

Plastic Pollution: Issues Pertaining to Developing Countries in Asia

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Abstract

Plastic pollution is a global problem and scientists are still finding solutions for plastic pollution, however, they are not still finding some effective solutions. In developing countries, Myanmar, Thailand, and Vietnam held many campaigns to reduce plastic pollutions but they could not control the plastic pollution problem. In this research, ways to reduce plastic pollution, estimated loss of Myanmar plastic companies by banning plastic product productions, plastic recycling usage of Myanmar people and some reasons for using plastic issues of human being are studied. Plastic wastes are filling on land and oceans and even air pollution can be caused when they were burned. The objective of this study is the management and controlling of issues in the developing countries in Asia caused by plastic pollutions. The information was collected from two countries, China and Myanmar. The respondents are divided into three groups: China students, International students of Northeast Normal Universities and Myanmar Students. Reduce, Reuse, Restore, Rethink, Recycle, Replace and Refuse (7 Rs) were mentioned for controlling plastic pollution in this study. Two types of questionnaires were used as a methodology for collecting data, where the first one was “plastic knowledge questions” to know the percentage of knowledge of each respondent and the second one was “like and dislike” questions to know the percentage of their daily plastic usages. Results were showed that the government bans the plastic industries in Myanmar, the owners of industries will lose approximately 120,000 US\$ and this amount is just only loss for investment of machines and the compensation of industry workers will consider as loss of the industry owners. Out of 300 people according to their gender, 110 (36.7%) want to use cloth bags instead of plastic bags, 108 (36.1%) want to use paper bags and 82 (27.2%) prefer other materials to plastic materials. Out of 300 people, 0% of people are never using plastic issues 132 (44%) are always using plastic issues by their genders. Out of 300 people according to their ages, 0% of people are never using plastic issues and 110 (36.7%) are always using them. The research showed that the use of plastic materials is very familiar to people but they can be recycled in general and this research can be applied to all developing countries.

Keywords

Plastics, Plastic Waste, Asia Country, Plastic Pollution

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1. Introduction

The problems of plastic pollution are pervasive in the world. The governments, media and public that have the knowledge of the plastic pollution and environment sustainability of many different countries, have gained attention to the problems of the plastic pollution and they are trying to get the solution orientation for these problems. People are throwing plastic litter in the estimated amount of 8 million tons (Mt) through the world oceans [1]. In 1907, Leo Hendrik Baekeland, a Belgian-born American living in New York State started invention the plastic. The first plastic is synthesized with polymer, made from phenol and formaldehyde. Therefore, the present age of human era has been referred as the Plastic age. Plastics have the properties of stability and durability and they are flexible, light, cheap and convenient to carry things. People think that plastic is the necessary thing for packaging and single use. Thus, the demands of the plastic materials increased more and more depending on the human population. Now the plastic pollution becomes the major problem of the environment. The lifetime of the plastic issues are between the 20 years to 500 years according to their sizes and quality [1]. Plastic materials can take up to centuries or even more to decompose overtime it starts breaking down into the tinny debris by weathering processes and the pressure of the water [2]. Plastic wastes can be seen on the land. The wastes of the plastics become individually micro-plastics (MP) with the average diameter of < 5 mm [3]. The micro-plastic (MP) on the land threaten the soil biota. They can cause changes of soil habitats. Land pollution (the terrestrial pollution) can destroy natural property and persistence of soil and it becomes drivers of the environmental change [3]. This is very clear to see that the micro-plastic (MP) is dangerous to the micro-organisms, soil animals and plants. The plastic wastes shouldn't bury. The micro-plastic (MP), presented in the terrestrial environment is not good for the several potential consequences for biodiversity as well as for the human health and ecosystem health [3]. When plastic materials are burning, some toxic gases such as hydrochloric acid, sulphur dioxide, dioxins, furans, and heavy metals as well as particulates emerge to be air pollution [4]. Human can suffer many diseases such as heart diseases, cause rashes, nausea, headaches and cause damages to the nervous system, kidney and livers [5]. The micro-plastics (MP) leach into the water from the water bottles. The ubiquity of micro-plastics (MP) of all sizes in drinking water, surface water, ground water, tap water and waste water has raised the question if pollution of water occurs [6–8]. “Presence of Microplastics and Nanoplastics in Food, with Particular Focus on Seafood [8–10]. In the seas and oceans, the micro-plastics (MP) are readily ingested by marine organisms [11–15]. The micro-

