Available online @ www.iaraindia.com
RESEARCH EXPLORER-A Blind Review & Refereed Quarterly International Journal
ISSN: 2250-1940 (P) 2349-1647 (O)
Impact Factor: 3.655 (CIF), 2.78 (IRJIF), 2.62 (NAAS)
Volume VIII, Issue 26
January - March 2020
Formally UGC Approved Journal (63185), © Author

WASTE PLASTIC AND R.C.A - THE ONLY RAW MATERIALS FOR PLASTIC TILES AND BLOCKS

D. RISHAV SINGH
Department of Civil Engineering (Dream Institute of Technology)
Thakurpukur, B.H. Road,
Kolkata - 700104

Abstract

This paper elucidates about the use of plastic waste material in making of Plastic Tiles and Plastic Blocks with mixing of Recycle Cement Aggregate (R.C.A). The components used include everything from plastic screws and hangers to bigger plastic parts that are used in decoration, electric wiring, flooring, wall covering and waterproofing. Plastic use in road construction that have shown same hope in terms of using plastic waste in road construction. i.e. plastic roads. Plastic Tiles and Blocks are made mainly by using plastic carry bags, disposable cups and PET bottles that are collected from garbage dumps and RCA materials which are one of the biggest list in Constructional waste and is available very easily everywhere they mostly come from building demolishing . By using plastic waste and RCA as modifier, we can reduce the quantity of cement and sand by their weight, hence decreasing the overall cost of construction. The disposable plastics are the main source of plastic. For these plastic pollution is not only the ocean also in desert. Construction waste is very dangerous as it is directly affecting our health and creating much pollution like Air, water, land etc.

Keywords: *Plastic Recycled, RCA Waste Construction, Waste, Replacement, 3-R Principal; Waste Management's Tiles, Blocks.*

Introduction

In simple word a plastic is material which is made from natural materials such as cellulose, coal natural gas, salt and crude oil through a polymerization process. Polymerization is a process where molecules (i.e. Monomer) is converted into polymer. Polymers is repeating structure of molecules (i.e. Monomer) like a long chain if reparation is in order then polymer if in non-order then macromolecules.

In simple word concrete means mixing of cement, sand, aggregate and water in ratio. Where cement act as a binding material, sand and aggregate as filler material. when any building is demolished this concrete is only called a waste and it has no importance for others but here R.C.A. is used as a filled material after doing the crushing and sieving .

History of Plastic and R.C.A:

Over the last century humans have learned how to make synthetic polymers,

sometimes using natural substance like Cellulose but more often using carbon atoms provided by Petroleum and other fossil fuels. This polymers are strong, light weight and flexible. In words, its what make them so Plastic, Now, human learned how to create and manipulate them, polymers have become an essential part of our lives. Especially over the last 50 years plastic have changed the way that we live. The first Synthetic Plastic was invented in 1869 by John Wesley. By treating cellulose, derived from cotton fiber with camphor, John Wesley discovery a plastic that can be made in many shapes and this invention eliminated the use of natural substance. This discovery was Revolutionary for the first time

This development helped not only people but also the environment at that time because no pollution with plastic use was notice at that time. The demand of plastic was so high that during World War II the demand of plastic was increased by 300%.

Around 200 BC Human have learn the way of construction but without use of cement composition they used volcanic Ash and other natural substance in concrete. Joseph Aspdin Invented cement in UK in 1824. John Smeaton who Known as Father of Civil Engineering discover the method for concrete by using cement, this discovery this revolutionary because it was cheap in compare to other building materials. About 6 billion cubic meter of concrete is made each year which is equal to 1 cubic meter for every person on earth.

1. TYPES OF PLASTIC:

There are 7 types of plastic exist in our current modern days:

The different types of plastic that are manufactures and used worldwide are provide in Figure 1.

