CONVERTING WASTE POLYETHYLENE TEREPHTHALATE (PET) PRODUCTS INTO UNSATURATED POLYESTER (UP) COMPOSITES

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ABSTRACT

How to handle the plastic waste is a big task for the modern society in environmental protection. People already focus on it, especially in PET soft drink bottles. Polyethylene terephthalate (PET) is widely used in packaging applications due to its clarity, light and low gas permeability. However, the post consumer PET bottles are not reused by manufacturers. They are left as plastic waste causing environmental problem since they cannot be degraded by natural processes. The effective solution that has been done to solve this problem is to recycle them.

On the other hand, concrete is one of the most common materials for human beings to use in construction. Concrete has good compressive strength, but poor in flexural and tensile strength, which limits its applications. Hence, scientists have tried to improve its properties by adding the polymer instead of the cement. Compared to cement based materials, the polymer concrete is very strong material. The fast curing time of this product is another important advantage in many construction applications.

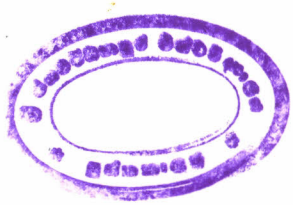
Polymer Concrete (PC) can be made by using Unsaturated Polyester (UP) resins. Currently, one widely used method is to convert high molecular weight polymer into low molecular weight molecules via chemical reactions. In this research post consumer PET bottles were depolymerized to lower molecular weight molecules by glycolysis with excess Ethylene Glycol (EG). The resulting glycolysed products were used to synthesis unsaturated polyester resins with phthalic anhydride and styrene monomer.

Polymer concrete mixture was 10% unsaturated polyester resin, 45% of oven dried gravel, 32% oven dried sand and 13% of fly ash. Methyl Ethyl Keton Peroxide (MEKP) was used as an initiator and Cobalt Octoate was used as an accelerator. All the components were mixed for a period of 3 minutes. Specimens were then transferred to a mould and allowed to cure at room temperature.

Curing of the Polymer Concrete (PC) is about 6 to 12 hours.

Average compressive strength of polymer concrete 2.12 Nmm^{-2}

Theoretically, the early rate of strength gain is much faster for PC than it is for cement concrete. PC gains more than 80% of its final strength in one day, while normal cement concrete achieves about 20% of its final strength in one day. However, the fast curing expected was not observed in this experiment. Therefore further research needs to be done by improving reaction conditions and additives.



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