plastics (MP) are directly swallowing the lives of marine animals. People are taking the micro-plastics (MP) by eating the sea-foods. When the terrestrial animals and marine animals ingest the micro-plastics (MP) and then they become our food as meat and seafood curries. So, people are eating their own plastic rubbish indirectly. After the impact on human by micro-plastics threaten the immune response systems of human [7, 8, 16]. By eating the micro-plastics (MP), people suffer from many diseases such as cancer, learning disabilities, poor memory, speech or language problems, deformations of the body, sexual development problems [16–18]. Most of the people have the knowledge of plastic pollution and micro-plastics (MP) and they know how to reduce the amount of plastic wastes by holding the Campaigns of NGO, NPO and some organizations and media of the world [19]. However, they cannot follow their knowledge with good consciences. They want to live their comfort zone by using the plastic materials. Human is very difficult to change his daily habit. So, it is very difficult to solve the problems of plastic pollution in land and oceans. In developing countries, especially Myanmar, they are controlling their plastic pollution problems by using the recycling techniques with many plastic recycling industries.

1.1. Sources of Plastic Pollution of Oceans

Since 1950, the total estimated amount of 8 billion tons of plastic materials has been produced [1, 19]. Among them, about 30% of plastics are still using, 10% of those has been incinerated and the remaining 60% (by the amount of 4900 Mt) has discarded on land, in the natural environment including oceans. The largest amount of plastic wastes reach to the oceans from the coastlines of Asia, mainly China and the United States (US) [1, 19]. The average amount in one third of the plastic wastes is mismanaged and the wastes of the plastics transfer to oceans. In 2010, the average amount of 8.3 million tons (Mt), (4.8 to 12.7 Mt) of the total plastic wastes transferred to the oceans. The plastic wastes come from river transport between 1.15 and 2.41 million tons (Mt) every year, corresponding between 9 to 50% of total plastic transport to the oceans [20]. Around 90% of this plastic input is estimated by only 10 rivers in the world [21]. In 2015, 46.7% of plastics becomes for packaging, 13.9% for textile and 12.3% for the consumer-institutional product sectors [1, 19]. The main reason of plastic pollution is the plastic bags. The plastic bags cannot be controlled to reduce using, to reuse and to recycle.

1.2. Plastic Bags with Different Raw Materials

The plastic bags are made by PP (Polypropylene), HDPE (High Density Polyethylene), MDPE (Medium Density

Polyethylene), LDPE (Low Density Polyethylene) and LLDPE (Linear Low Density Polyethylene). The plastic bags with PP and HDPE are high strength and they have higher melting points. The plastic bags with LDPE are softer, more flexible and they can melt at a lower temperature and they can be easier to destroy than the plastic bags with HDPE.

1.3. The 7 Rs for Reducing Plastic Pollution

Plastic pollution is the global problem nowadays. Many scientists, environmental conservationists, some organizations and governments of some countries are violently trying to solve this plastic pollution problem [22, 23]. People are very familiar with the using of the plastic materials. Since 1907, the plastic started inventing and so people have used the plastic materials for averagely 113 years [24]. Using of plastic issues becomes the habit of people. Even they know about the disadvantages of the plastic issues, they cannot change their lifestyle without using the plastic issues. The following 7 Rs for reducing plastic pollution are so easy to beat the plastic pollution in landfill and oceans. They are Reduce, Reuse, Restore, Rethink, Recycle, Replace and Refuse [25, 26].

1.3.1. Reduce

To reduce plastic pollution of the world, one of effective ways is "Reduce". How to reduce using the plastic issues, the other materials such as cloth shopping bags, paper bags should be used instead of plastic bags. The usages of disposal water bottle and disposal cups should be reduced by carrying your own water bottles and your own cups. The plastic bags are the main causes of plastic pollution in land and oceans. So, usages of disposal plastic bags should be reduced to sustain the land and ocean clean [27].

1.3.2. Reuse

All plastic materials can be reused to plant the trees, to decorate the room and some plastic materials are useful for domestic things in kitchens. After reusing plastic materials for many times, they are ready to decompose without supporting the more rates of plastic pollution in land and oceans [29].

