ATTITUDE AND PERCEPTION ON THE DISPOSAL OF PHARMACEUTICALS AND PERSONAL CARE PRODUCTS IN MALAYSIA: A Pilot Study

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Abstract. Pharmaceutical and personal care products (PPCPs) are common products being used widely and easily accessible to everyone. While it is beneficial for human use, the adverse effects once introduced to the ecosystem are alarming. Studies also show that PPCPs penetrated the surface water bodies. Numerous studies have proven that the occurrences of PPCPs especially in the water bodies have given substantial effects towards animals especially those associated with water. This trace has changed the physical features of the animals and has significantly reduced the amount of the species at the area. Even though the amount of PPCPs being introduced to the environment increasing based on the usage by consumers, a lot of studies have been carried out to remove the PPCPs from the environment using advanced technologies. Considering the feasibility of the technologies to be implemented, most of these novelties are yet to be installed in the water treatment plant due to its installation cost, maintenance fees and shortage of skilled operators to operate the machinery. Although the advanced technologies are highly reliable to remove the PPCPs, it is golden to tackle the issue from the grassroots level which will be the preventive measures rather than treatment actions. Hence, the main objective of this study is to evaluate the level of attitude and practice among the general public towards the PPCPs handling and disposal. This will later be translated into a baseline study so to have a guided database for future outreach programs and policy-making purposes. The method used in this study was a self-administered survey questionnaire which was distributed randomly among 44 respondents. University Malaya students were selected as the sample of this study for its feasibility and diversified characteristics demographically and socio-demographically. The data were then analysed by classifying it and studying the trends of each class to identify the gap of current practices. The study findings demonstrated that although most of the respondents do not have knowledge (77.3%; n=34) on PPCPs, their attitude toward the disposal of PPCPs is highly positive. However, even though the attitude perceived is positive toward the PPCPs waste handling techniques, the actual practice is showing otherwise. The lack of knowledge, proper facilities for disposal and guidelines found to be the main contributing factors to such practices. Finally, this study found that knowledge and attitude per se will not be enough to achieve good practices in handling the disposal of PPCPs to control the penetration of the traces into the environment. Unless there are enough designated facilities for the disposal and proper guidelines on the disposal manners to facilitate for the general public is being introduced, only then the good attitude that was shown can be delivered to prevent more PPCPs being introduced to the environment.

Keyword: Knowledge-attitude-practices, pharmaceutical, and personal care products, endocrine disruptive chemicals, sustainability, prevention, waste disposal, water pollution, emerging pollutants.

1. INTRODUCTION

Every year, countless transaction has been made by both consumers and manufacturers on domestic products. Due to this rapid bi-lateral deal, which is synergistic, the emerging pollutants (EPs) are currently alarming. Back in 2003, the Norman Network has reported that there are more than 700 emerging pollutants have been found in the European aquatic system per se.
Recently, one of the most common products that topped the list of emerging pollutant is pharmaceuticals and personal care products (PPCPs). PPCPs are known as the silent pollutant due to its nature which is not only it is non-harmful to human but also very helpful to be used domestically such as the antibiotics and shampoo. Unfortunately, it starts to develop chemical reactions and changing its characteristics once introduced to the environment as waste.

While changes in the usage and disposal phase of existing chemicals or the synthesis of new chemicals can create new sources of EPs, there are a lot of new technologies have been developed along the way. However, the preventive actions are too little to be seen as an option.

As one of the most common emerging pollutant, PPCPs has gained a lot of interest among both researchers and technology manufacturers. One of the most explored areas of study for PPCPs is the technology to remove PPCPs traces from the water and soil.

As of 11th December 2018, Science Direct has registered a total of 101 academic writings regarding PPCPs which covering the area of technology development and enhancement for removal techniques. While it is golden to have a wide range of options in removing the traces using advanced technologies, it is vital to ensure that the root cause of the traces can be tackled.

Since there are no policies or regulation on the disposal of PPCPs both locally and internationally, it is important to understand the general public’s perceptions and understanding of the PPCPs’ issues. This will later be the baseline study for any approaches of preventive actions at the grassroots level and the policy developments for both consumers and manufacturers.

