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Waste Plastics for Fuel, Energy and Chemicals

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ABSTRACT

Most of the hydrocarbon based thermoplastic can be efficiently converted into useful fuels, furthering their usefulness. This will prevent them from ending of in landfills or clogging the waterways and ocean. Ecofuel technologies plastic bottles are one of the most significant factors. plastic has been widely adopted by the global industry as the most common can make this process or profitable business undertaking, ensuring wider acceptance for recycling. There are numerous elements or factors which pollute the nature and environment. Among these factors, plastic or, more specifically, and adaptable material for marketing their products. Current level of plastic usage and disposal is one of the biggest environmental challenge that we have to deal with. Collecting and recycling plastic is one of the most important actions currently used to meet this challenge, but it represent one of the most demanding areas in the plastics industry today.

Keywords : Plastic Waste, Fuel, Recyclable Plastic, Bottles Deposit.

I. INTRODUCTION

Large scale manufacture of thermoplastics started in 1920s with the production of PVC and within the next twenty five years all the major plastic in use, PS, PET, PE and PP were being manufactured in large quantities of these, PE, PP and PS are from petroleum biproducts, being polymers of ethylene, propylene and styrene respectively.

The swift acceptance of these man-made polymers is mainly due to the convenience they brought to every day life.

They have very unique properties – lightweight, strong, durable and highly moldable into many shapes and form.

They do not break easily when dropped or during transportation and being lighter weight compared to materials they replace, they leave a smaller carbon footprint. They are ideal for sanitary packaging.

Recycling plays a vital role in saving the environment. It helps in reducing the wastes everywhere and therefore saves the environment from too much pollution.

The first step to total waste management is segregation. It is by segregating wastes properly that people can easily identify which materials are recyclable and which are not. Today, only 11% of the total amount of waste in Metro Manila is recycled.

Plastic waste consumption and production as well as generation continue to increase since the first industrial scale production . This increase has been accelerated as plastics are used in the production of many products. However, 20-25% of plastics are used as long term infrastructure products while almost 50% are produced for disposable applications i.e. packaging. In developing economies, the rapid increase in population, urbanization and economic development means the rate of PSW generation is also increasing at alarming rates. Furthermore, to draw in individuals with the goal that they can toss or drop the container in the correct place so we made it greater by methods of remuneration (coin). In this manner, the plastic arranging machine is utilized to make best re-utilization of plastic jugs without hurting nature and atmosphere. By changing starting with one shape, then onto the next, we can reuse plastic over and over. The choice of container is additionally imperative on this part. The principal target is a plastic container. The plastic is utilized to make polyester fabric or other plastic articles. Our entire framework is traceable and tractable with the assistance of GPS module and server data observation system.

II. METHODS AND MATERIAL

A. SYSTEM DESIGN

The dimension of the design shown in Figure 1 is 4 ft x 2 ft x 2 ft. The length from the top to the platform is 1.5 ft. The frame of the trash bin is made up of steel and the walls are made up of acrylic. The platform is galvanized iron. Through the use of a servo motor, this platform is designed to tilt on either side of the trash bin depending on the decision of the system. The response time of the platform is five seconds. There are also two LEDs in the system to further designate if the material is a plastic bottle or a beverage can. Red LED indicates plastic bottle while green LED indicates beverage can.

B. METHOD

Research framework We analyzed and integration of literature review to understand the product servitization, sustainable design and development model and the application analysis of plastic mold, as the same time, through in the depth expert's interview to extract the related impact factors of product servitization and the plastic mold sustainable development design

III. RESULTS AND DISCUSSIONS

There were 25 samples of plastic bottles and 25 samples of tin cans used in the experiment. Five trials per sample per position were done. The tables below show the collected data from the experiment.

SAMPLE	TRIAL	POSITION	
		UPRIGHT(Hz)	INVENTED(Hz)
	A	1165.54	
	B	1092.62	1150.09
SUMMIT	C	651.5	1275.52
	D	646.96	1172.46
	E	743.19	1433.62
	A	1572.69	1062.55
	B	708.02	1166.05
WIKINS	C	842.06	855.49
	D	932.86	961.51
	E	641.89	1075.13

It was observed that the frequency of plastic bottles ranges from 600Hz to 1900Hz. For tin cans, it ranges from 1400Hz to 3000Hz. Although there were overlaps at 1400Hz - 1900Hz, the number of times in which no overlap was seen is greater than the number of frequencies that overlaps. It was also observed that if the boundary will be set to 1700Hz, less samples for both plastic bottles and tin cans will be affected due to the overlap.

CUT OFF FREQUENCY	MATERIAL	CORRECT	INCORRECT
	PLASTIC	235	15
1800	METAL	193	57
		85.60%	14.40
	PLASTIC	226	24
1700	METAL	214	36
		88.00%	12.00%
	PLASTIC	214	26
1600	METAL	223	27
		87.40%	12.60%

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IV. METHODOLOGY

Our Solution

The problem is not plastic but our single use and throwaway culture. As the following Table comparing the energy content of various plastic and the fuels show.