1.3.3. Restore

Some plastic materials such as keyboards of computers, the plastic chairs and the plastic tables and so on can be restored. People prefer using new things to the old ones. The non-plastic materials cannot be challenge to the safe of the world, but the plastic materials are daily challenging to the health of the world. If there is no necessary to buy the plastic materials, people need to restore the plastic materials to reuse those things [30].

1.3.4. Rethink

"Rethink" is very important to tack the global problems of plastic pollution. Why do we use the plastic things? Can we live without plastic? Some people think that plastic is the convenient one of the packing system. The age of the plastic is about 113 years and before those years, people alive without using plastic materials. Nowadays, many people are participating to tackle plastic pollution problems, even if we can stop using the plastic materials, the old plastic wastes will still challenge to our world [31]. Plastic wastes are ready to place on the land and especially in the oceans. "Rethink" that before plastic materials on the world how people stay on the world without plastic.

1.3.5. Recycle

"Recycle" this is very popular to reduce plastic pollution. In Myanmar, they control their plastic wastes by recycling process. At some home factories, they collect the old plastic materials and they produce playing toys, plastic water bottles and some domestic materials again. By using machines, polyethylene (C_2H_4)_n balls and Polypropylene (C_3H_6)_n balls are produced with the recycling process [32]. Polyethylene and Polypropylene are also known as resins and they can aid to produce the new plastic things. If the rates of recycling weights of plastic and that of production rates of plastic is balanced, "Recycle" will be the effective one of reducing plastic pollution of the world [33]. At homes, people can recycle the plastic materials by several ways in planting, kitchens and playing time of children.

1.3.6. Replace

This is very easy to "Replace" the plastic materials with the other materials. In our surrounding, there are many things that can replace the plastic materials. At the place of plastic cups, glasses and ceramic cups are ready to replace and they cannot give the negative impacts to our surroundings. At the place of the plastic bags, the cloth bags and the paper bags are ready to do shopping with you. Your steel lunch boxes and your glass and steel water bottles are waiting for you to take care of your health without bad impacts of micro-plastic [34].

1.3.7. Refuse

Before we cannot solve plastic pollution problems, we should "Refuse" the use of plastic materials especially the plastic bags. There is very difficult to recycle the plastic bags. There is very few techniques to recycle the plastic bags to produce new things. Moreover, most of the people don't want to reuse and recycle the plastic bags because they prefer the new plastic bags to the old ones. To sustain the world environment and the health of the world "Refuse" to use the plastic is one of effective facts [35].

2. Materials and Methods

2.1. The Study Area

The first study place is the Northeast Normal University, Changchun, Jilin China, its latitude is 43.8620 °N and its longitude is 125.3314 °E. The second one is the Bago University, Bago Division, Myanmar, its coordinates are 17.2703 °N and 96.4726 °E. The Shwe Pauk Kan Industrial zones, Shwe Pauk Kan Township, Yangon, Myanmar, latitude and longitude are 16.9280 °N and 96.1872 °E, respectively.

2.2. Data Collection

Data were collected from 300 students that consisted of 102 males and 198 females. All students have the knowledge of the plastic pollution of the world. The number of female students was higher than the male students. The questionnaires were prepared in Appendix 1. The questionnaires were used to find the level of plastic knowledge in human and to collect their suggestions and their own ideas for replacing the plastic materials with other

materials. Based on the collected data, the students were grouped into different categories shown in table 3. The data for the loss of plastic industry by banning the plastic material productions were collected from the seven plastic industries of Myanmar by estimating the monthly salary of workers and the investment for the machines that produced the plastic materials and the 15 home industries of Myanmar. The estimated number of workers, the average salary and the average amount of Investments for machines are shown in table 2 and 3 to guess the loss of the plastic company when the government wants to burn all plastic industries.

3. Results

The researchers interviewed 7 plastic industries and 15 home industries in Myanmar to know the loss of their business when government banned their business to reduce plastic pollution. They give the estimated amounts of salary of workers and estimated amounts of investment of their machines that produce plastic products. But these amount can guess their loss.

Table 1. The statistical Data of Plastic Industries in Myanmar in 2019.

