



สภาพปัจุหะและแนวทางการจัดการมูลฝอยภายในมหาวิทยาลัยราชภัฏสุรินทร์

Problem Status and Managerial Proposals of Solid Waste

in Surindra Rajabhat University

Amnuay Wattanakornsiri^{1*}, Phinyo Jandaeng¹, Tongsai Jamnongkan² and Jakrigd Labkosa¹

บทคัดย่อ

งานวิจัยนี้เป็นการศึกษาสภาพปัจุหะ แนวทางการจัดการ และปริมาณ องค์ประกอบและลักษณะสมบัติ มูลฝอยในมหาวิทยาลัยราชภัฏสุรินทร์ ผลการศึกษาพบว่า มีปริมาณมูลฝอยโดยเฉลี่ย 302 กิโลกรัมต่อวัน และ อัตราการผลิตมูลฝอยเฉลี่ย 0.023 กิโลกรัม/คน/วัน ผลการวิเคราะห์องค์ประกอบของมูลฝอยพบว่า องค์ประกอบ ส่วนใหญ่เป็นกระดาษ ร้อยละ 37.49 พลาสติก ร้อยละ 24.95 ขวดพลาสติกรีไซเคิล ร้อยละ 23.88 และเศษอาหาร ร้อยละ 13.68

สภาพปัจุหะและแนวทางการจัดการมูลฝอย พบร้านักศึกษาและบุคลากรมีความรู้เรื่องมูลฝอยและการ จัดการในระดับปานกลางร้อยละ 53.76 สภาพความรุนแรงของปัจุหามูลฝอยในมหาวิทยาลัยฯ มีค่าอยู่ในระดับ ความรุนแรงมาก (4.19 ± 0.87) ความพึงพอใจในการจัดการมูลฝอยมีค่าอยู่ในระดับที่มีการดำเนินการมาก (3.74 ± 1.09) และความพึงพอใจในการมีส่วนร่วมของชุมชนในมหาวิทยาลัยฯ มีค่าอยู่ในระดับที่มีส่วนร่วมมาก (4.00 ± 0.96) เนื่องจากนักศึกษาและบุคลากรมีความรู้เรื่องมูลฝอยและการจัดการในระดับปานกลาง ความพึงพอใจ ในการจัดการและการมีส่วนร่วมอยู่ในระดับมาก แต่ปัจุหาด้านมูลฝอยยังอยู่ในระดับรุนแรงมาก ดังนั้น มหาวิทยาลัยฯ ควรมีโครงการอบรมให้ความรู้เรื่องมูลฝอยและการจัดการโดยเร่งด่วน

แนวทางในการจัดการมูลฝอยของมหาวิทยาลัยฯ ปัจจุบันยังมีปัจุหาที่ต้องปรับปรุงในด้านการเก็บ รวบรวม การคัดแยก (ภาชนะรองรับมูลฝอยต้องแยกประเภทเดิมๆ) การมีระบบบีไซเคิล การมีระบบกำจัดมูลฝอย (เตาเผา หรือการฝังกลบแบบถูกสุขอนามัย) นอกจากนี้ผู้บริหารมหาวิทยาลัยฯ ควรมีนโยบายสิ่งแวดล้อมที่ชัดเจน โดยเน้นแนวทางการจัดการมูลฝอยให้เหลือศูนย์ รวมถึงต้องส่งเสริมโดยมีการรณรงค์เพื่อสร้างความตระหนักร แก่ นักศึกษาและบุคลากร

¹Environmental Science Program, Faculty of Science and Technology, Surindra Rajabhat University, Surin, 32000, Thailand

²Department of Fundamental Science and Physical Education, Faculty of Science at Siracha, Kasetsart University, Chonburi, 20230, Thailand

*Corresponding Author, E-mail: amnuaywattanakornsiri@hotmail.co.th

ABSTRACT

This research aimed to study the problems, managerial ways, and quantities, compositions and characteristics of solid waste in Surindra Rajabhat University (SRRU), Surin, Thailand. The results found that there were 302 kg/d and 0.023 kg/c/d of the solid waste average quantity and production rate, respectively. The compositions were 37.49%, 24.95%, 23.88% and 13.68% of paper, plastic, recycled plastic bottle and food waste, respectively.

With regards to the problems and managerial ways of solid waste, students and staffs had the knowledge of solid waste and its management at medium level equal to 53.76%. The problem condition of solid waste was in the highest severe level at 4.19 ± 0.87 . The satisfactions in working performance and in university community participation of solid waste management were in high levels at 3.74 ± 1.09 and 4.00 ± 0.96 , respectively. However, students and staffs had the knowledge of solid waste and its management at medium level and the satisfactions of the working processes and participation were at high level, but the severe problem conditions were still at highest level. Therefore, SRRU should urgently have a training project about solid waste and its management.