Polyethylene terephtalate (PET)	1 PET	Beverage bottles, medicine jars, rope, clothing and carpet fiber
High-density polyethylene (HDPE)	2 HDPE	Containers for milk, motor oil, shampoos and conditioners, soap bottles, detergents, and bleaches
Polyvinyl chloride (PVC)	3 V	All kinds of pipes and tiles
Low-density polyethylene (LDPE)	4 LDPE	Cling-film, sandwich bags, squeezable bottles, and plastic grocery bags
Polypropylene (PP)	5 PP	Lunch boxes, margarine containers, yogurt pots, syrup bottles, prescription bottles, plastic bottle caps, plastic cup
Polystyrene (PS)	6 PS	Disposable coffe cups, plastic food boxes, plastic cutlery and packing foam
Polyethylene Acrylonitrile butadiene styrene (ABS) Polyamide (PA) or Nylons Polybutylene terephthalate (PBT)	7 OTHER	Baby bottles, compact discs, and medical storage containers

Fig 1: Different types of plastic

World construction Aggregate Demand (million metric tons) (The Freedonia Group, 2012)

Problems with C&D Waste

	2005	2010	2015	% Annual Growth	
				2005 - 2010	2010 - 2015
Construction Aggregate Demand	27300	37400	48300	6.5	5.2
North America	3280	3010	3710	-1.7	4.3
Western Europe	2920	2630	3050	-2.1	3.0
Asia Pacific	16000	24750	32600	9.1	5.7
Other	5100	7010	8940	6.6	5.0

2. THE IMPORTANCE OF PLASTIC AND CONCRETE IN TODAY'S SOCIETY:

In today's society plastic is highly depended on by a number of industries, including aerospace and automotive. By some it may be argued that without plastic the developments made within these industries would not have been possible or at least profitable and with 170,000 people employed in the industry. According to a report since 1950 around

8.3 billion tons of plastic have been produced and only 9% of it has been recycled. About 2 million plastic bags are used every minute.

Concrete is used more then any other manmade material on the planet. About 6 billion cubic meter of concrete is made each year which is equal to 1 cubic meter for every person on Earth. During 19th Centuries the demand of concrete is increased by 200% due to its demand and durability. According to Washington post "China has used more concrete during the year 2011-2013 then united states concrete use in the entire 20th Century." Each year 2.5 Billion cubic meter debris of concrete is produced in the world.

3. PLASTIC WASTE:

Plastic is killing more than 1.1 million seabird and animal every years. The average person eats 70,000 micro plastic each day. Plastic debris is found absolutely everywhere, from the Arctic to Antarctica. But thanks runoff, and to our fondness for directly dumping our trash into the nearest river or lake, plastic is growing increasingly common in the world's oceans. We already know that franking is bad for the planet - it pollutes water, soil and air with toxins, it creates underground cavities that collapse into sinkholes, and it raises pressure in underground rock formations, destabilizing them and leading to earthquakes, even in places where earthquakes are uncommon. Plastics go into the water bodies which are already polluted due to many sources. Fish and other aquatic animals. Plastics become a nuisance because of their non-biodegradability. Soil fertility deteriorates as plastic bags form part of manure and remain in soil for years. Polythene bags if burnt release highly toxic gases like phosgene, carbon monoxide, chlorine, sulphur dioxide, nitrogen oxide beside deadly dioxins.

Fig 2: Plastic Waste

4. CONCRETE WASTE:

Concrete is the most generally utilized substance on Earth. Concrete is a parched behemoth, sucking up for all intents and purposes a tenth of the world's mechanical dihydrogen monoxide use. In urban areas, concrete also coordinates to the warmth island impact by retaining the glow of the sun and catching gases from vehicle debilitates and forced air system units – however it is, at any rate, superior to progressively foreboding black-top. Limestone quarries and concrete processing plants are moreover regularly contamination sources, alongside the trucks that ship materials among them and building destinations. At this scale, even the procurement of sand can be calamitous – annihilating such a large number of the world's sea shores and stream courses that this type of mining is presently progressively run by composed malefaction groups and connected with deadly viciousness. The cementation of Japan negated great tasteful goals of concordance with nature and an energy about major (fleetingness), however was justifiable given the ever-present fear of quakes and torrents in one of the world's most seismically dynamic countries.