Hence, this study is undertaken to investigate and to evaluate the PPCPs issues from the perspectives of the general public via the knowledge and awareness of PPCPs, their attitude and perceptions while dealing with the products from the stage of purchasing until disposing and the current day to day practices on the PPCPs.

2. LITERATURE REVIEW

In 2015, a new set up for the world-changing movement known as the Sustainable Development Goals (SDGs) which superseded the Millennium Development Goals (MDGs) has pointed out a very significant correlation of sustainability between the general public, environment and manufacturers in order to ensure that this world can be a much better place to be handed over to our future generations. Aim to be achieved by the year 2030, SDGs has listed 17 goals that will be covering the issues of social and economic namely; poverty, hunger, health, education, global warming, gender equality, water, sanitation, energy, urbanization, environment and social justice (UN, 2014).

Since Malaysia is one of the join members of this movement, many initiatives have been highlighted to achieve the targets and ultimately to realize the goals. One of the major issues that have taken place was the health and environment. Under these two (2) issues, one of the main concerns was on municipal solid waste (MSW) management and its effects on both human health and the ecosystem.

2.1 Municipal Solid Waste (MSW) Management in Malaysia

Municipal solid waste (MSW) management has been one of the most challenging environmental issues to be tackled especially in Malaysia (Malakahmad, et al., 2017). Malaysia, among other developing countries still choose to landfill their MSW over the other advance technologies despite the unsettled health and environmental issues because landfill has been recognized as the cheapest way to dispose the waste generated (Bong et al., 2017; Kamaruddin et al., 2017; Malakahmad et al., 2017; X. Wang, Howley, Boxall, & Rudd, 2016; Younes et al., 2016).

With the rapid urbanization, consumer demand and purchasing power, the waste generation is quite distressing day by day, not just of the amount, but also the composition (Malakahmad et al., 2017). The composition of
waste has changed tremendously from component that’s friendly to the environment such as organic wastes to wastes that’s complicated and not easily degraded by nature such as plastics and also containing harmful material such as electronics items, batteries, pharmaceuticals and personal care products (PPCPs) (Fauziah et al., 2015; Hannan et al., 2015; Malakahmad et al., 2017; Younes et al., 2015).

With the complexity of the MSW composition, improper disposal management has become one of the main factors to the discharging of hazardous contaminant into the nature which will be toxic not just to the environment, but also to human (Fauziah et al., 2015; Hannan et al., 2015; X. Wang et al., 2016; Younes et al., 2015).

2.2 Pharmaceuticals and Personal Care Products (PPCPs)

Recently, immense research has been carried out on the PPCPs which has been categorised as one of the emerging pollutants (EPs). This chemical which has been classified into 20 classes is also one of the sources of the endocrine disruptive chemicals (EDCs) (Archer et al., 2017; Oates et al., 2017; Yi et al., 2017).

According to Boxall et al. (2012), pharmaceuticals can be defined as any therapeutic, prescribed or over the counter drugs which meant for treatment or prevention of diseases for both human or animals; while personal care products can be summarized as products that can improve the quality of life for example sunscreens, facial wash, cosmetics, hair removal machines, and anti-dandruff shampoos.

All these products can enter the environment whether by intentional such as open disposal and direct discharges to the drainages or unintentionally for example while swimming with sunscreens (Archer et al., 2017; J. Wang & Wang, 2016). The characteristic of PPCPs which usually in fine sizes (micro/nanoparticles) has increased its penetration level which makes it escapes the conventional treatment processes. It will settle its traces in the sewage treatment plant (STP) or the wastewater treatment plant (WWTP) and contaminating the water bodies which will be the source of drinking water (Kamaruddin et al., 2017; Papageorgiou et al., 2016). This can eventually come into the interactions with human either directly through the water sources or indirectly via the food consumptions (Fauziah et al., 2015; Malakahmad et al., 2017; Oates et al., 2017; Yi et al., 2017).

