public response towards waste minimisation on particular components of its implementation, such as what method the community people are willing to practice, what will be the reward incentive system would be more attractive for them or what economic instruments would result to sustainable waste minimisation (Keramitsoglou, 2013).

2. 0 METHODS

2.1 Questionnaire Design

This analysis is conducted to investigate the effectiveness of Biosense Scheme in educating and its potential in changing their behavior toward food waste composting. Specifically, this study intends to capture the difference level of achievement of respondents their level of knowledge, perception and intention toward food waste composting before and after they joining the program. According to Dimitrov and Rumrill (2003), a randomized quasi experiment-one group pretest-posttest treatment design is appropriate to employed. The questionnaire for this analysis was divided into following section:

- **Section 1:** Demographic profile
- **Section 2:** Knowledge
- **Section 3:** Action
- **Section 4:** Perception on Biosense Scheme

2.2 The Data Collection

The analysis of this study is based on primary data collected recently during pre-test survey among respondents in Seremban. A total 15 questions was distributed to 231 respondents among students from primary and secondary schools, teachers, government staff, private staff and non-government organization (NGO) staff in Seremban area. This project involves the collaboration of Heritage Biotech (M) Sdn Bhd, Seremban Municipal (MPS) and Solid Waste Management and Public Cleansing Corporation (PPSPPA).

Table 2: Details on Respondents

Respondents	Ages	Total
1) Students		
a) Primary schools	11-12 years old	34
b) Secondary schools	13-15 years old	35
2) Government staff		104
3) Private staff	18 to 40 years old	23
4) NGO staff	> 41 years old	35
		N = 231

2.3 Case Study Selection

In Negeri Sembilan state of Malaysia, the Seremban district is estimated 485 tons of waste generated each day, 45% of waste product is compostable waste. Food waste composting at source offers the perfect solution to solve the large amount of dumped food waste as it prevents from being throw into landfill (Health and Environment Department, Seremban Municipal Council, 2012). Hence, with sufficient method it may enhance the implementation of food waste diversion, therefore local authority need to know the people acceptance before adopt it as a mandatory.

2.4 RESULTS

2.4.1 Respondent's Knowledge about Composting

Composting is one of the potential waste management elements to divert waste generated to landfill. The potential of practicing composting are huge as 70% of Malaysian wastes are wet waste, which not easily recycle as the dry waste. In Malaysia, the average components of MSW are quite similar with the largest categories consisting of food waste (45%), plastic (24%) followed by paper (7%), iron (6%) and lastly 3% for glass and others (Government of Malaysia, 2006).

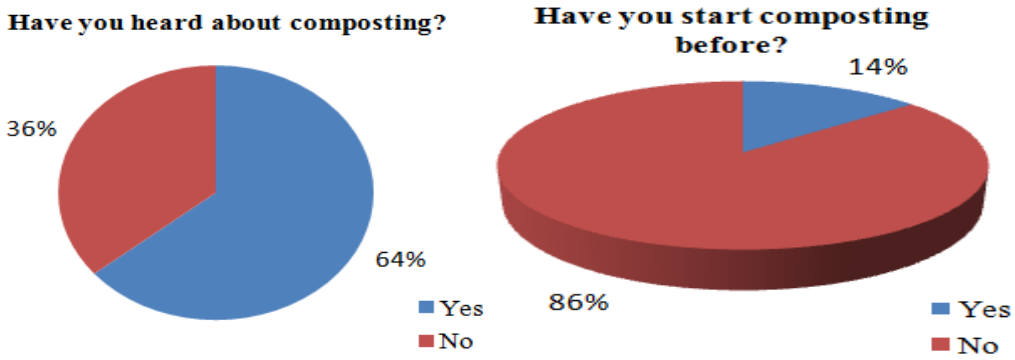

Figure 1: Knowledge on Composting

With regard to solid waste minimization, the respondents were asked about composting. According to Figure 1, the findings revealed that 64% of the respondent had heard about composting. Only 36% of the respondent never heard about composting either through formal or informal education about composting. Otherwise, about 86% of the respondents never start any composting activities before, while only 14% already start producing compost by their own or with guidance from others. The reasons given by those who already start composting states that composting are good for the environment, especially to those who willing to reduce amount of waste generates at home. For those who not practicing composting, few factors have been listed. According to Figure 2, more than 50% of the respondent agreed that bad odor of

food waste was the main reason people do not start composting. About 45 of respondents states there is no facilities to do composting are another main factors impeding on waste minimization. These results shows presented that they will do composting if the government provides the tools such as composting bin and accessories to keep and separate their household waste.

