

DESIGN AND FABRICATION OF PLASTIC BOTTLE RECYCLING MACHINE

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ABSTRACT

Plastics are inexpensive, lightweight and durable materials, which can readily be molded into a variety of products that find use in a wide range of applications. As a consequence, the production of plastics has increased markedly over the last 60 years. However, current levels of their usage and disposal generate several environmental problems. Recycling is one of the most important actions currently available to reduce these impacts and represents one of the most dynamic areas in the plastics industry today. Analysis of data shows a rising consumption in PET bottles and the forecasted PET consumption in year 2015 estimated to be 60000Tons, twice the estimate in the year 2010. This situation will create serious environmental problems that require much more effort to be exerted by all stakeholders to look for scientific and practical solutions for the disposal of plastic waste through recycling. The aim of this work as the title suggests is to design and manufacture a machine which will minimize the volume of commercially used mineral water plastic bottles as well as cold drink bottles. This project would help the people to crush commercially used plastic Bottles conveniently. This project aims to design and manufacture a plastic bottle recycling machine to form threads to make household goods that is portable and can be installed at multiple public places, which will aid in recycling of used bottles.

Keywords: - Plastic bottles, Recycle, Cutting tools, Electric motor.

1. INTRODUCTION

The design process was accomplished in many stages. At first, we checked out the objectives of the design and the basic mechanism of the machine. The ideas and innovations about the working of project were implemented in this stage of the Project. The machine had to be simple in design and construction such that its maintenance and repair could be convenient. The bottle recycling machine is an electrically operated machine and thus it is important to have an optimum usage of effort. Accordingly, the mechanism was designed. This conceptualized machine should also have the agility to make the threads from bottles of different dimensions and hence the dimensions and other design aspects were chosen accordingly.

Recycling is important in today's world if we want to leave this planet for our future generations. It is good for the environment, since we are making new products from the old products which are of no use to us. Recycling begins at home if you are not throwing away any of your old product and instead utilizing it for something new then you are actually recycling. When you think of recycling you should really think about the whole idea; reduce, reuse and recycle. We've been careless up to this point with the way we've treated the Earth and it's time to change; not just

the way we do things but the way we think. Recycling is a complex method of environment protection, which aim is the limitation of the raw materials consumption and decrease of waste quantity. It should be a multiple system of the same materials using in the next material and usable goods. In practice, recycling is often the necessity and it always becomes the only reasonable strategy of the working if consider waste formation in the End of Life phase .Every product has to be designed, produced, sold, consumed or exploited and every product, after time, doesn't satisfy the needs because of the physical or moral consumption.