Although there are advanced technologies that can remove and prevent the PPCPs from entering the environment especially the water bodies, but due to its high installation and maintenance cost, these techniques have been put aside and most countries decided to remain with the conventional methods in treating their wastewater or sludge (Yang et al., 2017). The most common PPCPs that can be found in the house are as stated in table 2.3-1 and 2.3-2.

Table 2.2

| Use As                      | Emerging Contaminant                          |
|-----------------------------|-----------------------------------------------|
| Pharmaceuticals             |                                               |
| Analgesics                  | Ibuprofen, carbamazepine, hydromorphone, naproxen, |
| Antibiotics                 | Sulfamethoxazole, trimethoprim, erythromycin, ampicillin |
| Antidepressant              | Fluoxetine, dosulepin, nortriptyline           |
| Chemotherapeutic products   | Methotrexate, fluorouracil                     |
| Hormones                    | Estradiol, ethynylestradiol                   |
## Table 2.2-2 List of common personal care products and its emerging contaminant

| Use As                  | Emerging Contaminant                                                                 |
|------------------------|----------------------------------------------------------------------------------------|
| **Personal Care Products** |                                                                                        |
| Disinfectants          | Triclosan, triclocarban                                                               |
| Human indicator         | Caffeine, nicotine                                                                     |
| Preservative *          | Methylparaben, ethylparaben, propylparaben, butylparaben                               |
| Sunscreen agent         | 1-Benzophenone, 2-Benzophenone, 3-Benzophenone, 4-Benzophenone                         |
| Fragrances              | Calaxilid fragrance, toxalide fragrance                                               |

*Normally found in toiletries (shampoo, conditioner, facial wash, body wash) and cosmetics.

## 2.3 PPCPs and Health Issues

Due to its toxicity and recalcitrant performances, PPCPs might be a potential threat to health and environmental problem (Sun et al., 2014; J. Wang & Wang, 2016; Yi et al., 2017). A wide range of studies has reported that PPCPs have been detected mainly at the source of drinking water, sewage and water treatment plants. This is due to the improper disposal (Hua et al., 2018; Kang et al., 2018), low metabolic system (human capability) (Grassi et al., 2013; K'Oreje K et al., 2018; Kasprzyk-Hordern et al., 2009; Kibuye et al., 2018) and the general consumptions (Reungoat et al., 2011; Yang et al., 2017; Yi et al., 2017; Zepon et al., 2018). Since the residues of PPCPs have been found in the food chain, the adverse effects of PPCPs to human health are significant (Boxall et al., 2012; Cincinelli et al., 2015; Colborn, 1995; Li et al., 2018; MacLusky et al., 1998).

The most disturbing fact of the introduction of PPCPs to the environment is its longer residing time or half-life (Kang et al., 2018; Kasprzyk-Hordern et al., 2009) and the change of its characteristics (Kim et al., 2014; Matamoros et al., 2007; Miege et al., 2008) when mixed with other chemicals throughout the process of entering the ecosystems. The longer it is being transported; it is becoming more complex and harder to be removed naturally in the environment (Hijosa-Valsero et al., 2016; Kang et al., 2018; Kasprzyk-Hordern et al., 2009). Although this can be removed using the advanced technologies, it is still not feasible due to higher cost are needed to undertake the process.

According to Eertmans et al. (2003), PPCPs has proven to be one of the factors in male fertility disorders.

## 2.4 PPCPs and Environment

While there are concerns on whether the PPCPs will pose an adverse effect on other wildlife such as mammals, reptiles, amphibians and birds, the majority of the studies are focusing on the effects of PPCPs on fishes and invertebrates. For examples, according to Nambirajan et al. (2018), the decline on three (3) vulture species in populations are due to the occurrence of diclofenac which giving the direct impact towards the ecological, socioeconomics and human health (Markandya et al. 2008). Also, there is concern that veterinary medicines (antiparasitic) may be affecting indirectly the insect-eating bats and birds’ population due to the disturbance in the availability and quantity of food for this species (McCracken 1993).

