Hard Plastic Coarse Aggregate (Hpca) As Partially Replacement Of Natural Coarse Aggregate (Nca) For Concrete Structure

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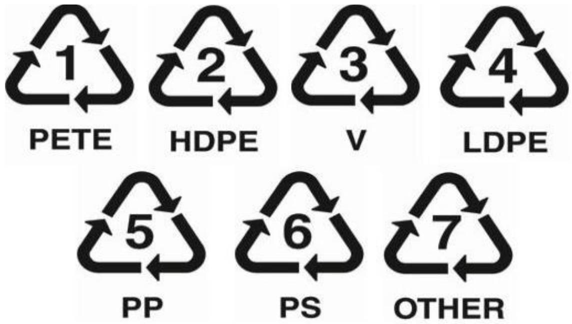
Abstract - **The use of plastic is increasing day by day, although steps were taken to reduce its consumption. This creates substantial garbage every day which is much unhealthy. A healthy and sustainable reuse of plastics offers a host of advantages. The suitability of recycled plastics as coarse aggregate in concrete and its advantages are discussed here. The initial questions arising of the bond strength and the heat of hydration regarding plastic aggregate were solved. Tests were conducted to determine the properties of plastic aggregate such as density, specific gravity and aggregate crushing value. As 100% replacement of natural coarse aggregate with plastic coarse aggregate is not feasible, partial replacement at various percentages were possible. The percentage substitution that gave higher compressive strength was found. Plastic bags which are commonly used for packing, carrying vegetables, meat etc creates a serious environmental problem. Plastic bag last in environment up to 1000 years because of plastic bag last so long the number of plastic bag accumulated increases each year. Numerous waste materials are generated from manufacturing processes, service industries and municipal solid wastes. The increasing awareness about the environment has tremendously contributed to the concerns related with disposal of the generated wastes. Solid waste management is one of the major environmental concerns in the world. With the scarcity of space for land filling and due to its ever increasing cost, waste utilization has become an attractive alternative to disposal. Research is being carried out on the utilization of waste products in concrete. Such waste products include discarded tires, plastic, glass, steel, burnt foundry sand, and coal combustion by-products (CCBs). Each of these waste products has provided a specific effect on the properties of fresh and hardened concrete. Every year more than 500 billion plastic bags are used (nearly one million bag per minute). Hundreds of thousands of sea turtles, whales and other marine mammals die every year from eating discarded plastic bag for mistaken food. On land many animals suffer from similar fate to marine life. Collection, hauling ad disposal of plastic bag waste creates an additional environmental impact. In a landfill or in environment, Plastic bags take up to 1000 year to degrade.This paper presents a detailed review about waste and recycled plastics, waste management options, and research published on the effect of recycled plastic on the fresh and hardened properties of concrete. The effect of recycled and waste plastic on bulk density, air content, workability, and compressive strength, splitting tensile strength, modulus of elasticity, impact resistance, permeability, and abrasion resistance is discussed in this paper.**

keywords **- HPCA (hard plastic coarse aggregate), NCA (natural coarse aggregate), SWM (solid waste management), Global Warming**

Introduction:

The word plastic is derived from the Greek (plastikos) meaning capable of being shaped or molded. Plastic that are made up of polymers having only aliphatic (linear) C atoms in their backbone chains. e.g.: poly propylene. Plastics that are made up of heterochain polymers contain O, N, S in their backbone chains, in addition to C. e.g.: poly carbonate. Plastic behavior of polymers is influenced by their morphology (arrangement of molecules).they are either amorphous or crystalline. Most thermo sets are amorphous, while thermoplastics may be amorphous or semi crystalline. Plastic materials dumped into the earth prevent the production of nutrients in the soil. Because of this, the fertility of the soil is reduced and affects the agriculture sector. When its persistence in the environment can do great harm. It causes immune and enzyme disorders, hormonal disruption leading to endocrinal disorders and even infertility and is also considered as carcinogenic (cancer). Not only human health, it dangerously effects other animal life and alters the environment (air, water and soil) sustainability causing hazardous pollution. Plastics are widely used in making electrical instruments, telephones, paneling for walls, instrument boards, automobile parts, lamps, goggles, optical instruments, household appliances, etc. Plastics are a range of synthetic or semi-synthetic polymerization products that can be molded into a permanent object having the property of plasticity. Plastic are found extensive industrial applications. Plastics having a variety of properties are available at present. They have low specific gravities, ease of fabrication, resistance to low thermal and electrical conductivities. Many plastics can take range of color to enable them useful for decorative purposes.