Name of Plastic Industry	Estimated Numbers of workers	Estimated Salary per general workers by US \$	Estimated investment amount for machines only by US \$
Main Stream	1500	137	684,461
M & E	1000	137	683,685
T & K	1800	144	1203,671
Utility Plastic	700	132	722,001
Myanmar	2000	144	1417,636
NLP	2000	144	962,668
Shwe Nan Daw	850	137	673,989

When the SME businessmen was interviewed, they gave the exact data and most of them forget the prices of their machines but they can give us the nearly amount of their machinery investment. The owners of 15 home industries was interviewed.

Table 2. The statistical Data of Plastic Home Industries in Myanmar in 2019.

Name of home Industry	Number of workers	Salary of workers by US \$	Estimated investment amount of machine by US \$
Hlaing	20	100	27,000
U Khin Mg Win	15	100	20,000
Pyit Time Htaung	18	100	27,000
Daw Maw	17	100	20,000
Win Pa Pa	21	100	30,000
T & G	15	100	20,000
U Thaug	25	100	35,000
U Khin U	20	100	20,000
Tha Zin	18	100	20,000
Hlaing Min	15	100	20,000
Htwe	15	100	20,000
Htun Htun	15	100	20,000
Zaw Gyi	12	100	20,000
U Ba Kaung	13	100	20,000
U Than	11	100	20,000

In this study, the researchers used 300 people, 102 are male and 198 are female. 120 are in age of under 20 and 180 are between 21 and 29 years old. Out of 300 people, equally 100 people are Chinese, International students of NENU, China and Myanmar.

Table 3. Demographic profiles of respondents of survey (Changchun, China and Bago City, Myanmar).

Variable	Categories	Number	%
Sex	Male	102	4.17%
	Female	198	63.60%
Age	< 20 years	120	40%
	21-29 years	180	60%
Nationality	China	100	33.33%
	International	100	33.33%
	M	100	33.33%

Out of 300 people according to their genders, 110 (36.7%) want to use cloth bags instead of plastic bags, 108 (36.1%) want to use paper bags and 82 (27.2%) prefer other materials to plastic materials, in figure (1-a). Out of 300 people according to their ages, 118 (39.4%) want to use cloth bags instead of plastic bags, 97 (32.3%) want to use paper bags and 85 (28.3%) prefer other materials to plastic materials, in

figure (1-b). Out of 300 people according to their genders, 77 (25.7%) have used plastic materials, 112 (37.4%) plastic bags and 111 (36.9%), plastic disposable cups, in figure (1-c). Out of 300 people according to their ages, 83 (27.7%) have used plastic materials, 108 (36%) plastic bags and 109 (36.3%), plastic disposable cups, in figure (1-d).