The managerial ways of solid waste in SRRU need to be improved in terms of collection, separation (must have separate-type waste containers), recycling system, and solid waste removal system (incinerator or sanitary landfill). Besides, university administrators should distinctively create an environmental policy as zero-solid waste discharge and support campaigns for creating awareness of students and staffs in solid waste management.

คำสำคัญ: การมีส่วนร่วมของชุมชน องค์ประกอบของขยะ

Keywords: Community participation, Solid waste composition

Introduction

The increase of population and urbanization cause more solid waste, that is a source of environmental pollution (air, water and soil) including nuisance to public (Mehta, 2011). Presently, solid waste is one of the most visible environmental problems in Thailand. Solid waste management in Thailand is generally not effective because governmentally local organizations lack of

budget, personnel and knowledge in appropriate ways, and use inappropriately managerial technologies. They have normally used the methods of open-dumping and open-burning (Chiemchaisri et al., 2007). These improper management strategies create environmental problems including leachate flooding, aquatic system deteriorating, breeding of insects and rodent vectors and spreading of diseases (Saadat et al., 2012).

Besides, it is commonly established that an unscientific solid waste management or disposal is contributing to global warming (Talyan et al., 2007). Moreover, a limitation of expensive and unavailable land for disposal or landfill is due to land cost increasing and public protesting, respectively, as well as an absence of public behavior and awareness to manage solid waste is still exist (Chiemchaisri et al., 2007).

An educational institute, assumedly called a small-medium community, has a potential to develop an integrated waste management because there are lecturers and academicians who have more knowledge in solid waste management and environment when comparing with general people. They might have more awareness and opportunity to cooperate in solid waste management than other people in bigger communities. Especially, universities would drive their efforts towards responsibility in solid waste management. Many universities in industrialized countries have started to manage their solid waste at least 20 years ago; some of them have been successful in recycling and solid waste minimization (Armijo et al., 2003). For example, Brown University, Colorado State University and University of Florida could recycle their solid wastes at 31%, 53% and 30%, respectively. Besides, Rutgers University and Brown University could reduce an amount of solid waste by giving

their food waste to local farmers for feeding pigs and goats (De Vega et al., 2008).

Surindra Rajabhat University (SRRU), located in Surin Province, Thailand, is well known for its beautiful green campus and as an educational institution for local development. It consists of 12 lecture buildings, 14 office buildings, 3 demonstration school buildings, 2 cafeterias, 2 gymnasiums, 1 library building, 1 meeting hall, 4 dormitories and 99 staff houses. More than 13,000 people (about 12,000 and 1,000 people living in day and day-night time, respectively) live in the campus area. However, it is due to lack of a proper waste management plan and strategy, solid wastes are sent to a waste management company to eradicate and found to be scattered inside the campus. Therefore, it becomes necessary to manage solid waste of the campus in a scientific way. In the present study, we investigated the quantities, compositions and characteristics of solid waste, including the problem status and managerial proposals of solid waste management in SRRU.

Methodology

This research was done by data collection, sample collection and analysis, direct investigation, interview, and questionnaire. To analyze the problem status and solid waste management practice

including for the managerial proposals, the methodologies used were as the followings.

Data on present status of solid waste generation of SRRU, *i.e.* quantities, compositions and characteristics of solid waste, were studied in October 2012 for break-semester and February 2013 for open-semester by purposive sampling of solid waste containers from 6 sorting locations, *i.e.* staff apartment, student dormitory, cafeteria, office building, lecture building, and workshop building, using the conning and quartering process (Pollution Control Department, 2003). The sampling was carried out according to international standards, American Society for Testing and Materials (ASTM), ASTM D 5231-92 (ASTM, 2003). Each sorting sample was weighed to 30 kg and prepared properly, mixed, coned and quartered. Samples were then classified into four categories, *i.e.* paper, general plastic, recycled plastic bottle and food waste manually. Each material category was then weighed and registered in the data sheet. In addition, samples' moisture content was studied from the weight difference after oven-dried at 105°C for 24 h (Jilani, 2007). This research did not concern with hazardous wastes, *i.e.* chemical tube and bottle, chemical contaminant waste, filter paper waste and so on. Data on collection method, transportation and present solid waste management were studied by direct investigation and interview of related staffs.