Fig 3: Concrete Waste

5. EXPERIMENTAL:

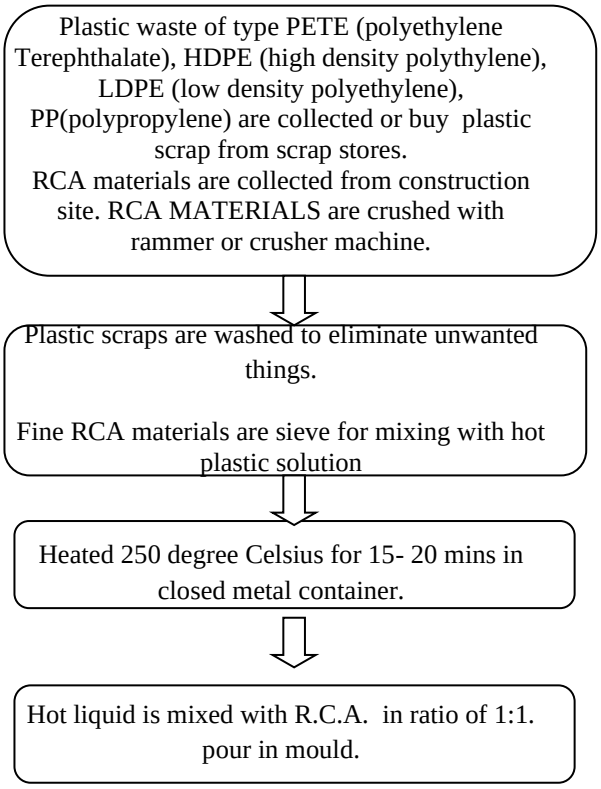
Plastics used in the experimental program are waste water bottles, polythene. Sand was sourced from local supplier.

RCA used in the experimental program are collected from a local building demolishing site. Using recycled materials as gravel reduces the need for gravel mining. From economic point of view recycled concrete is a construction materials that the community does not need to pay for: those who generated the concrete waste pay for fee to have it recycled.

1. Specific gravity of R.C.A (G) =2.62
2. Fineness modulus (F.M)=2.9

Fig 4: colourful plastic tiles

Process of making of Plastic Tiles



PREPARATION OF SPECIMEN:

The collected waste such as plastics bottles are cleaned in water and dried properly before being cut into small pieces to enable easy heating. The plastic pieces and RCA are taken in a proportion of 1:3, 1:1.5, 1.1 (plastics : RCA) by weight and are heated in container. The heated materials are then mixed to get a homogenous mix and then poured into cube moulds of 70.7x70.7x70.7 mm size. After cooling it for 10 hours in the mould, the specimen are remolded and immersed in water for 24 hours being removed for testing

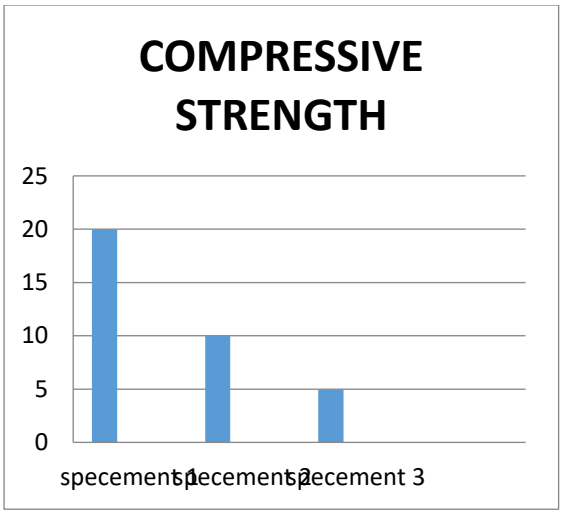
Fig 5 : melting of plastic

TEST OF SPECIMEN:

The sample was tested for water absorption, and compressive strength and normal blocks were also tested to compare with those of sand plastic block specimens.