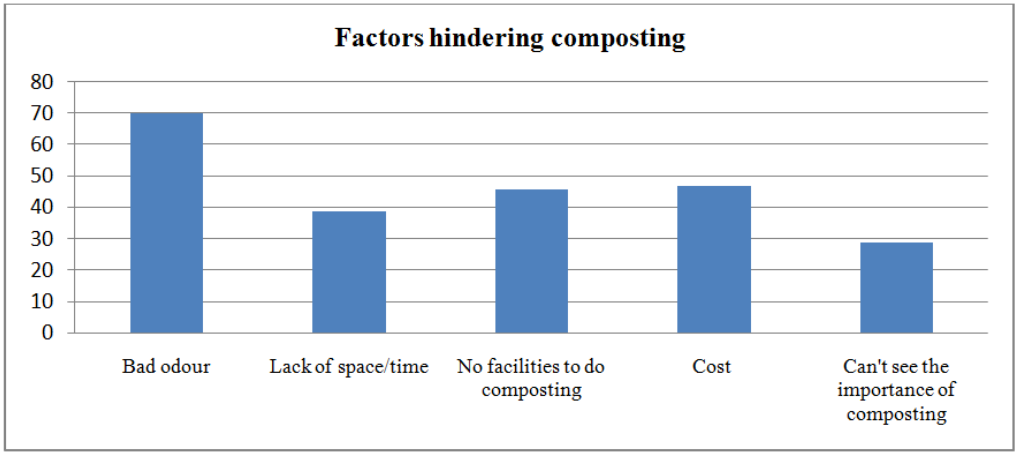

Figure 2: Factors Influences Composting

2.4.2 Factors Influence Process of Food Waste Composting

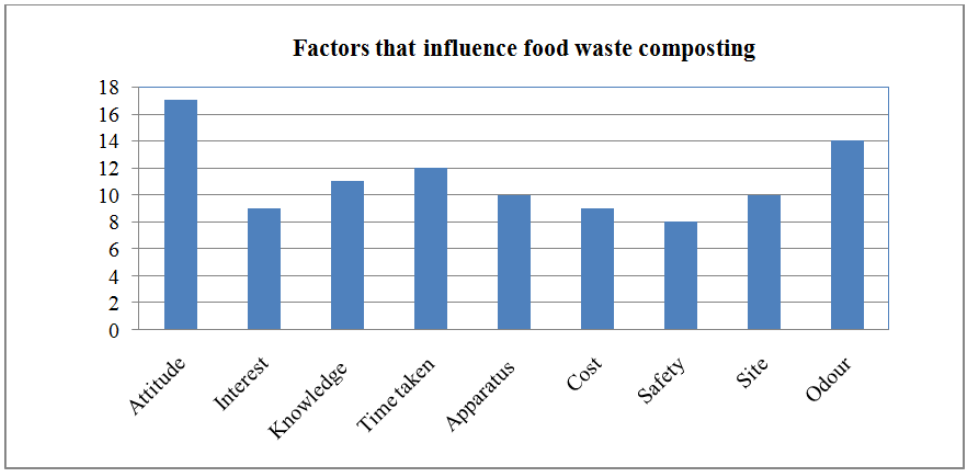

Figure 3: Factors Influence Food Waste Composting

Based on Figure 3, we can conclude that the major factors influence our respondent to do composting activity is their attitude towards environment (17%), odors that will come out during the process (14%), time taken for composting (12%) and their knowledge about composting (11%). In terms of attitude, Paengkaew et.al (2006) observed that majority of Asian students appeared to have lack of environmental consciousness and attitude needed to protect their environment. Therefore it is important to develop skills, awareness, and attitude and put in to practice. However, the stream of education especially for science students showing a significant difference on attitude which have learn on some chapters on environmental pollution and waste management in their course and therefore they are little aware regarding waste management.. Habit is the major challenge that we need to change to make sure people accept this new lifestyle. On the other hand, rest of the respondent claims that the cost, apparatus and safety during composting are the least affected factor