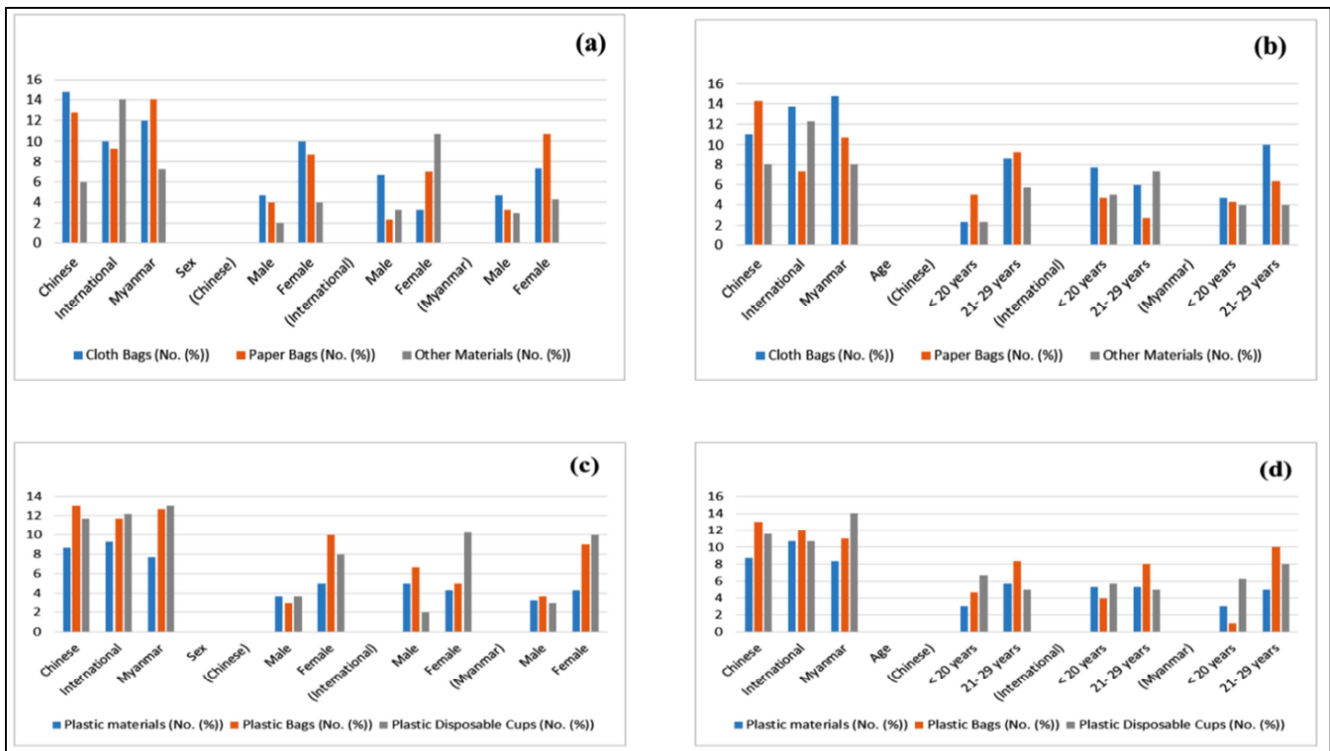


Figure 1. (a) Types of materials that suggested by respondents by gender (Changchun, China and Bago City, Myanmar), (b): Types of materials that suggested by respondents by age (Changchun, China and Bago City, Myanmar), (c): Types of plastic products commonly used by gender (Changchun, China and Bago City, Myanmar), (d): Types of plastic products commonly used by age (Changchun, China and Bago City, Myanmar).

Out of 300 people according to their genders, 0% of people is never using plastic issues, 22 (7.3%), 146 (48.7%), 132 (44%), are seldom, often and always using plastic issues respectively, in figure (2-a). Out of 300 people according to their ages, 0% of people is never using plastic issues, 46 (15.4%), 144 (47.9%), 110 (36.7%), are seldom, often and always using plastic issues respectively, in figure (2-b). Out of 300 people according to their genders, 143 (47.7%) of

people are never recycling plastic issues, 105 (34.9%), 25 (8.4%), 27 (9%), are seldom, often and always recycling plastic issues respectively, in figure (2-c). Out of 300 people according to their ages, 146 (48.6%) of people are never recycling plastic issues, 117 (39%), 21 (7%), 16 (5.4%), are seldom, often and always recycling plastic issues respectively, in figure (2-d).