COMPRESSIVE STRENGTH:

Tiles should have a specified minimum compressive strength so that they can be used in construction works

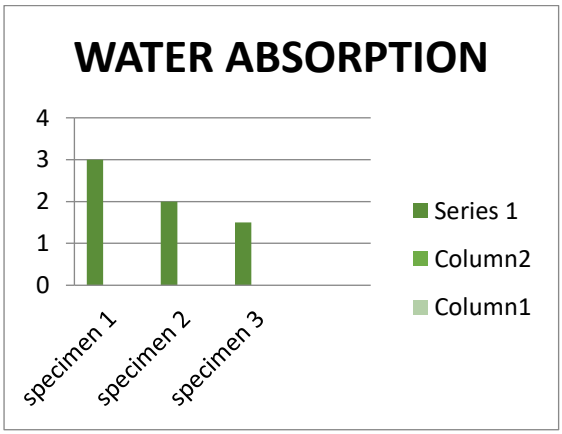


At Y axis compressive strength
1st specimen= 1:3 proportion (15 Mpa)
2nd specimen =1:1.5 proportion (10Mpa)
3rd specimen=1:1 proportion (5Mpa)

WATER ABSORPTION TEST:

*Water absorption of tiles specimens are tested.

* It has shown that recycled sand and plastics block have low water absorption ratio.



*1st class tiles have water absorption =20% of its weight

*2nd class tiles have water absorption =16% -20% of its weight.

BUT,

Specimen 1 = 1:3 (plastic: sand) has water absorption 3% of its weight

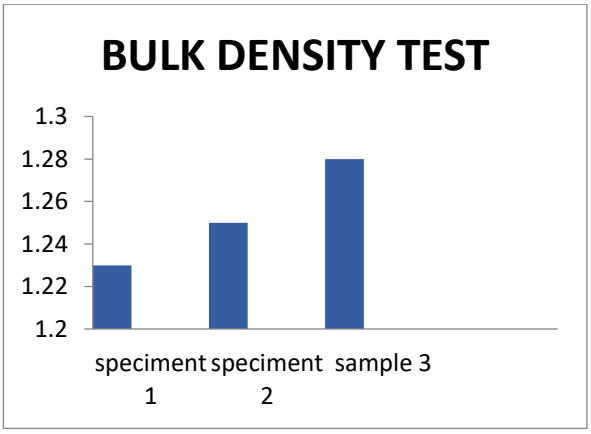
Specimen 2 = 1:1.5 has water absorption 2 % of its weight

Specimen 3 = 1:1 has water absorption 1.5% of its weight.

As the water absorption of the recycled tiles have the low water absorption ratio so it has superior durable properties.

BULK DENSITY TEST:

Bulk density is a property of powders granules and other divided solids, especially used in reference to mineral components, chemical substances, ingredients, foodstuff , or any other masses of corpuscular or particulate matter. Soil weight is most often expressed on a soil volume basis rather than on a particle basis. Bulk density is defined as the dry weight of soil per unit volume of soil. Bulk density considers both the solids and the pore space, where as particle density consider only the mineral solids.



RESULT:

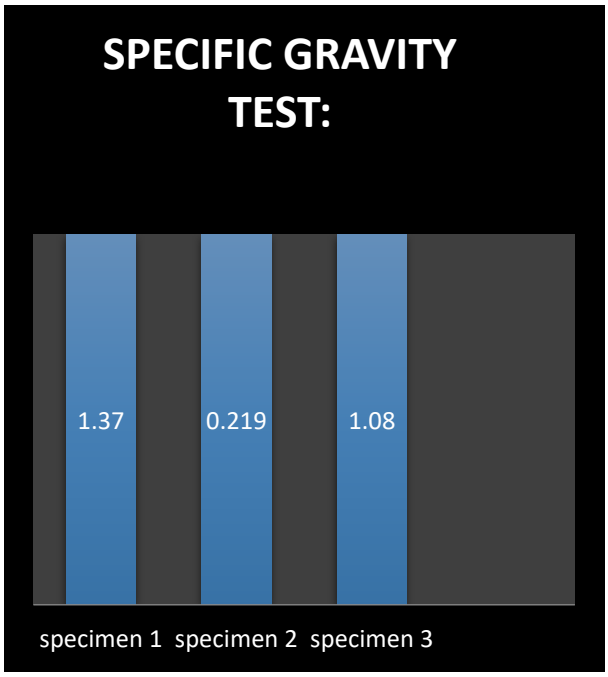
Specimen 1= proportion 1:1 =1.23 gm/ml

Specimen 2= proportion 1:1.5= 1.25 gm/ml

Specimen 3 = proportion 1:3 = 1.28 gm/ml

SPECIFIC GRAVITY TEST:

Specific gravity is a special case of relative density. It is defined as the ratio of density of a given substance, to the density of water. Substances with a specific gravity greater than 1 are heavier than water, and those with a specific gravity of less than 1 are lighter than 1.