towards composting. While the factors such as composting site can be as the problem to those who live in an apartment, condominium or small houses without free lot.

People Acceptance towards Biosense Scheme

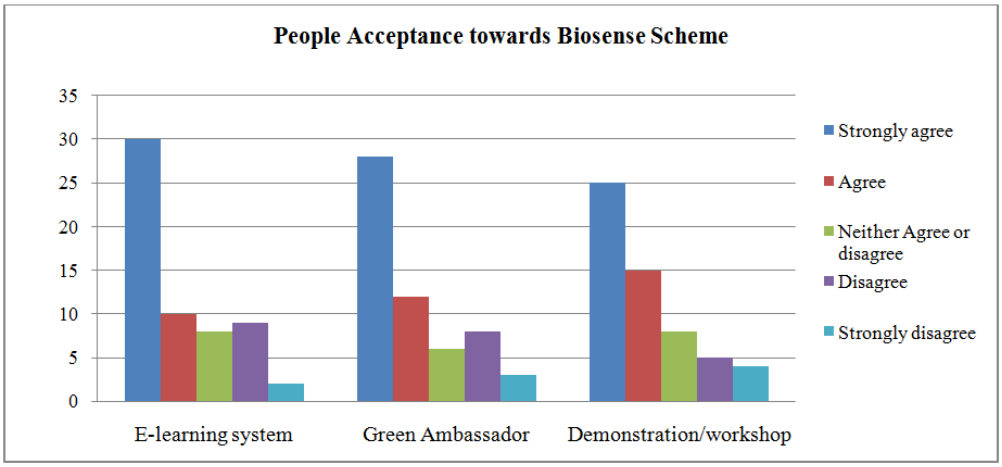

Figure 4: People Acceptance towards Biosense Scheme

Since 2012, Heritage Biotech had conducted various programs in order to encourage public community reduces their wastes by composting. The feedback from distribution of previous questionnaire was used to evaluate the acceptance towards activities under Biosense scheme. According to Figure 4, about 30 out of 100 respondents strongly agree that e-learning system through Bonus Hijau be as good tools to educate people on composting. Through e-learning system, Bonus Hijau has been introduced as the official website Heritage Biotech. This website provides the information regarding food waste composting, instead some animation provided stepwise on how to produce compost. Hence, most of school students who tends to know about composting can refer on Bonus Hijau as their reference.

Otherwise, the role of Green Ambassador (GA) is also preferred to create awareness of among school children on the importance of composting as more than 20 respondents strongly agree with this method. The important role of GA is to approach the target groups in order to trigger their attention towards food waste composting. A few respondents stand at disagree and strongly disagree with this approach GA approach. Thus, to approach our target group, program such as demonstration and workshop, hands on activity and buy-back program have been conducted to attract people's attention towards composting. During the demonstration and workshop session held by Heritage Biotech, almost all respondents gave the positive response towards the presentation and slideshow done by the Green Ambassadors. The workshop which has been held since 2012 include briefing about Recycle Bank, Food Waste Composting Demonstration to students and teachers and Bio Organic Garden implementation. During program of Recycle Bank, a briefing on recycling program has been held to encourage the students practice recycling of used materials (waste) into new products. This program is actually as an effort to support the reduction of waste to landfill by segregating the used materials at sources. The concept of this program is every student who recycle the used material needs to collect the point for each item and able to redeem with special prizes prepared by Heritage Biotech. Another program under this system is Bio Organic Garden Implementation which involved the implementation of Bio Organic fertilizers from composting food waste to plant and soil. This program involves the members of Science Club, Natures Club, Decoration & Hygiene Unit and Creative & Skill Association. Our GA will provide the plants, Bio Soil, Bio Organic fertilizers and also others apparatus for planting. The

steps to grow plants and seeds were taught and some tips and advice are given to take care of the plant until it grows well.