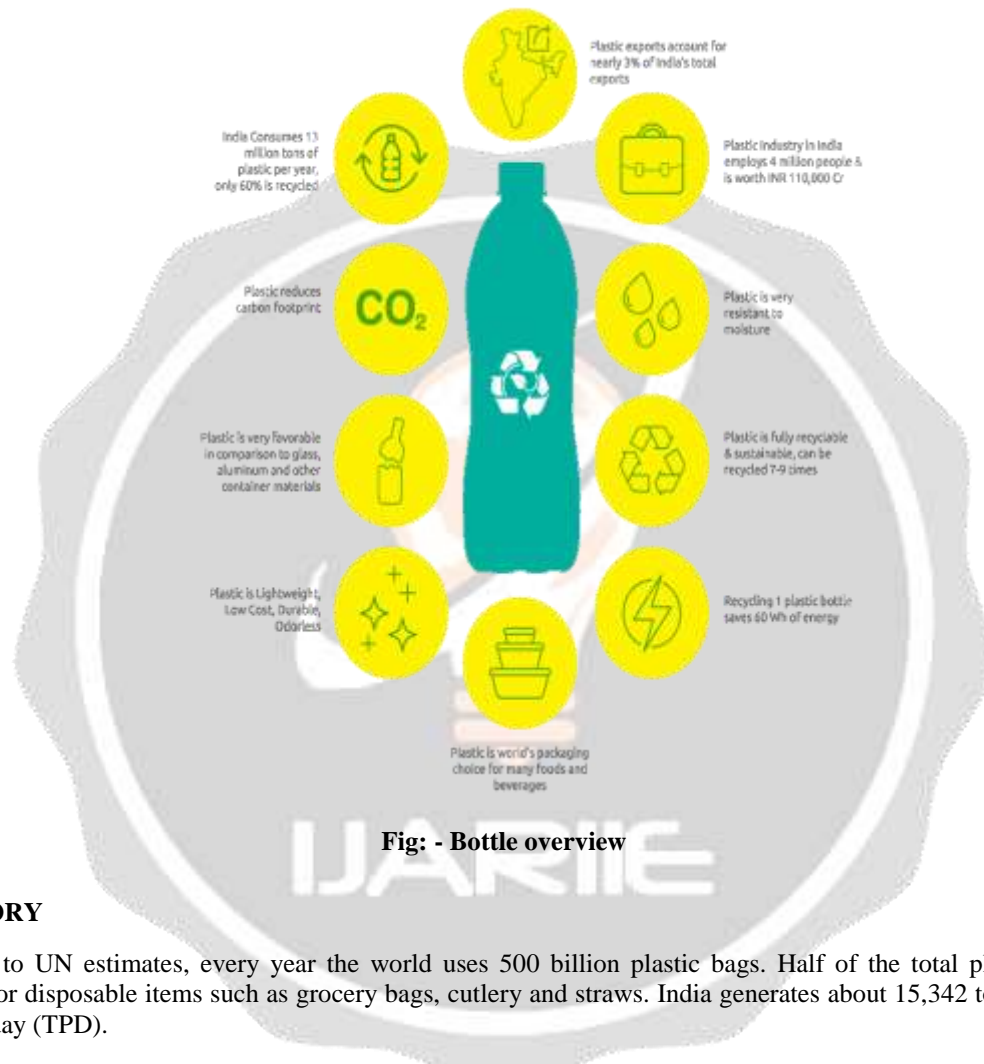


Fig: - Bottle overview

1.1 HISTORY

According to UN estimates, every year the world uses 500 billion plastic bags. Half of the total plastic used is single-use or disposable items such as grocery bags, cutlery and straws. India generates about 15,342 tons of plastic waste per day (TPD).

India has been chosen as the global host of the World Environment Day, that will focus on galvanizing greater action against single-use plastic pollution on June 5 this year, by the United Nations Environment Programmed (UNEP, now also known as UN Environment). After demonstrating global leadership on climate change, India will lead the charge on 'Beat plastic pollution', the theme for World Environment 2018.

In India, 70 percent of total plastic consumption is discarded as waste. Around 5.6 million tonnes per annum (TPA) of plastic waste is generated in country, which is about 15,342 tonnes per day (TPD). Government data shows that 17 states and union territories have imposed complete ban on manufacture, sale and use of plastic carry bags, but there is "no proposal to impose ban on the use of polythene bags completely throughout the country". Maharashtra, India's second most populous state, which produces plastic products worth Rs. 500 billion, notified a state-wide a ban on most single-use plastics in April this year.

1.2 OBJECTIVES OF THE STUDY:

Major objective

To assess the general plastic waste management in Khartoum state and to effectively manage the PET plastic bottles by identifying practical means to introduce cleaner production tools mainly recycling in order to achieve sustainable development goals.

Specific objectives

- To collect and study available data on plastic and PET plastic bottles in particular.
- To effectively manage the PET plastic bottles waste and minimize the volume.
- To identify ways and methods for collection of PET bottles waste.
- To recommend on what to be done to support the growth of PET bottlerecycling.

1.3 INDIAN STASTICIS

There is every possibility that India has the highest recycling rate of polyethylene terephthalate or PET, a kind of plastic used to manufacture drinking water bottles and food containers. Among 900 kilo tones of PET bottles made in India annually (2015-2016), 65 % is recycled at registered facilities , 15% in the unorganized sector and 10% is reused at homes, states a yearlong studies by scientist from Council of Scientific and industrial research (CSIR)

And national chemical laboratory (NCL). The rest ends up at landfills. The recycling rate for PET bottles in japan is 72% Europe ids 48.3% and US is at 31%The data was released by NCL and PET packaging association for clean environment (PACE) a new Delhi based industry body representing PET manufacturers, recyclers and processersAccording to UNEP United Nation EnvoinmentProgramme