1. Types of plastic:



Methods of process:
A.SOLID WASTE MANAGEMENT (SWM):

1. Mechanical recycling:

Mechanical recycling of plastics refers to processes which involve melting, shredding or granulation of waste plastics. Plastics must be sorted prior to mechanical recycling. Technology is being introduced to sort plastics automatically, using various techniques such as X-ray fluorescence, infrared and near infrared spectroscopy, electrostatics and flotation. Following sorting, the plastic is either melted down directly and molded into a new shape, or melted down after being shredded into flakes and then processed into granules called regranulate.

2. Chemical or feedstock recycling:

Feedstock recycling describes a range of plastic recovery techniques to make plastics, which break down polymers into their constituent monomers, which in turn can be used again in refineries, or petrochemical and chemical production. A range of feedstock recycling technologies is currently being explored. These include: pyrolysis, hydrogenation, gasification and thermal-cracking. Feedstock recycling has a greater flexibility over composition and is more tolerant to impurities than mechanical recycling, although it is capital-intensive and requires very large quantities of used plastic for reprocessing to be economically viable.

3. Thermal reprocessing:

Thermal reprocessing consists of heating a thermo plastic at very high temperatures, thus making the plastic flow. The plastic is then converted into a new product as it cools. This method does not involve the modification of the chemical composition of the plastics. For example, PET, being thermoplastic polyester, can be heated and reprocessed into building panels, fence posts, or fibers for carpeting. This process cannot be repeated indefinitely since repeated thermal reprocessing may eventually adversely affect the plastic properties. Thermal reprocessing is quite straightforward if it is applied to relatively pure thermoplastics. However, thermal reprocessing could not be applied to thermosets (such as cross-linked polyesters) because they cannot soften at high temperatures without degrading. Thermal reprocessing becomes much more involved if various thermoplastics are mixed together. One way of doing is to separate the various plastics. Separation of various plastics can be easy or complicated depending on the source of the waste. The other way to thermally reprocess mixed plastics is to use special equipment that takes into account the deferent thermal properties or makes few demands on the melting behavior of the plastic wastes (i.e., compression molding or melting in salt bath) and does not require meticulous removal of non-plastic wastes. Systems/mechanisms have been developed to reprocess mixed or commingled plastic wastes where plastics with lower melting point act as a matrix that carries other plastics and contaminants into the mould.

4. Fillers:

Plastic waste can also be used as fillers with virgin resins or other materials like concretes or as fill material in road construction. In such applications, chemical composition of the plastics is generally not very significant. This is an easy way to recycle thermoses or contaminated plastics in second grade applications. One such use is thermoplastic wastes that are melted and co-extruded or co-injected into mouldings with virgin resins. These virgin resins with superior properties are forced into the perimeter of the mold while the recycled plastics, with inferior properties, are injected in the center of the mold. Plastic wastes may also be used with some electiveness as a partial replacement of inorganic aggregates in concrete applications to decrease the dead weight of structures. Similarly, recycled rubber can be used in asphaltic concrete mixes or as a fill material in road construction. The advantages of adding recycled rubber to the asphalt mix include increased skid resistance under icy conditions, improved flexibility and crack resistance, and reduced traffic noise. Many researchers have reported the use of scrap tire/rubber in cement mortar and concrete, and have published a review paper, detailing the research on the use of scrap tire/rubber in concrete.