RESULT:

Specimen 1= proportion 1:1= 1.37
Specimen 2= proportion 1:1.5= 1.219
Specimen 3= proportion 1:3= 1.08

Table 1

Physical properties of the R.C.A.

Physical properties	value
Specific Gravity	2.54
Aggregate crushing value	28.91%
Aggregate impact value	24.17%
Water absorption value	2.44%
Nominal Max size (mm)	20
Fineness Modulus	6.79
Bulk Density (kg-m^{-3})	1250
Porosity (vol.%)	5.03
Absorption (wt.%)	2.03
Moisture content (wt%)	1.57
Angular number	12.7

Table 2:

Specification of the Tiles

	NORMAL TILES	OUR PLASTIC TILES
DIMENTION	for wall 12*12,8*10,4*4 ,8*8,12*24, for floor 12inch	250*300*10mm
WEIGHT	4pounds/ft^2	450 gm
RATE	50 rs per square feet	20 Rs.
WATER ABSORPTION	3% to 7 %	1%

Fig 6: plastic tiles

Other Specification:

- Making cost of one unit of plastic tiles = Rs. 5-7.
- Selling Price of plastic tiles per unit = Rs.15-25.
- Volume of material required in 1 unit of plastic tiles = 0.000075 meter cubic.
- Amount of plastic = 250 gm.

6. HOW TO SET UP THE BUSINESS FROM THIS PLASTIC TILES:

- Selection of area where factory will setup.
- Area required 15000 to 2000 square feet.
- The owner have to notify and register their premises with the local governing authority before the beginning of operations

- Document required: application Form for the consent. DD for the statuary fees amount. Lease agreement copy, NOC copy in name of factory.
- Manufacturing process of each product with flow diagram. SSI Registration copy. M.O.A. copy. List of raw material with monthly or annual consumption.
- Shed for storage unit and machines. Setup of power connection, water supply, place to keep raw materials.
- The installation of machines Cutter Machine (for Waste plastic, Boiler unit (to liquid the plastic), Mixing Machine (for mixing the mixture), Mould for tiles, Table vibrator (for good compaction) Crusher Machine (for crushing the concrete debris).

CONCLUSION

1. Making plastic tiles from RCA and waste plastics can be an alternative to the traditional clay tiles.
2. RCA plastic tiles have lower water absorption, compressive strength higher than compare to clay tiles.
3. Waste plastics and waste Concrete which is available everywhere may be put to an efficient use in tiles making.
4. The process is so simple that a villager can also start this as a business with very less investment, Raw material waste plastic and waste concrete can be available at very low price and easily available. Running this business don't required any special skills even labors can also work very comfortable with minimum training. This business model is a profitable with minimum investment.

REFERENCE

[1] Oehlmann J. et al., A critical analysis of the biological impacts of plasticizers on wildlife, Phil. Trans. R. Soc. B 364, 2047 2062. (doi:10.1098/rstb.2008.0242) (2009)

[2] Gilpin R., Wagel D. and Solch J., Production, distribution, and fate of polycholorinateddibenzo-p-dioxins, dibenzofurans, and related organohalogens in the environment. In Dioxins and health (eds A. Schecter & T. Gasiewicz), 2ndedn. Hoboken, NJ: John Wiley & Sons Inc. (2003)

[3] P. D. Sharma, Plastic waste reduce, reuse, recycle, 2015

[4] Hazzan EB, A Study of Plastic Moulding Techniques in Oyo State. Ladoke Akintola University of Technology, Ogbomoso, Oyo State, 2003

[5]https://www.ijert.org/research/comparative-analysis-of-tiles-made-from-recyclable-ldpeplastic-waste-IJERTV8IS020022.pdf