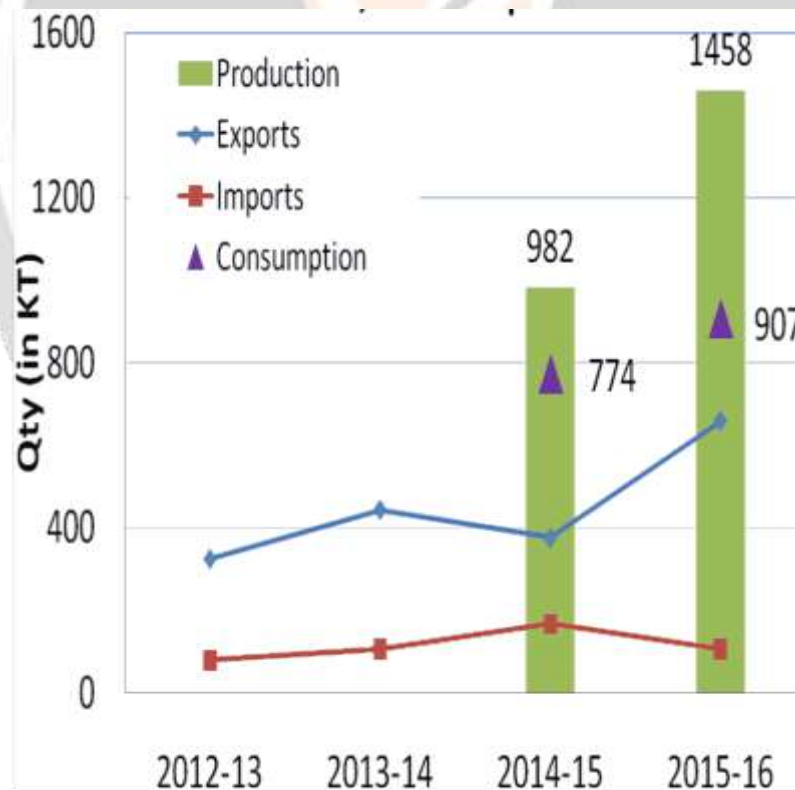


Fig:-PET Production, Consumption

1.4 INDIA'S STRUGGLE WITH PLASTIC:

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India's capital city of Delhi introduced a ban on disposable plastics last year. The use of plastic carry bags has been partially banned in some pilgrimage centers, tourist and historical places located in Andhra Pradesh, Arunachal Pradesh, Assam, Goa, Gujarat, Karnataka, Odisha, Tamil Nadu, West Bengal, Uttar Pradesh and Uttarakhand.

The government has notified the Plastic Waste Management Rules, 2016, which regulate manufacture, sale, distribution and use of plastic carry bags including those of compostable plastic, and plastic sheets for packaging or wrapping applications. (Report by Central pollution control board) CPCB