Data on attitudes in solid waste management were studied by questionnaire. Population totally 13,027 people including lecturers and staffs, cleaners and students were randomized to be the sampling groups following the stratified random sampling method of Yamane (1967). They comprised 203 lecturers and staffs, 86 cleaners and 390 students (with totally 679 people) from the population of 412 lecturers and staffs, 112 cleaners and 12,503 students, respectively. The questionnaire was separated into 3 sections, *i.e.* general information, knowledge assessment of solid waste and its management, and satisfaction in working performance and university community participation of solid waste managment. Hence, the collected data were done through Statistical Program for the Social Science (SPSS) for the values of percentage, average, and standard deviation.

Results and Discussions

Present status of solid waste generation

It was found that solid waste was generated around 302 kg/d from 13,027 people in 6 different locations that the production rate was 0.023 kg/c/d as shown in Table 1. Solid waste generation in October 2012 was lower than that of in February 2013 owing to the period of break-semester in October.

Table 1. Solid waste generation at Surindra Rajabhat University

Month	Average daily solid waste generation (kg/d)	Solid waste production rate (kg/c/d)
October 2012	248	0.019
February 2013	356	0.027
Total average	302	0.023

Table 2. Composition, quantity and weight percentage of solid waste at Surindra Rajabhat University

Month	Solid waste composition	Quantity (kg/d)	Weight percentage (%)
October 2012 (Break-semester)	Paper	94	37.90
	Plastic item	52	20.97
	Recycled plastic bottle	69	27.82
	Food waste	33	13.31
Total		248	100
February 2013 (Open-semester)	Paper	132	37.08
	Plastic item	103	28.93
	Recycled plastic bottle	71	19.94
	Food waste	50	14.04
Total		356	100

For waste composition as illustrated in Table 2, paper was the highest proportion originating from 6 various locations. The quantity of plastic items, *ie* plastic bag, plastic glass and straw, on February 2013 was nearly double (98.09%) when compared to those of quantity generated on October 2012 because of the period of open-semester. In this matter, if the university administrators have a solid waste separation system a big amount of solid waste can be reduced because most of them can be recycled.

Generally, moisture content of solid waste is one of the key parameters that determine the possibility of waste treatment application, *eg* incineration, animal husbandry,

composting, landfill, and recycling. With regard to moisture content of solid waste in this study as illustrated in Figure 2, food waste had the highest moisture content up to 65.39% that it mainly consisted of abandoned rice, vegetable, and fruit peel. Therefore, this can be used for animal husbandry and generated into biogas for future perspectives. The recycled plastic bottle still had water left so it contained high moisture up to 45.26%. Besides, all proportions had high moisture content because there was no waste separation system, so the moisture could be transferred into each other composition. Therefore, the university administrators should suddenly create a solid waste separation system.

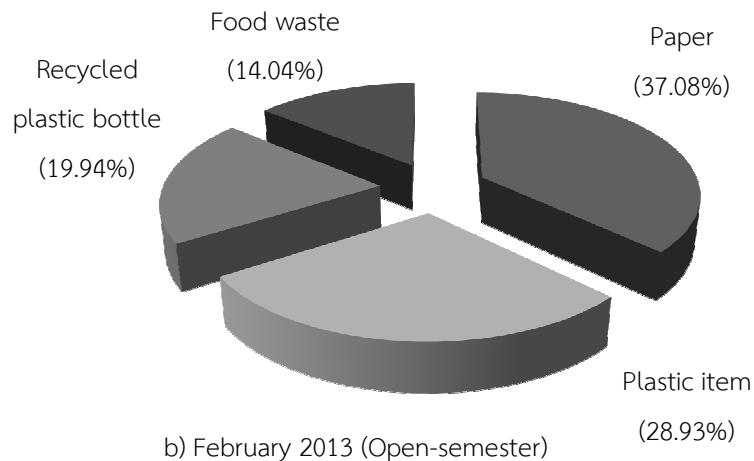
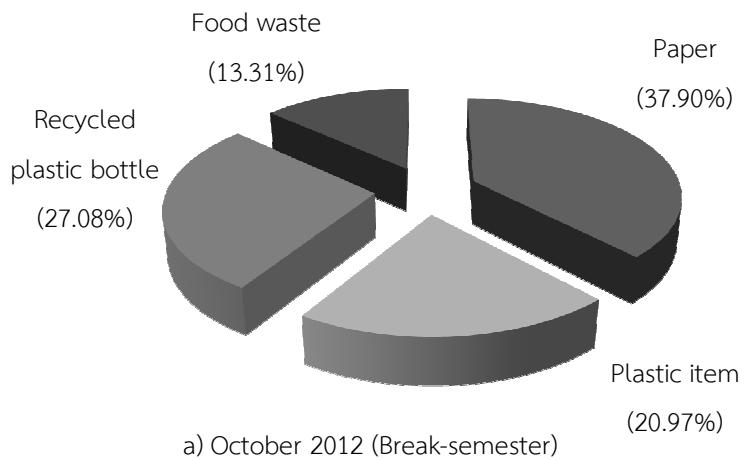