Otherwise, hands-on activity method has been applied to approach our school children. This is good to school students who prefer direct approach on how to produce compost properly, instead of listening and watching techniques. Indirectly, the participant can also learn about composting techniques more effectively by doing it themselves. Still, some of respondents are not agreed with the hands-on activity. Bad odor from collected food waste, dirty as well as not interested in composting could be the factors they refused for this approach. Thus, more efforts or improvements could be made to eliminate odor during composting by introducing new technology.

Buy Back program has been introduced since some people will not practice composting unless compost bring benefit to them. Through this program, Heritage Biotech will buy back the compost which has been produced by community and a "Bonushijau" point was given. With certain "Bonushijau" points collected, public can redeem attractive items, such as electrical appliances, IT gadgets, school items, sport items and communication device as a reward. Other than composting, Heritage Biotech also encourages community to recycling. Community can collect the recyclable items with minimum 30 kg to exchange for the "Bonushijau" points. Overall, public acceptance on this program gave positive responses agree with this program. Nevertheless, this program is good method to be carrying on in future encouraging people involve in composting activity.Based on the results obtained from this survey, it is necessary for government to make a prompt action in increasing public awareness about proper waste management for future generation. One of the main action is expose more on proper waste management through education sector (Blanchard, 1995), as most of Asian countries had already introduce environmental education at primary, secondary and tertiary levels (Sharmin, 2003).

2.4.4 Bonus Hijau Website

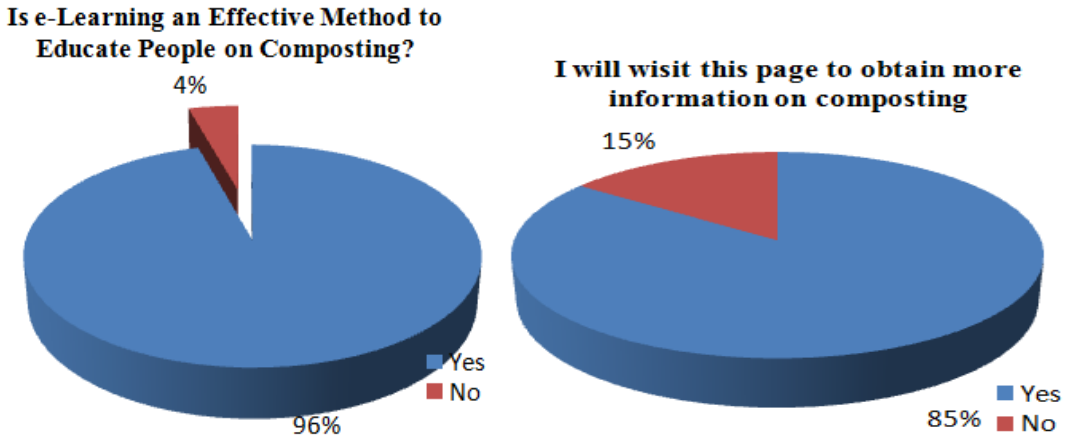

Figure 5 (a): Is E-Learning an Effective Method to Educate People on Composting

Figure 5 (b) I Will Visit This Page to Obtain More Information on Composting

E-learning is another new communication tools to improve the process of learning about new things. Another term same as e-learning includes online learning, distance learning, technology based training, web based training or computer based training. Under Biosense's scheme, Bonus Hijau had been introduced as the official website for the Green Sustainable project. According to Figure 5(a), about 96% respondents agreed that e-learning is an effective tool to educate public especially school children. Most of our respondents reveal Bonus Hijau is such an interesting website as various

informations can be obtained such as stepwise method on composting. The use of animation in Bonus Hijau about food waste composting capable to attract school children kept access this website for more information.