Energy content of various plastic and fuels Most of the plastic have the same energy content locked away in them as petroleum derivatives from which they were made. As a comparison, the non-petroleum based polymer, PET has an energy density of only 24 MJ/ kg. Our take is that instead of considering plastic as a waste or pollutant, we can unlock its energy potential and remake it into a new and reliable resource. Discarding or land filling them away is to squander this significant source of energy. Capturing this energy potential economically for subsequent use, in a profitable business model will generate revenue for the coastal and local economy while providing incentives for cleaning our ocean, beaches and land.

WASTE COLLECTION SYSTEMS

Waste collection systems are a very important pillar in waste management and for this reason a number of studies have been conducted. Reference indicated that to ensure maximum participation rates and high diversion of recyclable materials, the correct collection scheme design has to be provided to households to capture traditionally “non committed recyclers.”

PAST:

Scientists have been trying to capture the energy content of these plastics for over 50 years, by either burning them or de-polymerizing them under inert atmosphere (pyrolysis) to smaller hydrocarbons to be used as fuel. Burning the plastic generates noxious fumes and dioxins due to incomplete combustion. Burning them under restricted oxygen levels result in the production of syn-gas, which is a mixture of carbon monoxide and hydrogen. This can directly be used in a generator to produce electricity or can be converted to diesel using Fischer-Tropsch procedure. Since some oxidation has already taken place, the energy recoverable is always less than what was available from the plastic. Pyrolysis results in producing ‘plastic oil’ with a broad distribution of hydrocarbons that has to be sent to refineries where usable consumer products such as diesel and gasoline can be distilled out.

TECHNOLOGY:

The EFT pyrolysis reaction takes place in two stages. In the first stage, the ‘sacrificial’ catalyst fragments the plastic into small hydrocarbons with chains C2 to C200. The catalyst also captures all the debris and non-reacting material. In the second stage, the finishing catalyst fragments the hydrocarbons further to chains of C2 to C40 (if diesel is the desired product) or C2 to C14 (if gasoline is the objective). A fractionator after the second stage separates the light hydrocarbons from the heavy, giving us ‘drop-in ready’ fuels, avoiding the need to send the products out for additional refining. This approach addresses two of the major obstacles in implementing plastic to fuel processes –

1. logistics, no need to move lots of plastic to a central fixed point and

2. moving the oil produced to a refinery for further processing. By producing useful fuel for use, the value obtained for the product is at least 200% higher than otherwise.

IMPLEMENTATION

EFT wants to put their PTF units on beaches and on remote islands where either they suffer from high volume of plastic accumulating on the sand or the price of diesel is high enough to justify even with small capacity units. Putting the units on high traffic beaches like the ones on Bali and Caribbean not only helps to clean the beaches and restores them to their desirable condition, the fuel generated has a ready market from the many cruise ships that flock these sites It has been reported that only ten rivers (mainly in Asia and Africa) contribute to majority of plastic entering the ocean. EFT wants to put large capacity (5 tons to 20 tons) at the river mouths to collect the plastic before it enters the ocean. Added advantages are a relatively lower concentration of salt and the plastic has not been reduced in size due to wave action and sunlight. Many of these countries can also use the fuel or the cash generated from the sale of these fuels.

MSW constitutes different types of waste categories and it is not surprising to find PSWs. Plastic waste constitutes 8-11% of the MSW composition in developing economies and only 4% of waste generated in Africa is recovered. Plastic packaging and containers represent the highest tonnage. In developing economies, recycling activities are mostly conducted by the informal sector. However, identified that lack of useful government interventions and legislations is the main problem with the collection and recovery system.

V. PROPOSED LEVERS' DRIVEN PSW REVERSE LOGISTICS MODEL

Above depicts the proposed model for the recovery and recycling of PSW in Zambia. The model consists of the following stages; consumption, collection and separation, processing and converting plants and reuse plants. The consumption stage consists of the households while the collection and separation stages consist of the formal and informal waste collectors. The levers incorporated in the model at the consumption stage (households) are chosen based on theory or evidence from previous studies.

VI. CONCLUSION

The proposed levers driven plastic waste recovery and recycling model provides useful factors that should be considered during the development and implementation of waste management programs.

It has been observed that the system will better work if the cut-off frequency between plastic bottles and tin cans is 1700 Hz. In terms of accuracy, the present study has a little improvement compared to the previous study. This study demonstrated that even though the cap of the plastic bottle hits the platform first, it can still be detected by the system as a plastic bottle. Thus, results showed that the system's accuracy when the plastic bottle's cap hits the platform first is higher compared to the first study. Our main purpose was to build a machine that will help in creating a "Greener"environment. Introduction of the Plastic collecting machine in the waste management sector can prove to be hugely beneficial for all solid waste management.As future work, it is suggested to formalize the conceptual model proposed as a model of optimization MILP or other in order to analyze the economic and environmental feasibility of this type of network. It is also suggested to carry out research for plastic recycling with this type of application considering more stages than just the collection and the simultaneous collection of more than one type of plastic. In this case where most of the research was conducted in a University. The University, Government agencies and the private entrepreneur would form a three prong partnership which would have a very high probability of success. The two parties, namely governmental agencies could take care of financial burden in a partnership with the individual or joint entrepreneur in a (80 to 20) relationship. The individual or joint entrepreneur would be responsible for day to day management of the entity. The University, the third party would provide the technical and scientific backbone to the entrepreneurship as described here.

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