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AN INNOVATIVE TECHNIQUE AS PER SPI CODE TO BREAKDOWN THE PLASTIC

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ABSTRACT - The lethal product which acquires major portion in day to day activities of human beings is the petrochemical production commonly known as PLASTIC.A study reveals a data of approximate plastic consumption of India is about 18MT per year out of which 70% is discarded as waste undergoes many process. Disposal of plastic as solid waste in dumping yard creates environmental issues. The groundbreaking process of recycling plastic as per SPI code consists of breakdown and transformation of plastics into marble with varying 70% percentage of plastic and other constituents which makes the marble adoptable in the areas of less soil bearing capacity, parking lots. The upcoming modern techno-society to utilize the recycled plastic as outplay of concrete and cement techniques of civil works and it will proves to be more economical.

Keywords: **use of plastic as marble, soil bearing capacity, outplay of concrete and cement.**

1. INTRODUCTION

The developing patterns and consumption of a country has a major impact of the plastics. Though plastics plays a significant role in every industry due to their efficient and relaxable use, as these are conventional(petro based) are non-biodegradable. The advantageous aspects of usage of plastic have been reached the limits we cannot replace their possession in daily activities. The disposal of plastic has a straight option of dumping in yards as municipal solid waste combined with other wastes. In India about 6.3 BT plastics have been discarded as waste in which 13MT plastic waste are dumped in oceans. Something like 50% of plastics are single use products and almost it takes around 450-1000 years to decompose. Each and every plastics recycled and it depends on technological methods, economical and logistical factors.

PET(PolyEthyleneTerephthalate) and HDPE(High-densitypolyethylene) are good examples of closed loop recycling and it occupies major of MSW which it can used as heavy component as marble in parking lots as aesthetic use. Here discarded PET and HDPE has been collected to be mixed in zinc oxide to make it heavy, aluminium oxide and magnesium carbonate of marble composition.

1.1 PLASTIC CONSUMPTION AND WASTE STATISTICS

The inspiring innovation of versatile plastic makes life easier, better. They step in every manufacturing process such as

Automobile industry -helmets,
airbags ,
Instrument panel ,
dashboard.

Electronics- Mobile
Televisions
Computers
Wiring cables
Toasters

Infrastructure-Roof and flooring insulation
Reflective films
LED bulbs
Plastic foam spray

Packaging- to keep the products fresh
Hygienic medicine

Textile- polyster

Sports- Football
skateboarding
Mouth guards
latex gloves

fig-1 applications of plastic

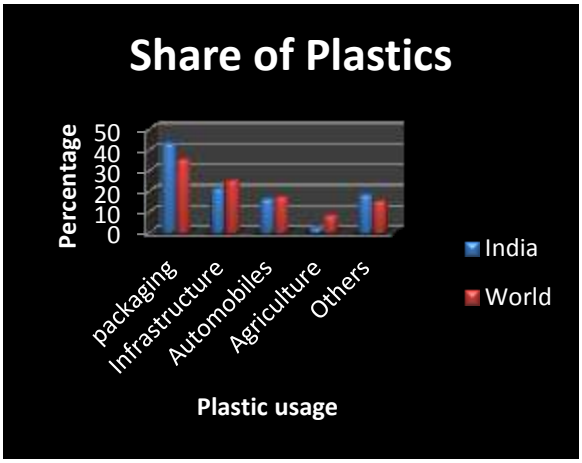


chart-1 percentage of usage

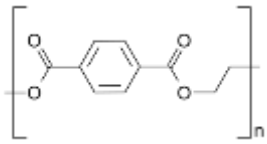
1.2 NEED FOR PLASTIC MARBLE

- Corrosion resistant
- Good insulation for cold, heat
- Economical and longer life
- Easy maintenance
- Easy processing
- Light weight
- Best alternative to concrete pavers

1.3 CHEMICAL STRUCTURE OF MATERIALS

1. PET/PETE (Polyethylene Terephthalate)

The production of PET is by step by step polymerisation growth of ethylene glycol and terphthalic acid. The structure has repeating units of Benzene rings.

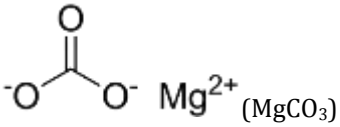


2. HDPE(High-density polyethylene)

With the usage of Ziegler-Natta and mettallocene catalysts or activated chromium oxide at low temperatures and pressure HDPE is manufactured. The structure allows polymer chain to pack closely together due to lack of branches in it. When chemical structure of polyethylene becomes linear then it is HDPE.

3. Magnesium carbonate

Magnesite which is a common name for magnesium carbonate and is of white, yellowish , grayish-white or brown crystalline solid. Materials which are capable of withstanding high temperatures has magnesite.