Otherwise, based on Figure 5(b), 85% of the respondents agreed to visit Bonus Hijau website to find more information about composting at anywhere and anytime. Hence, this website should kept updated and improve so that more people will aware of this website in future, as nowadays people tends to surf internet when they need to know something. However, approximately 15% of respondents refused to visit e-learning website for certain reasons which probably due to limited access to internet at home as well as schools.Several factors that cause e-learning is an effective method of education include the flexibility, convenience, accessibility, reduce the time as well as cost. Bonus Hijau website can be easy and quick accessibility anytime and anywhere where people can easily access various resources regarding food waste composting particularly in Bonus Hijau website. Additionally, publics also can get immediately feedback to their questions or problem regarding on food waste composting when using online services.

Figure 6 indicates the percentage of respondents who visits Bonus Hijau website in range of January to April 2013. The date reveals that most of our respondents are decided to visit the Bonus Hijau website after talk and demonstration is given. Hence, it shows that people actually want to know more about the food waste composting and learn it by themselves. However, more action must be made in order to promote this website to the public and to ensure more people are aware of this website to help them to getting started in food waste composting. On the other hand, approximately 15% respondents are refused to visit e-learning even after the briefing and demonstration of food waste composting. As mentioned before, most of our target respondents are school children, thus, it can be seen that no or limited access to the internet at home as well as school could be the main factor that they refused to visit the Bonus Hijau website.

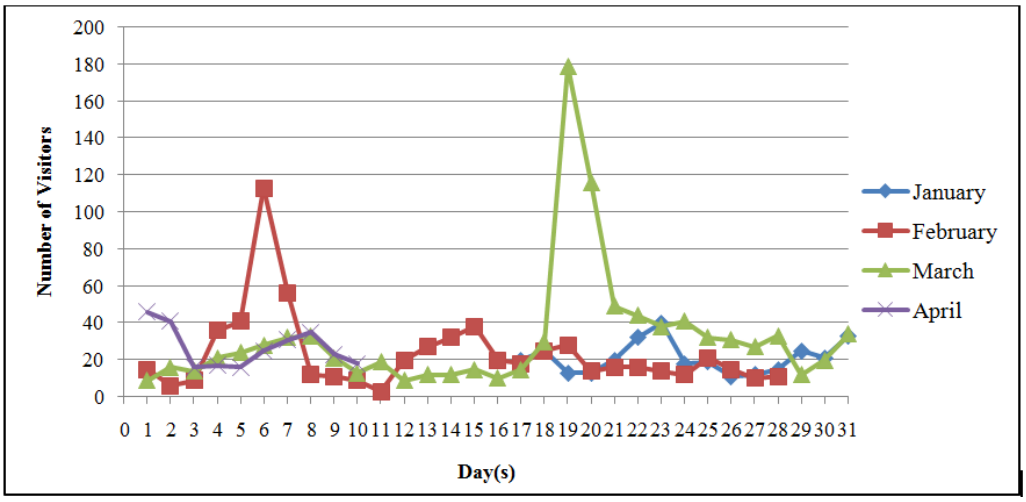

Figure 6: Monthly Website Visitors

Bonus Hijau website (www.bonushijau.com) has been developed to promote composting activity and also serve as the source of information to deliver knowledge about composting. The evaluations of the website visitor are started on 17th January 2013. This website is introduced and promoted to the community throughout road tour to school and demonstrate composting. Green Sustainable Project has been started on 17th January 2013 however the response of the teachers and laboratory assistant not very promising with 9 visitors. This might be the focus at that time was mainly on composting practice. On 30th January 2013 the webpage had received 29 visitors after visit to SK Seremban 2A. For the

following week, website had received 38 visitors result from the visit to the SK Taman Dusun Nyior. As can be seen, the website had vast number of visitors on 6th February 2013 with 113 guests. This number might be the response of the students after visit to SMK DatoShiekh Ahmad and shows that the students are welcomed eLearning very well. However there was overwhelming number of visitor on 19th and 20th March 2013 with 179 and 116 visitors respectively. The visitors' maybe comes from the students from SK Sri Kelana which Biosense team had made food waste composting demonstration a week before. Thus, this statistics reveals that public is capable to accept e-learning method as a tool to find more information about compost.