As mentioned above, fishes (A. M. Ali et al., 2018; A. M. M. Ali et al., 2017; Simmons et al., 2017; Tamura et al., 2017; F. Wang, Guo, Chen, Sun, & Fan, 2017; Yeh, Marcinek, Meador, & Gallagher, 2017; Zhang et al., 2017) and invertebrates such as micro invertebrates like freshwater rotifer (Jarvis et al., 2014; Luna et al., 2015; Martinez Gomez et al., 2015) and crustaceans (J. W. Kim et al., 2009) such as
Grass shrimp (Garcia et al., 2014) are the most studied species that affected directly by the PPCPs contaminants. The most prominent effects of PPCPs towards fish are the changes in sex in the population which reducing the amount of these fishes (Fauziah et al., 2015). Mussels are also one of the most affected invertebrates due to the introduction of PPCPs in the environment (Bai & Acharya, 2018). This has been seen in the coastal area of the United Kingdom and Japan seawater.

Aside, laboratory work has shown that there’s a change in the male mice sex due to the exposure towards the PPCPs contamination (MacLusky et al., 1998; Takao et al., 1999; Witorsch, 2002). There are profound studies has been carried out on the effects of PPCPs to human and animals and the advanced technologies that can remove the PPCPs from the environment.

However, there are gaps in the study upon preventive measure which will be helping in reducing the contamination of PPCPs from the earlier stage. Hence, this study was evaluating the level of knowledge, attitude and practice among the general public towards PPCPs disposal to identify the most suitable mean to reduce the exposure of PPCPs to the ecosystems.

3. METHODOLOGY

Knowledge of PPCPs is described as the ability to recognize the term PPCPs and understand the effects of PPCPs on both humans and the environment. Knowledge on PPCPs is also described as how a person perceived the level of reversibility from the effect once exposed to PPCPs. Also, the knowledge was determined by the ability to identify whether PPCPs are one of the sources of EDCs.

Attitude towards PPCPs’ disposal in this study consist of the overall perceptions; PPCPs until reaching the expiry date. The practice of disposal captured by the selection of mode of disposing; as general waste, sending back to a designated area or throwing into the sewerage system via toilet bowl or sink.

From selecting, buying, using and disposing of the PPCPs. Selecting PPCPs determined by choices that are made, for example, to choose whether organic or non-organic and environmentally friendly products. This study also investigated the attitude of a person when choices are given especially in handling the disposal of PPCPs; whether a person is willing to send the unfinished or unused or expired PPCPs to a designated place if any and to see the factor in disposing the PPCPs for example rebates or points collecting for redemption will enhance the willingness to handle the PPCPs disposal properly. This study was also exploring the personal perception of the influences that a person can give to both policymakers (governance body) and manufacturers (consumers' purchasing power and rights) upon the PPCPs' issues. Also, the attitude towards disposal of PPCPs assessed via the perceptions towards means of disposing the PPCPs; via public drainage, as general waste or flushing in the toilet or sink.

Practice refers to day to day practices upon the PPCPs selecting, buying, using and disposing of phases. This keyword was also considering the places where a person is getting their PPCPs such as government or private clinics, pharmacies, drugstores, and convenience stores. Selecting PPCPs practice describes by a person way of selecting the products especially on the ingredients of the products to ensure it is not harmful when introduced to the environment. While buying, this study intended to see the buying trend of a person; whether to buy environmentally friendly products, buy only what is needed, did not keep excessive amount at home and price over quality practices. As for the practice of using the PPCPs, it was determined by the usage behaviour; using PPCPs until everything finished, washing the container before throwing it away and keeping the

This study consists of three (3) main stages. The first stage was the identification of the study area or study scoping. This was determined using the existing studies and from the legislative side that related to domestic, pharmaceutical and industrial waste
management. The existing studies are being explored to understand the trend of researches and the area that still have room for improvements followed by the gap analysis, research scoping and boundaries set up.

The second stage was the data development phase. This consists of the questionnaire preparation until the data preparation and analysis. And the last stage was the study summary where the findings will be discussed, and a model based on the findings will be proposed.