5. Chemical modification:

Plastic can be recycled by chemical modification or depolymerization. The two ways to achieve depolymerization are hydrolysis (chemical decomposition) and pyrolysis (thermal decomposition). For example, PET (polyethylene terephthalate) can be chemically modified to produce unsaturated polyester, thermoset polyester typically used in bathtubs, boat hulls, and automobile exterior panels. Another example is the thermal decomposition of acrylic wastes into methyl methacrylate (MMA), a monomer typically used in aircraft windows and neon signs. The technology of depolymerizing single condensation polymers such as urethanes, PET, nylon, and polymethyl methacrylates is relatively easy. However, it is much more complicated to chemically modify mixed plastics to produce useful and economical chemical feedstocks. studied the liberation and its impact on the separation of personal computer (PC) scrap and printed circuit board (PCB) scrap. Special equipment functioning as a shape separator and an aspirator used for the classification of electronic scrap. reported that retained properties and durability are among the most important tasks when evaluating the possibility of mechanical recycling of plastic waste of rigid PVC. performed the mechanical recycling of 100% post-consumer plastic waste into high-qual-ity products. The chemical and physical properties of these recycled materials were compared with similar prod-ucts manufactured from virgin resins. The properties of a blow moulded bottle prepared from 100% post-consumer high density polyethylene (HDPE) showed that this recycled polymer exceeded the materials specifications for virgin plastics designs. Similarly, a sample of thermoplastic polyolefin (TPO, 100% polypropylene), obtained entirely from shredder residue (SR), displayed sufcient material strength for future separation and reprocessing. studied the thermo-mechanical recycling of post-consumed plastic bottles, especially the ones made of polyethylene terephthalate (PET), and its use as composite materials for engineering applications. reported that PVC floorings as plastic waste can be mechanically recycled in the form in which they were recovered without upgrading, and without the addition of new plasticizer. prepared polymeric blends by mechanical recycling and character-ized LDPE/Al residues from cartooned packaging with recycled HDPE/LDPE and virgin PE resins. It was observed that processability, mechanical properties, chem-ical resistance and water absorption are dependent on the blend compositions compared the two treatment options, i.e., energy recovery and mechanical recycling of plastic wastes from discarded TV sets in the context of life cycle assessment (LCA) methodology. They concluded that mechanical recycling of plastics is more attractive treatment option in environmental terms than incineration for energy recovery, which generates a larger environmental burden.reported that air classi-fication is one among the clean mechanical separation methods that can achieve reasonably good separation of metals and plastics from the PCB stud. proposed a dissolution/reprecipitation technique for recycling of polypropylene (PP). It comprises dissolution of the plastic in an appropriate solvent, reprecipitation by using a non solvent, thorough washing of the material obtained and drying. Furthermore, the solvent mixtures involved are separated by fractional distillation for reuse.developed a new reactor system for recovery fuels from the waste plastic mixture in steam atmosphere. This system was composed of three kinds of reactors connected in series. One was a reactor filled with stirred heat medium particles, which enabled the high heat transfer rate, the high holdup and the good contact of the melted plastics with steam. The second was a tank reactor. The last one was a fixed bed reactor with FeOH catalyst particles, which showed the catalysis in steam for the decomposition both of a wax and sublimate materials gen-erated by the degradation of plastics.

showed that cryocomminution improves the efectiveness of size reduction of plastics, pro-motes liberation of constituents and increases specific sur-face size of comminuted particles in comparison to a comminution process carried out at room temperature. described various methods available to recover materials from e-waste. In particular, various recycling technologies for the glass, plastics, and metals found in e-waste were discussed. For plastics, chemical (feedstock) recycling, mechanical recycling, and ther-mal recycling methods were analyzed.