2.4.5 Green Ambassador (GA)

(i) Does GA help you during Composting?

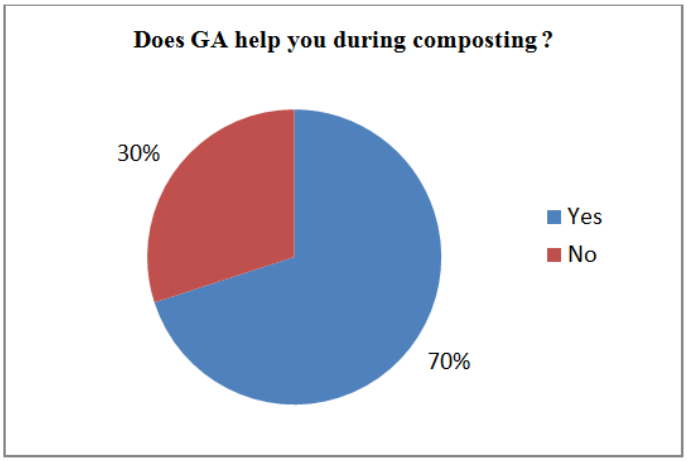

Figure 7: Role of Green Ambassador (GA)

According to Figure 7, 70% of our respondents agree that Green Ambassador (GA) helps a lot during composting. The role of GA helps to give information and educate schools students about the importance of conservation and preservation of environment through compost using food waste. During our visit to schools, GA has been assigned by students as a role model to practice green concept in environment. Students with better awareness towards social duty are more aware towards environmental awareness (Astalin, 2011).

(ii) How Often Do You Meet Your GA during Composting Program?

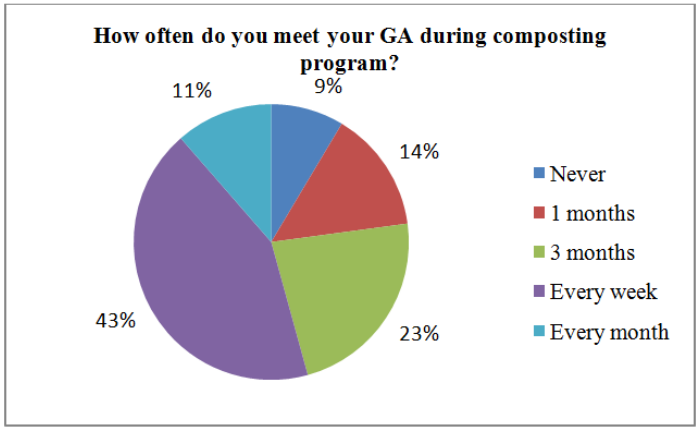

Figure 8: Frequency Meet Green Ambassador (GA)

Figure 8 shows the frequencies of school students meets the GA during composting activity program. The frequencies are based on scales never, 1 month, 3 months, every month and every week. According to this analysis, 43% of our respondents meet their GA for every week to update their results on composting activities. 23% of our respondents claims that meet GA for once in 3 months with possibilities not practicing the composting activities. But the higher percentage of our respondents meet GA for every week shows positively impact towards this system with high possibilities practicing composting.

CONCLUSIONS

According to this analysis, most of our respondent have not heard about composting before and have not start any composting activity. Most our respondent agreed to start composting and share this knowledge with others if all the facilities for composting process are provided. No facilities and lack of knowledge about proper technique are the common problem faced by most of the respondents refused to practice composting. In terms of the best method to promote food waste composting, our respondents agreed that hands on activity is more preferable, to get directly the proper method and procedures of doing and handling composting. In addition, Biosense Scheme with two main components, Bonus Hijau and Green Ambassador (GA) should be continuously pronounced to be as the medium in promoting composting to public community and school children.

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