($MgCO_3$)

4. Aluminium oxide

Aluminium oxide is ionic in nature as there is a presence of metal (ALUMINIUM) and non-metal(OXYGEN). These two components forms ionic bond by sharing the electron. The crystalline form of Al_2O_3 is Corundum and structure is in the form of trigonal-lattice.

(Al_2O_3)

5. Zinc oxide

The organic compound (ZnO) which is insoluble in water, yellow-gray granular solid without odour finds a place in various products as additives. The natural occurence as the mineral Zincite, it is synthetically produced as zinc oxide.

Zn=O (ZnO)

2. PLASTIC MARBLE METHODOLOGY

2.1 EXTRUSION OUTLINE

The technology of plastic manufacturing contains most vigorous process and it is characterized by

- new raw material
- different requirement
- continuous process.

The different types of materials undergoes extrusion process are

- Polyethylene
- Polypropylene
- Nylon(polyamides)
- Polstyrene
- Polycarbonate
- Acetal
- Arcyclic
- Acrylonitrile Butadiene Styrene(ABS)

The need for extrusion as plastic contains wide range of synthetic or semi synthetic organic compounds and it is malleable which can be remolded into solid objects. Chemical properties of thermoplastics does not undergo any changes while heating so that it can be recycled and remolded easily. Original form plastics can be molded to various shape, size according to specific requirements.

Extrusion is defined as high volume manufacturing process. The required plastic materials are fed into hopper to shred along with the additional materials which is then melted by applying required amount of heat. It is then followed by molding and compaction manually.

2.2 MODEL OF MACHINE

fig-3 3-D model of machine

1. Components of machine

- Hopper

fig-4 hopper

- Belt conveyor

fig-5 conveyor belt

- Heater

fig-6 heater

- Die
- Manual compact

2. Manual moulding

The mould has its own importance, which gives the required shapes of the product. It is the important process where resinous polymeric compound is converted into useful finished article.

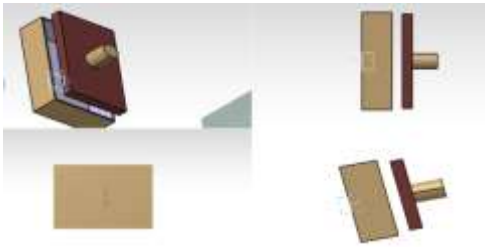


fig-7 mould and compaction

3. Dimensions of mold

- Thickness-65mm(2.5")
- Width-150mm(6")
- Length-75mm(3")

2.3 MIX RATIO

Chemicals	Plastic	Zinc oxide	Aluminium oxide	Magnesium carbonate
Block 1	70%	20%	10%	-
Block 2	60%	30%	-	10%
Block 3	60%	20%	10%	10%

3. PROCESS INVOLVED

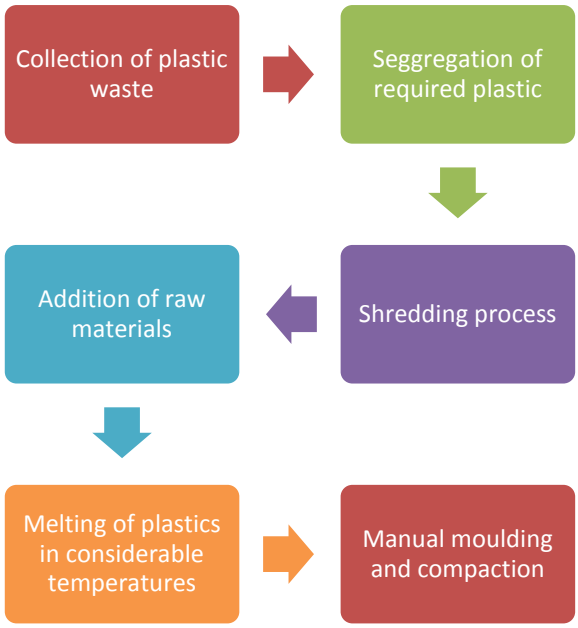


fig-8 process involved

3.1 Flow chart

- Collection of plastic from Municipalities as there is a ban in TamilNadu.
- Segregation process is done by hand-picking of required one.
- Shredding process through the hopper.
- Melting of materials at 250°c by coil heater.