suggest that strong currents in large rivers may transport litter offshore while in the smaller rivers, where currents are weaker, the litter tends to become beached in the estuaries. As existing research indicates, there is much speculation about the reasons for the composition and distribution of plastic debris and much still needs to be done on the major influences to identify where policy can be effective. Moore *et al.* (2011) studied quantity and type of plastic debris from two urban rivers to coastal waters and beaches in Southern California. Using nets in the rivers they found 2.3 billion pieces over 72 hours, which weighed 30,500 kg. The majority were foams, such as polystyrene (71 per cent), followed by 'miscellaneous fragments' (14 per cent), pre-production pellets (10 per cent) and whole items (1 per cent). 81 per cent of all plastics were between 1 and 4.75 mm (the size above which California officially classifies them as rubbish). The study suggests more systemic monitoring could provide a picture of how much debris is being transported by rivers, which in turn could provide a baseline to support decisions by policymakers on how to prevent plastic entering rivers.

PAPER SIGNIFICANCE:

Most of the failures in concrete structures occur due to the failure of concrete by crushing of aggregates. PCAs which have low crushing values will not be crushed as easily as the stone aggregates. These aggregates are also lighter in weight compared to stone aggregates. Since a complete substitution for NCA was not found feasible, a partial substitution with various percentage of PCA was done. Both volumetric and grade substitution was employed in this investigation. Disposal of waste plastic consumer bags from the domestic has become a major problem to the agencies in the town and cities. The waste plastic bags available in the domestic waste mainly consist of low density polyethylene (LDPE). Plastic bags dumped in the dustbins find their way into the drainage system and clog them. Often, these are burnt along the roadside, which produces fumes causing air pollution. Industrial wastes from polypropylene (PP) and polyethylene terephthalate (PET) were studied as alternative replacements of a part of the conventional aggregates of concrete. volume of aggregates were used for the preparation of the concretes Plastics have become an inseparable and integral part of our lives. The amount of plastics consumed annually has been growing steadily. Its low density, strength, user-friendly designs, fabrication capabilities, long life, light weight, and low cost are the factors behind such phenomenal growth. Plastics have been used in packaging, automotive and industrial applications, medical delivery systems, artificial implants, other healthcare applications, water desalination, land/soil conservation, flood prevention, preservation and distribution of food, housing, communication materials, security systems, and other uses. With such large and varying applications, plastics contribute to an ever increasing volume in the solid waste stream. In the year 1996, plastics amounted to about 12% of MSW, by weight, in United States. The waste plastics collected from the solid wastes stream is a contaminated, assorted mixture of plastics. This makes the identification, segregation, and purification of the various types of plastics very challenging. In the plastics waste stream, polyethylene forms the largest fraction, which is followed by PET. Lesser amounts of other plastics can also be found in the plastics waste stream, as given in.

Scope for present study:

Plastics recycling have to be taken into consideration in any plastic waste management program. In addition to reducing the amount of waste disposed in landfills, it can also significantly contribute to the conservation of raw petrochemical products, as well as energy savings have reported that there are a few technological and economic constraints that currently limit the full and efficient recycling of plastic wastes into useful products, and these are: (i) contamination of plastic wastes with other materials such as dirt and metals that can dam-age the equipment used in the reprocessing of the waste; (ii) plastics are not homogeneous materials like aluminum or paper, but consist of a large number of grades with different molecular structures and properties, and each plastic component in a mixed waste has a different melting behavior, theology, and thermal stability; (iii) plastic mixtures are usually insoluble and form discrete phases within a continuous phase; (iv) plastic waste feedstock is not usually uniform over time and (v) plastic wastes have a relatively low density. There is also a need for better education and awareness around plastic waste. Plastic footprints and labeling on products are possible but need the appropriate education to make them meaningful. Alongside this there could be labeling of products that contain known harmful additives. Banning of some harmful chemicals contained in plastic, such as Biphenyl A and some phthalates has already occurred, but for others restriction may have to be voluntary. A harmonized industry wide effort is needed to communicate information about chemicals used in plastic, alongside public education about the chemicals. Waste management is highly important in addressing the issues of plastic waste. The systems differ from country to country and region to region. Although international and European legislation exists, it requires better monitoring tonsure complete implementation. More specific legislation or clauses within existing legislation relating to plastic waste could be considered. In terms of addressing existing problems with plastic waste the identification of plastic waste hotspots may prove useful. This can be done by monitoring or by some forms of modeling, for example, models of ocean currents such as gyres and the Gulfstream that casts floating objects to Caribbean and eastern North Atlantic shores (Bowmer and Kershaw, 2010). Another approach is the identification and protection of species, habitats and human groups that are vulnerable to plastic waste and the chemicals associated with it. In general, there needs to be better integration of marine planning with terrestrial planning. The frameworks are in place for this in terms of the EU Recommendation for Integrated Coastal Management and the Integration of Marine and Maritime Research, but more needs to be done to ensure better implementation and this may need to be more focused on plastic waste (Mouat *et al.*, 2010; Kershaw *et al.*, 2011).