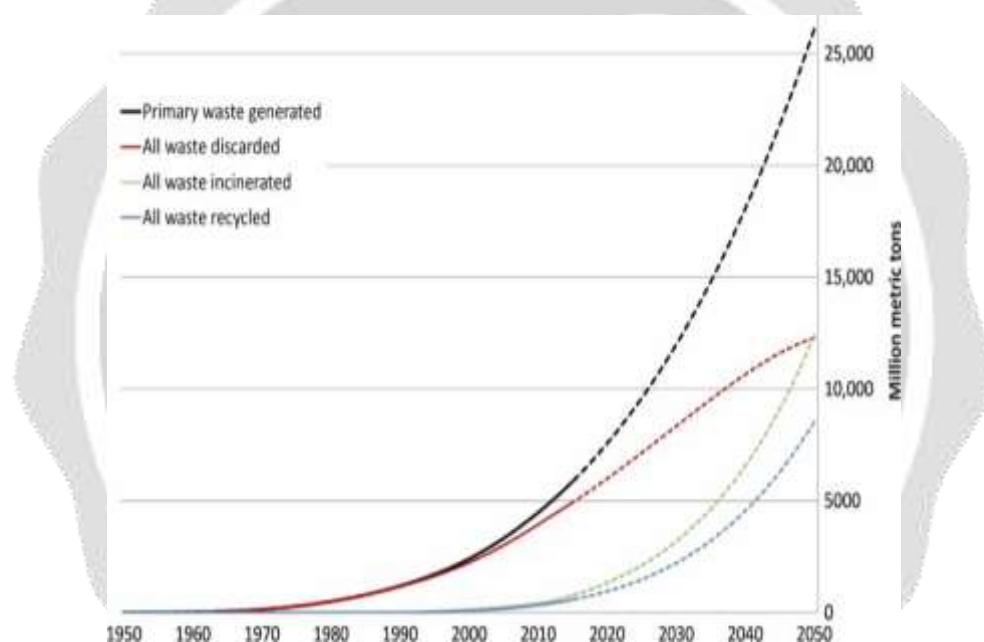


Fig: - Cumulative plastic waste generation and disposal

In the past decades, the focus has been on air and water pollution, as well as on the decreasing availability of landfills for waste disposal. Waste disposal in landfills causes pollution of not only the land but also of the water tables, resulting in hazards and damages to the environment, wildlife and humans. Various proposals and schemes have been made to reduce the disposal of waste in landfills. Perhaps the most significant system for waste reduction is the one that promotes recycling and reuse of discarded items. Plastic bottles are one of the largest components of waste discarded by human beings. According to the Container Recycling Institute (CRI), "Americans throw away 200 billion beverage containers including plastic bottles and aluminium cans each year. Beverage containers make up about 15 percent of all packaging waste in the US, and in 2000, only 31 percent were recycled. This suggests that 69% were disposed into the environment, which is alarming! Customers' consumption behaviour and disposal habits have not changed significantly enough to reduce disposal. Therefore, the assumption can be made that plastic bottle waste worldwide is exceedingly high.

1.5 IDEA GENERATION:

PET is the name of the resin used to make transparent light, shatterproof bottles for soft drinks, juices, water, detergents and soaps. PET bottles are the most significant, and use of PET allows recycling as well as reuse. There has been a fundamental change in our culture when it comes to recycling and sustainability. In 2015-16, 900 KT bottles were used in India. This comes with the question: what happens to PET bottles after use? Are they recyclable? If so, then how can they be recycled? What can be made out of those bottles? We went looking for the answers to the above question, hence the idea of generating threads from those PET bottles came into existence.

2. METHODOLOGY:

This paper contains a literature study of technologies of the possibilities to sort plastics and other materials, interviews with experts in the subject and industrial visits on recycling plants and traditional recycling plants. The approach of a project is divided in several stages: planning, conceptual development, design on system level, detail design, testing and calibration.

To achieve research objectives the following tasks are needed:

1. To conduct comprehensive literature review related to subject of recycled plastic.
2. Site visit to the recycled plastic plants.
3. Bringing samples of the recycled plastic from the plastic plants.
4. Making sieve analysis of the coarse plastic aggregate samples and natural aggregate.
5. Performing physical and mechanical laboratory tests on the coarse plastic aggregate samples and compare the results to the available standards.
6. Analyse the results and draw conclusions.

3. CONCEPT DEVELOPMENT:

The plastic bottles have more volume compared with its weight, so due to this plastic bottles take more space than other scrap, so the scrap collector avoids taking plastic bottles. If we cut these plastic bottles in the form of thread (recycling). So we decide to make a plastic bottle recycling machine which is motor-operated so it is affordable to the customer. The plastic bottle recycling machine is used to cut the thread with shearing force of tool within a specified width and the speed limit; and also it is connected to a bobbin where the thread will automatically wound on it.



Fig :- Cad Model

The principle of operation is as follows.

- Placed the plastic bottle vertically into probes.
- Pull the thread out manually and clamp it to the bobbin.
- As the motor started bobbin will start rotating and the shear force will apply.
- Due to which cutting action will get started.
- Hence the thread will come out of this.

4. WORKING

The plastic bottle recycling machine has modern recycling technique, which actually doesn't recycle directly but it can convert into another form such as thread and then it is used for making usually goods for household and industrial purpose. Electric power is given to high power Permanent magnetic DC Motor of 12 Volt with three brushes which is used to rotate the spindle. This power is transmitted to the spindle with the help of coupling arrangement. Two motor are used, one for cutting the base portion of bottle. The base of the bottle must cut uniformly so that it will placed properly on the work bench as well as to get initial manual threads. Magnetic DC motor connects with the coupling in order to get a drive by reducing the speed and maintaining the torque at moderate level this will give a uniform pulling force on already existing thread.

Both spindle and coupling rotate in clock wise direction when looking from LHSV. Clockwise direction of spindle gives pulling force of 3.5 N which shear off the continuous thread from the bottle. Bottle cutting is natural as it is guided with the guide ways end hold with the probe and due to gravity bottle will come down which reduce further efforts to cut the continues threads. Thread size can be vary according to requirement , the cutter blade is adjustable can be move by loosening and tighten the nut due to which we can get 2mm to 6mm threads very easily. Spindle perform two main operation one is to apply constant pulling force by which good quality thread is obtained and another is to wound the drawn thread on the spindle itself. When the operation is get finished the last end of thread is get clamped on spindle. Now the thread can be easily unwound from the spindle & further this thread will go through a heat treatment process to get harden and get high strength and it will get ready to use.