3.2 MATERIALS USED WITH THEIR PROPERTIES

1. PET: Polyethylene Terephthalate, the most common thermoplastic polymer resin, colourless, semi-crystalline.

Table-1: Properties of PET/PETE

SL.NO	PARTICULARS	VALUE
1	Melting point	260°c
2	Thermal co-efficient of expansion($\times 10^{-6}$ k^{-1})	20-80
3	Density	1.38 g/cm^3
4	Tensile strength	80MPa
5	Water absorption-over 24 hrs	0.1%

2. HDPE: It is known for its large strength-to-density ratio and stronger intermolecular forces and tensile strength.

Table-2: Properties of HDPE

SL.NO	PARTICULARS	VALUE
1	Melting point	120-180°c
2	Water absorption	0.11%
3	Density	0.93 g/cm^3
4	Tensile strength	20.3 MPa

3. ZINC OXIDE

Table-3: Properties of zinc oxide

SL.NO	PARTICULARS	VALUE
1	Molar mass	81.408 g/mol
2	Melting point	1975°c
3	Density	5.606 g/cm^3
4	Boiling point	2360°c
5	Solubility in water	0.16 mg/100ml

4. ALUMINIUM OXIDE

Table-4: Properties of Aluminium oxide

SL.NO	PARTICULARS	VALUE
1	Molar mass	101.960 g/mol
2	Melting point	2072°c
3	Density	3.987 g/cm^3
4	Boiling point	2977°c
5	Solubility in water	insoluble

5. MAGNESIUM CARBONATE

Table-5: Properties of Magnesium carbonate

SL.NO	PARTICULARS	VALUE
1	Molar mass	84.3139g/mol
2	Melting point	350°c
3	Density	2.958 g/cm^3
4	Solubility in water	0.00603 g/100ml

4. RESULT AND OBSERVATION

4.1 COMPRESSIVE STRENGTH

BLOCK-1

Table-6 Block 1 compressive results

SL.NO	PLASTIC (kg)	ZINC OXIDE (kg)	MAGNESIUM CARBONATE(kg)	ALUMINIUM OXIDE(kg)	COMPRESSIVE STRENGTH(N/mm^2)
1	1.5	0.75	0.5	0.5	15.78
2	1.5	0.75	0.5	0.5	16.11
3	1.5	0.75	0.5	0.5	16.06
				Average	15.98

BLOCK-2

Table-7 Block 2 compressive results

SL.NO	PLASTIC (kg)	ZINC OXIDE (kg)	ALUMINIUM OXIDE(kg)	COMPRESSIVE STRENGTH(N/mm^2)
1	2	0.75	0.5	11.23
2	2	0.75	0.5	12.05
3	2	0.75	0.5	11.58
			Average	11.62

BLOCK-3

Table-8 Block 2 compressive results

SL.NO	PLASTIC (kg)	ZINC OXIDE (kg)	MAGNESIUM CARBONATE(kg)	COMPRESSIVE STRENGTH(N/mm^2)
1	1.5	0.8	0.5	12.84
2	1.5	0.8	0.5	13.37
3	1.5	0.8	0.5	11.99
			Average	12.73

4.2 THERMAL RESISTANT RESULT

This test is to know the heat resistance.

Table-9 Thermal resistance results

BLOCKS	TEMPERATURE(°c)	REMARKS
BLOCK-1	75	No change
	150	No change
	225	Starts melting
BLOCK-2	75	No change
	150	Slight change
	225	Starts melting
BLOCK-3	75	No change
	150	No change
	225	Starts melting

4.3 COMPARATIVE RESULT BETWEEN CONCRETE PAVERS AND PLASTIC MARBLE

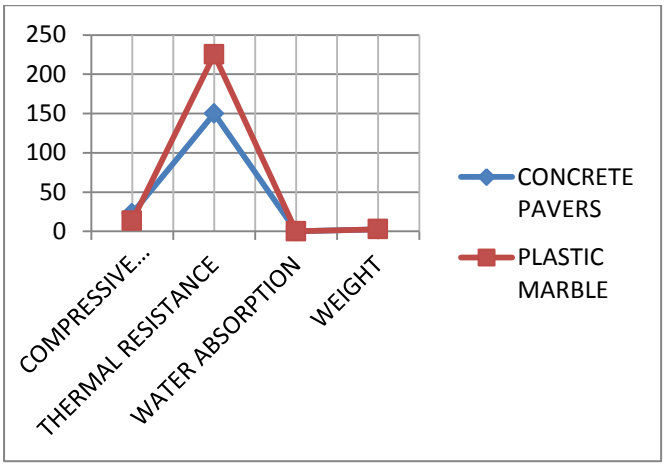


chart-2 comparative results

5. CONCLUSIONS

- The experimental study has concluded that Plastic marble can be more economical and alternative replacement of concrete pavers as well as a great solution to dispose the plastic waste.
- As the plastic marble does not attain the compressive strength as of concrete pavers it can be better replacement in areas of low soil bearing capacity , as aesthetic use in parking lots , flooring for rehabilitation of landfill as parks, cycling tracks.
- This is adoptable to all weather condition as it withstand high melting point.
- The above process is one of the best initiative along with the plastic roads to reduce the dumping of plastic waste in oceans and landfills to preserve animals and soil stability.
- It also paves a way to store energy while melting the plastics.

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