Figure 1. Weight percentage of solid waste at Surindra Rajabhat University

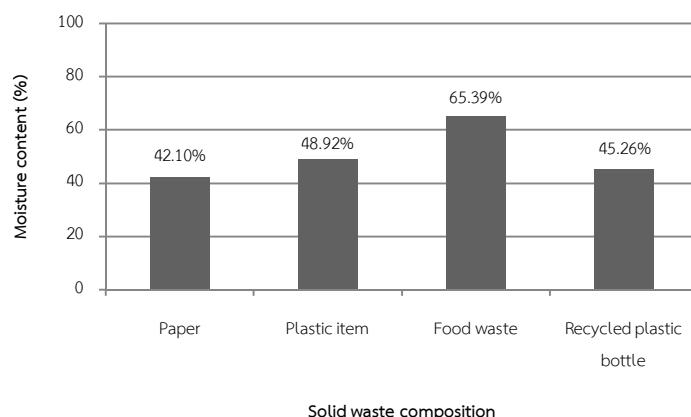


Figure 2. Moisture content of solid waste composition at Surindra Rajabhat University

Present status of solid waste management

There is no solid waste management strategy of SRRU at present. For the present status of solid waste management, it was found that the solid waste collection was the mixed refuse collection of both rubbish and garbage in the combinational containers comprising 120 dm^3 plastic bin, plastic basket and black waste bag, without solid waste separation. There were totally 6 staffs taking responsibility to collect and transport them every day except weekends. The transportation used one truck that has the loading capacity of 12 m^3 , collecting solid waste one round/d covering the university area from 08.00-12.00 am. After that, the collected solid wastes were transported to the solid waste collecting point, and there have been a waste disposal company taking them to landfill site.

Managerial proposals of solid waste management

From the questionnaire concerning the attitudes of solid waste management in SRRU, the results of general information showed that most questionnaire respondents were female totally 445 people (65.54%) and the rest respondents were male totally 234 people (34.46%) with totally 679 respondents. The results of knowledge assessment expressed that students and staffs of SRRU had the knowledge of solid waste and its management at 12.81%, 53.76% and 33.43%

of low (1-8 scores for 87 respondents), medium (9-12 scores for 365 respondents) and high (13-15 scores for 227 respondents) levels. Besides, full or excellent score respondents were 136 people (20.03%) who mostly were lecturers and staffs.

The results of satisfaction in working performance of solid waste management showed that most respondents expressed that there were the problems and the satisfaction of solid waste management at highest and high levels as the average values of 4.19 ± 0.87 and 3.74 ± 1.09 , respectively. The rating scales were 1.00-1.80, 1.81-2.60, 2.61-3.40, 3.41-4.20 and 4.21-5.00 were lowest, low, medium, high and highest severe levels, consecutively. The problems of solid waste management were of highest severe level in bad smell (4.23 ± 0.88), aesthetic (4.27 ± 0.76), solid waste container place (4.25 ± 0.84), germ hosting (4.25 ± 0.85), leachate (4.23 ± 0.90), drainage obstruction (4.24 ± 0.82), inadequate quantity of solid waste container (4.31 ± 0.79), and disarrange disposal (4.27 ± 0.84), and of high severe level in mixed refuse disposal (4.14 ± 0.92), public area disposal (4.07 ± 0.93), non-regular collecting system (4.07 ± 0.93), and lack of solid waste management policy (4.00 ± 0.94).

In addition, the rating scales of satisfaction of solid waste management were 1.00-1.80, 1.81-2.60, 2.61-3.40, 3.41-4.20 and 4.21-5.00 were lowest, low, medium, high and highest performance levels, respectively. All

satisfactory items were in the high performance levels that were separated solid waste container (3.81 ± 1.08), separated refuse disposal (3.77 ± 1.06), enough quantity of solid waste container (3.70 ± 1.01), sanitary removal (3.78 ± 1.02), solid waste separation (3.76 ± 1.08), solid waste recycle (3.75 ± 1.07), better incinerator providing (3.54 ± 1.31), better close-truck providing (3.71 ± 1.13), better public campaign providing (3.76 ± 1.05), and better public knowledge and suggestion providing (3.77 ± 1.0).