Work on many levels, ranging from beach clean-ups to bans on plastic waste disposal at sea, to targets for waste management and recycling. Several market-based instruments have been explored such as deposit schemes to encourage the return and multi-use of plastics, and taxation on single-use plastics that do not fit into deposit return systems. However there has been little widespread application of these instruments and more research is needed to maximize their effectiveness and ensure they do not have secondary effects other than those intended. Plastic waste has the additional complication of spanning many policy areas, such as marine management, coastal management, waste management and the regulation of chemicals. This range of responses is necessary for such a global problem with such local variation, but to ensure plastic waste does not fall through the holes in the net responsibility, there is a need to harmonies efforts and coordinate between different policy areas. A number of reports have called for better implementation of existing policy. The Marine Strategy Framework Directive has specified 'marine litter' as one of its descriptors of good environmental status and four indicators of this have been identified which can be applied to plastic waste. However, there may also be room for policy that is more specifically related to plastic waste, while still allowing for its connection to different policy areas. Lastly, there are a number of research gaps that need to be addressed to provide a stronger evidence-base on which to develop policy. Some of these are at the detailed level of impact, such as the actual levels of chemical exposure caused by plastic waste. Others are more action-orientated, for example, identifying potential hotspots where plastic waste is problematic, identifying high-risk products that use plastic or identifying wildlife and human groups that are more vulnerable to the impacts of plastic waste. However, the very nature of plastic waste as a fluctuating and mobile issue means that science is unlikely to be able to answer all the questions. It may be preferable to take policy action before waiting for a completely clear research picture to emerge so as to avoid the risk of impacts worsening and becoming more difficult to manage in the future.

Studying plastic waste:

In rivers and estuaries could prove useful in trying to identify sources. Browne *et al.* (2010) investigated the composition of plastic debris on the banks of a UK estuary from both the surface and the underlying 3cm of sediment. Out of the 952 items found, microplastic (less than 1mm) accounted for 65 per cent of debris and mainly (80 per cent) consisted of the denser plastics such as PVC, polyester and polyamide. Macroplastics tended to be less dense. There are a number of possible explanations for this. For example, it could be that denser plastics are more likely to suffer weathering as they are in contact with abrasive particles in sediment, or it could be that denser microplastics are easier to distinguish from the sediment so appear to be more abundant. The research found a larger amount of microplastics at the more exposed sites towards the mouth of the estuary where debris is likely to experience strong wave-action and abrasion. Another possible source is the discharge from sewage treatment, as domestic laundry may act a source of fibres or microplastics. **Most studies** tend to sample floating plastic debris, but it is also important to monitor suspended plastic and plastic on the sea bottom. Bongo nets can be used to

Sample suspended debris, while trawl surveys, scuba diver surveys, and submarine vehicles can be used to sample plastic waste on the sea bottom. Data from the KIMO (Kommunenes Internasjonale Miljøorganisasjon) 'Fishing for Litter' activities organized by national governments in the Netherlands, Scotland and the United Kingdom found that plastic made up a large percentage of marine litter on the seabed.