5. RISKS AND CHALLENGES:

We really do not anticipate any special risks or challenges for this campaign. We have the produced, tried and tested prototypes, so the only challenge that we are looking at is that of getting the crowd to know about the Plastic Bottle Cutter and back it. However, we believe that its utility is so obvious, that we believe it will generate the backing force it needs to come into existence.

6. RESULTS

Sr. No	Thickness of Thread (in mm)	Length of Thread (in m)
1	3	15
2	4	12

3	5	10
4	6	8.5

Above results are based on 3 liter bottle

Table: - Results of Machine

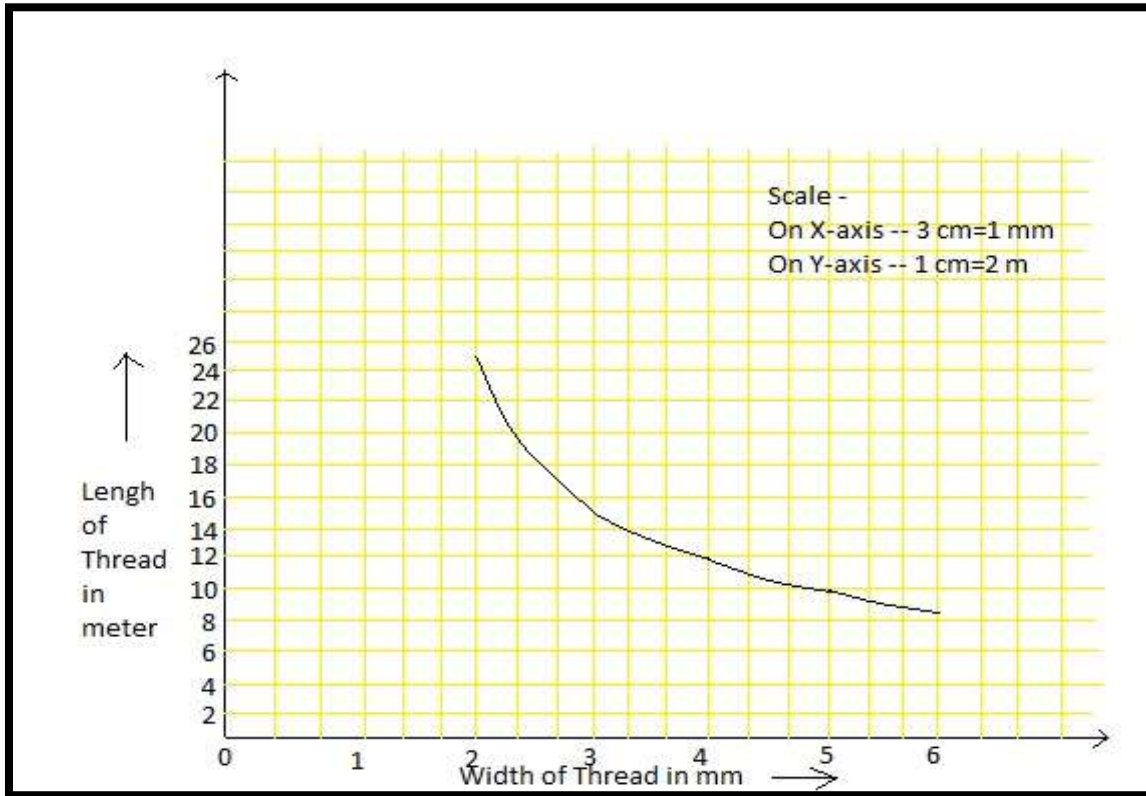


Fig 22: - Graphical Representation of Result

7. CONCLUSIONS:

The plastic Bottle Recycling Machine thus designed and fabricated is a unique, compact and portable. The final machine is an outcome of a series of processes, in which the first was analysis and study of requirements and conceptualization of machine, then the Fabrication and finally the Testing of Machine. Thus all the mentioned processes were successfully executed for the Plastic Bottle Recycling Machine.

The Plastic Bottle Recycling Machine thus manufactured is portable and compact. The shearing force that is required to crush a plastic bottle as found experimentally is well within the range of the force that can ergonomically be applied by an average human. The machine was then designed on the basis of the load required to crush the bottle. The tentative design and dimensions of machine components was then taken for fabrications. The Manufacturing difficulties brought further changes in the design. The model thus designed was fabricated and assembled.

8. ACKNOWLEDGEMENT

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