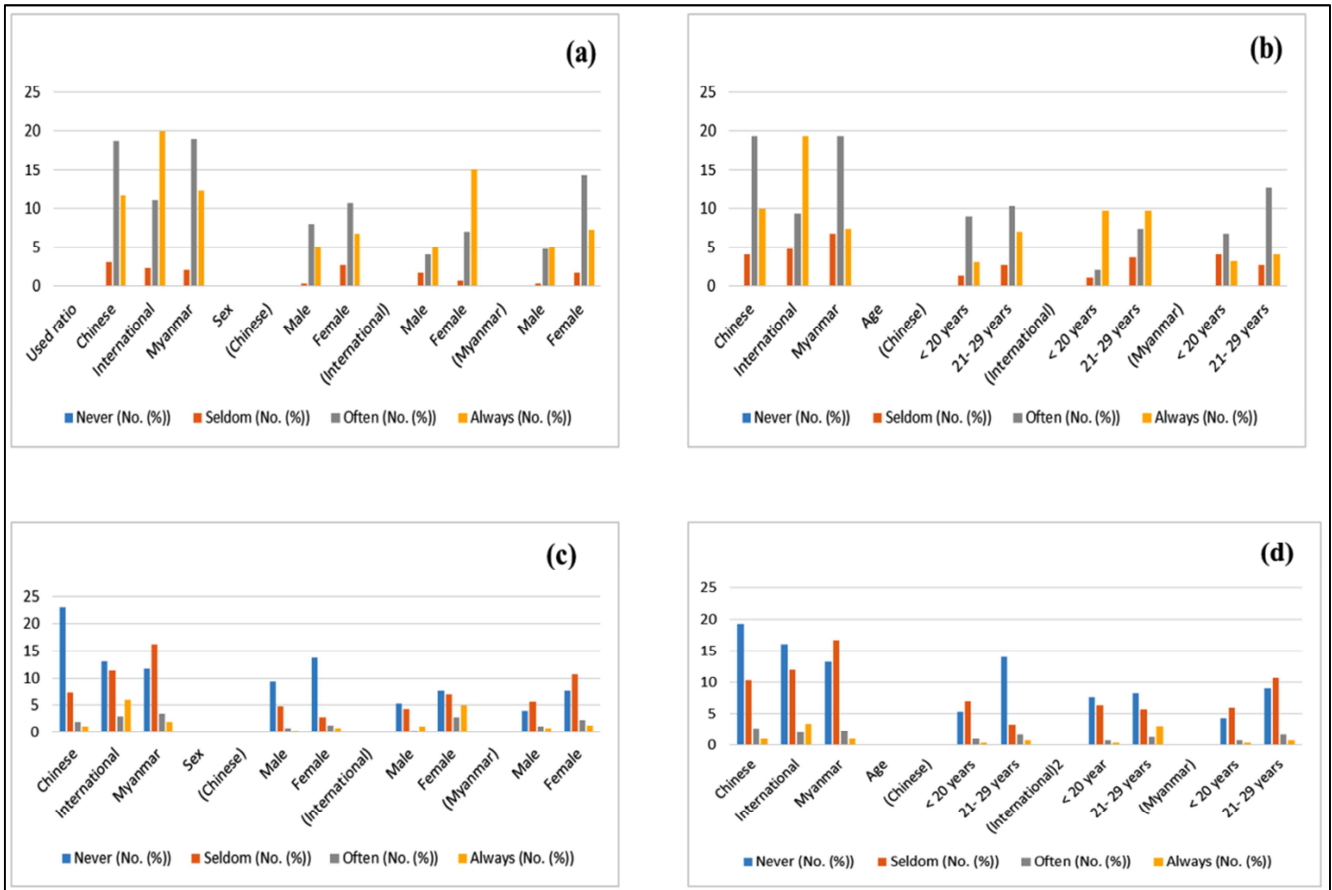


Figure 2. (a): Preference of the study population for and utilization of plastic bags by gender (Changchun, China and Bago City, Myanmar), (b): Preference of the study population for and utilization of plastic bags by age (Changchun, China and Bago City, Myanmar), (c): Factors attributed for widespread utilization of plastic materials by recycling by gender (Changchun, China and Bago City, Myanmar), (d): Factors attributed for widespread utilization of plastic materials by recycling by age (Changchun, China and Bago City, Myanmar).

Out of 300 people according to their genders, 28 (9.3%) are thinking that the most responsibility organization to control plastic pollution is Municipality, 22 (7.3%), 217 (72.2%), 27 (9.1%), 6 (2.1%), NGOs, Government, Environmental Agencies and themselves, respectively in figure (3-a). Out of

300 people according to their ages, 27 (9%) are thinking that the most responsibility organization to control plastic pollution is Municipality, 25 (8.4%), 205 (68.2%), 37 (12.3%), 6 (2.1%), NGOs, Government, Environmental Agencies and themselves, respectively in figure (3-b).