ENVIRONMENTAL IMPACTS

Impact is considered in terms of its role in monitoring the state of plastic waste in the environment. Once again, there is very little research on land-based wildlife. Monitoring entangled wildlife can be used to evaluate the effectiveness of policy. However, it must be remembered that this type of monitoring indicates changes in abundance of debris that are responsible for entanglement, which can vary according to species and location. For example, after the MARPOL Annex V banned the disposal of plastics at sea, there was no decrease in entanglement rates of Hawaiian Monk Seals (Henderson, 2001). This is probably because most entanglements are due to lost fishing gear rather than plastics disposed by ships at sea. If the monitoring had considered a species that tended to be entangled by the type of plastic waste disposed by ships, then the impact may have been noticeable. With this variability and the relatively small numbers of entanglements that are recorded, caution has to be taken when scaling up figures. For example, UNEP's general figure of 100,000 mammals dying each year has been called into question. (National Oceanic and Atmospheric Administration, 2010).Ingestion of plastic occurs more frequently than entanglement. The MFSD has identified ingestion of waste as an indicator for monitoring environmental status. Ingestion of plastic waste has been documented in a number of species. For some species, almost all individuals contain ingested plastic (Ryan *et al.*, 2009), including sea birds, fish, turtles, mussels and mammals. Clearly different species ingest different types and sizes of plastic debris. Many animals mistake plastic waste for prey, for example, fish can confuse plastic pellets for plankton, birds may mistake pieces of plastic for cuttlefish or other prey Countless marine animals and sea birds become entangled in marine debris or ingest it. This can cause them serious harm and often results in their death. There is still relatively little information on the impact of plastics pollution on the ocean's ecosystems (Quayle, 1992; Wilber, 1987). There is however an increasing knowledge about their deleterious impacts on marine biota (Goldberg, 1995). The threats to marine life are primarily mechanical due to ingestion of plastic debris and entanglement in packaging bands, synthetic ropes and lines, or drift nets (Laist, 1987, 1997; Quayle, 1992). Since the use of plastics continues to increase, so does the amount of plastics polluting the marine environment. Robards et al. (1995) examined the gut content of thousands of birds in two separate studies and found that the ingestion of plastics by seabirds had significantly increased during the 10–15 years interval between studies. A study done in the North Pacific (Blight and Burger, 1997) found plastic particles in the stomachs of 8 of the 11 seabird species caught as bycatch. The list of affected species indicates that marine debris are affecting a significant number of species (Laist, 1997). It affects atleast 267 species worldwide, including86% of all sea turtle species, 44% of all seabird species, and 43% of all marine mammal species (Laist, 1997). The problem may be highly underestimated as most victim are likely to go undiscovered over vast ocean areas, as they either sink or are eaten by predators (Wolfe, 1987). There is also potential danger to marine ecosystems from the accumulation of plastic debris on the sea floor. According to Kanehiro et al. (1995) plastics made up 80–85% of the seabed debris in Tokyo Bay, an impressive figure considering that most plastic debris are buoyant.

Conclusion:

Many of researchers are working on plastic is very precious thing for our planet in live works replacement plastic is good thing my view of replacement of plastic to coarse aggregate is some difficult to preparation of plastic as coarse aggregate in others research papers are saying Plastics collected from the disposal area were sorted to get the superior one. These were crushed into small fraction and washed to remove the foreign particles. Then it was heated at a particular temperature so that the necessary brittleness was obtained. After extrusion the molten plastic was cooled down and collected in boulders of 100 mm size approximately. These plastic boulders were crushed down to the size of aggregates. In my hard plastic preparation is collect plastic from disposal area and grading cleaning lets use hydraulic machinery for melting plastic as semi solid state then later it becomes cool down and it's convert as small size by using crushers in construction field each ingredient is play a signfince role in their performance in that point aggregate shape is play a significance role that's why I suggest this type of hard plastic coarse aggregate

Hard plastic coarse aggregate

Natural coarse aggregate

Others plastic coarse aggregate

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