The research started with the topic overview. This overview was covering two (2) areas. The first area was a legislative and governance review. This consists of the review from a legislation perspective until in-house guidelines. Any related regulations or procedures which currently being implemented locally and internationally is also being reviewed throughout the research process.

The second area was a literature review that looking into three (3) major topics namely; fate, transport and sources of PPCPs, challenges, treatments and removal technologies and interventions and future suggestions. These two (2) areas were then summarised using the strengths, weaknesses, opportunities, and threats (SWOT) analysis to better understand the current trend of the issue. The SWOT analysis was further refined by using gap analysis to prepare for the next phase of the research process.

After the SWOT and gap analysis being carried out, the next phase was determining the scope and boundaries of the study. This is also the phase where the problem statements, aim and objectives of the study, research questions and the most suitable methodology to be implemented in the study was decided. This is the most crucial part of the research process since this is the phase where the goals and drive of the study is being set up. Also, this phase will always be the main reference of the study boundaries to ensure that the research process is within its frame.

The questionnaire for survey purpose was developed after the methodology of the research has been decided. The development of the questionnaire is loosely based on the KAP studies from various areas and from the area of concerns which was found in previous research on PPCPs and MSW. Data preparation phase consists of data collection and data analysis. The KAP analysis will be summarised and a model was proposed based on the findings and discussion.

This study was carried out using a questionnaire-based survey which was analysed by classifying it before the trends of each class being studied. The survey questionnaire consists of five (5) sections which divided into socio-demographics which covering the background of respondents, knowledge, attitude, and practices on the disposal of PPCPs and priority actions to be taken.

The survey questionnaire was specifically designed to assess the trend of attitude and practices towards PPCPs handling and disposal and it was presented in a four (4) page survey form with 54-item. The survey questionnaire was developed to perceive the public awareness, attitudes and practice towards the PPCPs disposal. It entails mainly the closed-ended types of questions to allow uniformity and consistency throughout the data collection process. Since the scale of this study is for a pilot study, a small population of sample were chosen. For that, the University of Malaya (UM) active students were selected as the sample population for its location and feasibility of the data to be obtained in a short
The demographic characteristic of the respondents as per Table 3.3.

**Table** Error! No text of specified style in document.-3 **Demographic Characteristic of Respondents**

| Items            | Frequency (n) | Percentage (%) |
|------------------|---------------|----------------|
| **Age group**    |               |                |
| 20 and less      | 19            | 43             |
| 21 – 30          | 23            | 52             |
| 31 and above     | 2             | 5              |
| **Total**        | 44            | 100            |
| **Gender**       |               |                |
| Male             | 16            | 36             |
| Female           | 28            | 64             |
| **Total**        | 44            | 100            |
| **Citizenship**  |               |                |
| Malaysian        | 37            | 84             |
| Non-Malaysian    | 7             | 16             |
| **Total**        | 44            | 100            |
| **Ethnicity**    |               |                |
| Malay            | 30            | 68             |
| Chinese          | 9             | 20             |
| Indian           | 2             | 5              |
| Others           | 3             | 7              |
| **Total**        | 44            | 100            |
| **Religion**     |               |                |
| Islam            | 33            | 75             |
| Buddhism         | 2             | 5              |
| Christian        | 4             | 9              |
| Hinduism         | 0             | 0              |
| Others           | 5             | 11             |
| **Total**        | 44            | 100            |
| **Faculty**      |               |                |
| Science          | 20            | 45             |
| Non-Science      | 24            | 55             |
| **Total**        | 44            | 100            |
| **Academic Level** |             |                |
| Undergraduate    | 33            | 75             |
| Postgraduate     | 11            | 25             |
| **Total**        | 44            | 100            |
The faculties were first clustered into science and non-science group. Out of 16 faculty or academy or centre in UM, 9 (56.25%) of it clustered under the non-science while 7 (43.75%) clustered under the science group.

The reason why the population was clustered into a science and non-science group is because this study wanted to see whether there's a significant result that can be seen if a respondent is from a science background.

Also, in the survey questionnaire, there is an item on the nationality. This was asked to see whether there's a difference in the knowledge, attitude, and perceptions of respondents depending on the nationality.