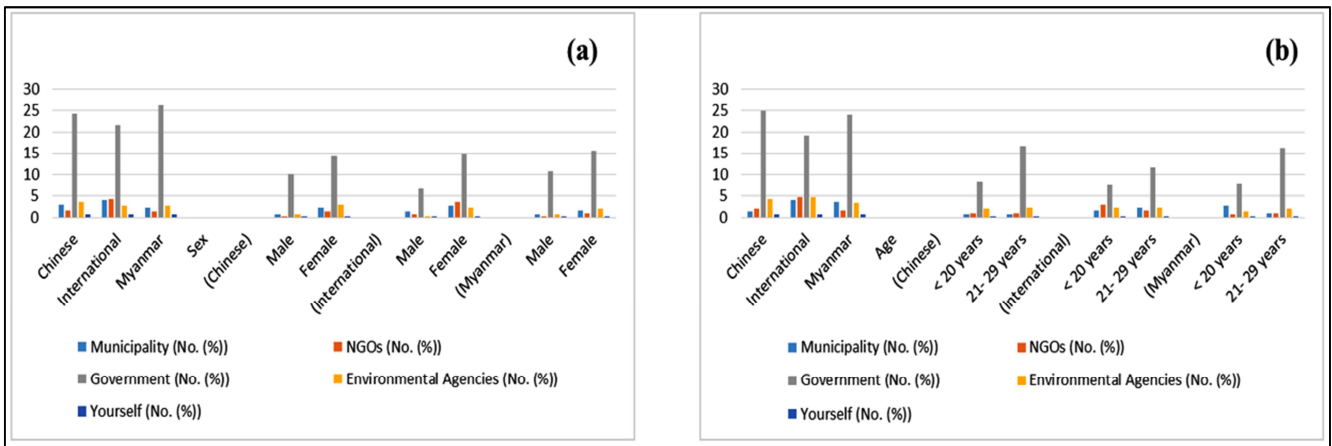


Figure 3. (a): The most responsible organizations to stop using plastic issues that answered by people by gender (Changchun, China and Bago City, Myanmar), (b): The most responsible organizations to stop using plastic issues that answered by people by age (Changchun, China and Bago City, Myanmar).

4. Discussion

The table 1 is shown some data of plastic industries in Myanmar. The estimated number of general workers are between 400~1000 people. In Myanmar, people are difficult to find jobs because it just only developing countries and it is just only poor country. The table 2 expresses only the investment for machines as table 1, without absolute investments such as the building cost and the courtyard areas. If the government bans plastic industries, the owners start losing their investment of machine. The building and the courtyard areas can use for the new business and the owners must pay the compensation to the workers. By observing the numbers of general workers, the benefits of their industries can be guessed. Plastic production industries need the low investment but they can get much benefit. In Myanmar, they are prior to the recycling plastic systems. Every day, 12000 tons of plastic materials can be recycled per one machine. The small industry has at least one machine for recycling. In Myanmar, the plastic pollution has been controlled by recycling plastic industries. Polyethylene (C_2H_4)_n balls and Polypropylene (C_3H_6)_n balls are produced by the recycling plastic industries in Myanmar and they export the resins to China. However the plastic bags are challenging to Myanmar every day. The plastic bags are very difficult to recycle and they are still aggregating in rivers and oceans. The table 3 is shown the information of home industries in Myanmar. There are a lot of home industries of plastic production in Myanmar. They used the old plastic materials to do playing toys. Every day, there are the average amounts of 120 tons per home industries for recycling. The owners of plastic industries hope that if they have the demands of their resins and playing toys, they can control the plastic pollution of Myanmar except plastic bags. The plastic bags are the major problems of plastic pollution in rivers and oceans in Myanmar.

Figure 1 (a and b) show the materials that suggested by the respondents. By the results of these tables, people have desire to replace the other materials instead of plastic issues and thus, the businessmen should invent demands of people. By figure 1 (c and d), plastic bags and plastic disposable cups are threatening to people more than the other plastic materials. The other plastic material can use by recycling again.

Figure 2 (a and b), show the preference of utilization of plastic materials. By the data, the respondents prefer to use the bags and they are very difficult to stop using plastic bags and there is no person who never use the plastic issues. Every person uses the plastic materials at his daily life. By figure 2 (c and d), the respondents don't want to recycle plastic materials because most people want to use things with new and bright color and no one wants to take old utensils when