With regards to the university community participation of solid waste management, there was the satisfaction at high level as the average value of 4.00 ± 0.96 . The rating scales were 1.00-1.80, 1.81-2.60, 2.61-3.40, 3.41-4.20 and 4.21-5.00 were lowest, low, medium, high and highest participatory levels, consecutively. All satisfactory items were in the high participatory levels that were reuse and recycle (4.02 ± 1.01), problem information following (3.97 ± 0.99), solid waste management participation (3.92 ± 1.04), solid waste management prototype (4.01 ± 0.92), regulation maintaining (4.04 ± 0.91), student instill (4.08 ± 0.91), opinion expression (4.02 ± 0.93), planning participation (4.03 ± 0.94), and donation in solid waste management (3.91 ± 1.03).

Most of students and staffs of SRRU had the knowledge of solid waste management in medium level and knew that

there were the solid wastes problems, *i.e.* aesthetic, solid waste container place, inadequate quantity of solid waste container, disarrange disposal and so on. On the other hand, they had satisfactions in working performance and university community participation of solid waste management in the average high levels because most respondents who got full or excellent scores implying having highest knowledge were lecturers and staffs but students still lacked of enough knowledge in solid waste management. Then, university administrators should have a training project giving knowledge in solid waste and its management to students, and support them to have more participation including instillation for solid waste management and environmental conservation.

Additionally, from direct investigation and interview of solid waste collecting staffs and cleaners there should have necessitous measures, *i.e.* separation system of solid waste (garbage, rubbish, recycle and hazardous waste) covering all buildings inside SRRU, and promotion of separated solid waste disposal for efficient management. Because SRRU removed the collected solid waste by sending to a waste management company there should be a solid waste removal system, *e.g.* incinerator or sanitary landfill.

Conclusions

This research showed that the daily generation of solid waste in Surindra Rajabhat University (SRRU), Surin, Thailand was about 302 kg and the production rate was 0.023 kg/c/d, as well as the main composition was paper (37.49%). Most of questionnaire respondents, *i.e.* students and staffs of SRRU, had the knowledge of solid waste management in medium level equal to 53.76% and knew that there were the solid wastes problems. However, they had satisfactions in working performance and university community participation of solid waste management in the average high levels but they still lacked of enough knowledge especially students in solid waste management. Hence, SRRU administrators should have an integrated solid waste management system and strategy, including training projects giving knowledge in solid waste and its management to students and supporting students to have more participation in instillation of solid waste management and environmental conservation.

Acknowledgements

This research was financially supported by Surindra Rajabhat University. We also acknowledge administrative boards of Faculty of Science and Technology for consulting and providing experimental equipments, and students of Environmental

Science Curriculum, Surindra Rajabhat University for collecting data of this research.

References

ASTM. (2003). Standard test method for determination of composition of unprocessed municipal solid waste. ASTM International Standard, 5231-5292.

Armijo, C., Ojeda-Benitez, S., and Ramirez-Barreto, E. (2003). Mexican educational institutions and waste management programmes: a university case study. *Resources, Conservation and Recycling* 39: 283-296.

Chiemchaisri, J., Juanga, J.P., and Visnanathan, C. (2007). Municipal solid waste management in Thailand and disposal emission inventory. *Environmental Monitoring and Assessment* 135: 13-20.

De Vega, C.A., Benitez, S.O., and Barreto, M.E.R. (2008). Solid waste characterization and recycling potential for a university campus. *Waste Management* 28: S21-S26.

Jilani, S. (2007). Municipal Solid Waste Composting and its assessment for reuse in plant production. *Pakistan Journal of Botany* 39: 271-277.

Mehta, P. (2011). Analyzing the Problems and prospects of solid waste management, its handling and legal dimensions in Indian context. *Research Journal of Pharmaceutical, Biological and Chemical Sciences* 2: 958-969.

Pollution Control Department. (2003). Reducing and utilizing municipal solid waste. Source: http://www.pcd.go.th/info_serv/waste_municip.html. Retrieved 2 August 2012.

Saadat, A.H.M., Parvin, F., Alam, A.T.M., and Kamal, A.K.I. (2012). Status of solid waste generation

at Jahangirnagar University Campus. *Journal of Environmental Science and Natural Resources* 5: 187-191.

Talyan, V., Dahiya, R.P., Anand, S., and Sreekrishnan, T.R. (2007). Quantification of methane emission from municipal solid waste disposal in Delhi. *Resources, Conservation and Recycling* 50: 240-259.

Yamane, T. (1967). *In Elementary Sampling Theory*. New Jersey: Prentice-Hall, Inc., Englewood Cliffs.