According to the UMPortal (2018), data as at 30th June 2018, a total of 21,055 students were enrolled and out of this number, 58% (12,128) was undergraduate and 42% (8,927) was postgraduate students. While preparing for the survey questionnaire, the most noticeable challenge was the insufficient amount of references regarding public awareness towards the disposal of PPCPs. Hence, this study was closely referring to the existing KAP framework from various field of studies.

4. RESULT AND DISCUSSION

Out of 50 survey questionnaire that has been given out, six (6) were omitted due to too many missing values from the set that reverted. The final sample of this study consisted of 44 respondents or a final return rate of 88%. Since the total population of University of Malaya student for the 2018/2019 session was 21,055, according to Krejci and Morgan (1970), the required sample size is 377.

However, since this study was prepared for a pilot testing phase, extant literature suggests that a pilot study sample should be 10% of the sample projected for the larger parent study (Connelly, 2008). Therefore, the sample size of this study (n=44) is sufficient for the purpose of this study. Of these 44 respondents, it was dominated by female with 64% (n=28) while 16 (36%) were male.

The age ranged from 19 to 38 years with a mean age of 22.23 years. Malaysian respondents were 84% (n=37) while only seven (7) out of 44 (16%) of the respondent were non-Malaysian. Majority of respondents were Malay (68%) followed by Chinese (20%), other ethnicities (7%) and Indian (5%). Total of 57% (n=25) of the respondents were from the non-science stream faculty while 43% (n=19) were from science stream faculty.

Majority of the respondents were the undergraduate students (75%, n=32) and postgraduate students were represented by 25% (n=12). For residential type, a large proportion of the respondents (55%, n=24) were staying in a hostel provided by the university which mainly the undergraduate students, followed by 32% (n=14) of them were renting a space, 11% (n=5) staying at family house and 2% (n=1) were staying at their own house.

Half of the respondents were self-funded and only 20% sustaining their daily expenses using the educational loan. Balance 30% of the respondents was getting support for living expenses using their scholarship budget.

4.1 Knowledge on PPCPs

This section encompasses the respondents’ general knowledge on PPCPs and its effects on both humans and the environment including animals and plants. Out of 44 respondents, only 15 (34%) have ever heard about the term Pharmaceuticals and Personal Care Products or PPCPs in short. Out of 15 respondents that heard about PPCPs, 5 (33%) of them were not sure what PPCPs are.

While PPCPs effects are irreversible (Onesios & Bouwer, 2012; Onesios et al., 2009), 33% of the respondent believes that PPCPs effects are reversible. Only 4 (27%) respondents know that PPCPs is one of the sources of EDCs (Archer et al., 2017; Bai & Acharya, 2018; Eertmans et al., 2003; Oates et al., 2017; Takao et al., 1999; Witorsch, 2002). Even though 47% of the respondent knows that PPCPs are not harmful to human (Archer et al., 2017; Hijosa-Valsero et al., 2016; Kibuye et al., 2018; Onesios & Bouwer, 2012; Papageorgiou et al., 2016), 33% of them believe that PPCPs are harmful to the environment. Details of this
section is shown in table 4.3-1 based on the 15 respondents that heard about PPCPs before.

4.2 Attitude towards PPCPs Disposal

This section started with personal preferences upon the disposal of PPCPs. Majority of the respondents agree that they will throw their unfinished or unused or expired PPCPs properly (77%) or at designated place (61%) if they know and aware of such methods.

This study was also looking into the location of purchasing the PPCPs. This section was developed to see the trend of location to get the products so we can come out with some sort of mapping on the most visited stores/services that providing these products. The mapping will later be used to plan an outreach program to enhance awareness on PPCPs disposal at the grassroots level.

4.3 Correlation between Knowledge, Attitude, and Practice

Knowledge and attitude have long been understood as the main contributing factors to the behaviour and practice towards any social issues. It is understandable to have inappropriate or unfavourable practices due to the poor level of knowledge. However, it is also true that just by having good knowledge and attitude will somehow reduce a good practice if the facilities and guidelines are not provided sufficiently. Also, one can have a good attitude despite the lack of knowledge for common sense can be the driving factors towards the good attitude and translated into good practice.