they go outsidess and usage of plastic materials, especially, using of plastic bags becomes a habit of the people because the life time of plastic bag is more than 100 years. Plastic bags are easy to carry and to pack materials and people don't have habit to carry own bags, own lunch boxes and own bottles if even they have the knowledge that they should carry those materials. Most of the people want to ban plastic industries by the governments. By interviewing to Myanmar plastic industries, other plastic materials can be recycled to produce resins. However, plastic bags cannot easy to recycle and they are blogging along the rivers and finally they accumulate in the oceans to give negative impacts to human beings, sea creatures, land creatures and air creatures by changing micro-plastics (MP). By figure 3 (a and b), most of people want their respective governments to enact the strict law to stop producing plastic materials, especially, plastic bags. Increasing tax of plastic materials cannot solve plastic pollution problem of the world. By giving awareness to public, people can get the knowledge of plastic but they cannot abandon their habit with the use of plastic. Most people think that Government is the main responsible organization to stop using the plastic bags because they cannot deny not to use plastic bags when they see at supermarkets and shops. They are very familiar with the use of plastic bags and other plastic materials because of plastic properties such as light, flexible and comfortable.

5. Conclusion

The plastic pollution problem is global problem and it is daily challenging to the worlds. In Myanmar, they are facing the plastic bag problems and they are recycling the other plastic materials. The rivers and the oceans of Myanmar and other countries cannot sustain the water clean due to plastic bags. For the other plastic materials, the recycling technique can control plastic pollution problem. The results indicated that even people have the awareness of the plastics, they are very difficult to stop using the plastic materials because people are very familiar with usages of plastic issues, especially, plastic bags and plastic disposable cups and the using of plastic becomes daily habit of them. Among the plastic materials, plastic bags are challenging to the worlds. The oceans of the world are full with the plastic bags. The plastic pollution cannot still control and new plastic bags are ready to go to the oceans because of the people demands. Therefore, the government should enact the strict law to stop producing the plastic bags to the plastic bag industries. By studying Myanmar plastic industries, even the government ban to produce the plastic bags, their industries can run the producing of the other plastic materials by recycling old plastic materials. The plastic bags can be replaced with paper, cloth and wool bags.

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Appendix

Profile of respondent

Gender: Male _____ Female _____

Age: < 20 years _____ 20-29 years _____

Nationality: Myanmar _____ International Student _____ Chinese _____

Occupation: _____

Plastic Knowledge Questions

Please Circle the correct answer.

1. How much plastic is dumped into the oceans each year?

- A. 8 million tons B. 5 million tons C. 7 million tons D. 9 million tons

2. How long does plastic bag take to compose in water?

- A. 100 years B. 50 years C. 20 years D. 400 years

3. How long does plastic bottle take to decompose in water?

- A. 450 years-1000 years B. 600 years-1500 years C. 60 years-180 years D. 1800 years-infinity

4. How many marine creatures die from plastic straws?

- A. 1000,000 B. 100,000 C. 10,000 D. 1,000

5. Does plastic kill the birds?

- A. sure B. may be C. may not be D. impossible

6. Are plastic bags harmful to humans?

- A. sure B. may be C. may not be D. impossible

Questions for "Like or Dislike"

Please Circle the correct answer.

1. Do you take your own recycle bags to go to shopping?

- A. Always B. Often C. Seldom D. Never

2. Do you take your own bottles when you go to buy some drinks?

- A. Always B. Often C. Seldom D. Never

3. Do you take your own lunch box to buy food not to take the plastic bags and disposable box?

- A. Always B. Often C. Seldom D. Never

4. Do you want to use plastic materials by recycling?

- A. Always B. Often C. Seldom D. Never

5. Do you want to reduce using the plastic material in your daily life?

- A. Always B. Often C. Seldom D. Never

6. How many plastic bags do you use every day?

- A. fewer than 5 B. 5 bags C. between 5 to 10 bags D. a lot

7. How many single use plastic cups do you use every day?

- A. 1 B. 2 C. 3 D. more than 5

8. I think that I use plastic items and I don't like to replace the plastic items to other materials.

- A. Never B. Seldom C. Often D. Always

Suggestions of People

Please Circle the correct answer.

1. To stop using the plastic pollution, who is mainly responsible to do so?

- A. Municipality B. NGO C. Government D. Environmental agencies E. Yourself

2. Plastic materials are harmful to environment, human and also living organism. Therefore, do you want to stop using plastic bags and some plastic materials?

- A. Yes B. No

i. If you answer A. Yes, which materials do you want to replace with plastic materials?

ii. If you answer B. No, why do you want to use plastic?

3. Write your suggestions and ideas about effective ways of solving the problems of plastic on our environment.

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