Therefore, this study believes that in order to have a good practice in PPCPs disposal, one should have at least good knowledge or good attitude towards disposal. By having both, the successfulness of the practice will increase. However, it is also deliverable by having just a good attitude.

Conversely, the current practices are being challenged due to the insufficient information and aid being addressed at the grassroots level. The matrix of knowledge, attitude, and perception of PPCPs disposal as shown in table 4.3-4 while the correlation between knowledge, attitude and practice are being illustrated in figure 4.3-1.

Table 4.3-4 Matrix of knowledge, attitude, and practice of PPCPs disposal

| KNOWLEDGE | ATTITUDE | PRACTICE |
|-----------|----------|----------|
| Good      | Good     | Good     |
| Good      | Not Good | Not Good |
| Not Good  | Good     | Good     |
| Not Good  | Not Good | Not Good |

Figure Error! No text of specified style in document.3-2 The correlation between Knowledge, Attitude, and Practice

4.4 Priority Action to be taken
One of the additional sections being implemented in this study was the priority actions to be taken based on the observation of respondents. Out of 44 respondents, 16 (36%) believes that educating consumers should be the top priority, followed by educating manufacturers (29.5%, n=13). Third priority goes to the introduction of designated facilities for disposal (11.36%, n=5). Upgrading the water treatment plant comes fourth with 9.1% (n=4) while development of standards or guidelines and regulatory approaches to control the PCPPs disposal matters share as the fifth in rank with 0.7% (n=3) respectively.

These results are consistent where majority of respondents agrees that educating both consumers and manufacturers on the effects and impacts of PPCPs should be the first priority in order to ensure that any further actions taken in the governance level will be a successful approach. This is because by having the same understanding in the proper way of managing PPCPs waste and disposal method, will eventually giving a significant result of the optimization in the usage of both guidelines and designated facilities. Hence, both elements show a lower priority in this study.

Also, the upgrading of water treatment plant (WTP) to have an advanced technology which can remove the PPCPs before it is being piped out to consumers also gaining concern among respondents which has put it at the fourth rank of priority. This is understandable due to the cost of installing individual water filters at home while upgrading the WTP at the source level will somehow reduce the cost for consumers.

Table 4.4

| Rank | Priority List                                                                 |
|------|------------------------------------------------------------------------------|
| First | Educating consumers on the impact of PPCPs on human health and the environment due to the mishandling/improper disposal management |
| Second | Educating manufacturers on the impact of PPCPs on human health and the environment due to the mishandling / improper disposal management |
| Third | Introducing designated facilities for disposal which contributes to the proper management of PPCPs |
| Fourth | Upgrading the water treatment plant (WTP) facilities to a more advanced technology so it can remove the PPCPs fully from the water body |
| Fifth | Developing the PPCPs standardized disposal guideline based on the cradle to grave concept |
| Sixth | Imposing a regulatory approach on how to dispose of PPCPs in a good manner (Infrastructural / building structure etc) |

4. CONCLUSION

Since the PPCPs contamination has gained much concern in the recent world, there is not much effort has been taken to prevent pollution from entering the environment from the grassroots level. Although the amount of advance technologies is quite promising in removing the PPCPs in the ecosystem, due to the few constraints (installation cost, maintenance fees, and skilled operators), the implementation is still far to be idealised.

Hence, it is vital to also understand the underlying factors that can be controlled before the contaminators entering the ecosystem. Therefore, by having the baseline data from the general public’s perspective will be a huge opportunity to overcome the issues to reduce the amount of PPCPs in the environment.

Therefore, it is suggested that in the future a more extensive study with a bigger population should be carried out in order to get more accurate data upon the social perceptiveness of
this issue since the data represented only suitable for pilot study. Later, this comprehensive data will be beneficial for the policymakers and NGOs in delivering more sustainable approaches to enhance the management of PPCPs disposal, especially on the domestic scale.
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