

*Review Article*

A Review on Studies and Research on Use of Plastic Waste

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ABSTRACT

Minimization of waste material is important aspect of the modern growth and development initiatives. Plastic is used in various domestic and industrial applications. Use of plastic bags and bottles is very common. The disposal of plastic waste is major problem due to non biodegradable nature of plastic. The plastic can be used as feedstock for ethanol like products. It can be used for road construction and other construction related activities. The current review summarizes the research on use of waste plastic

Key words: recycle, composite materials, disposal, strength, fuel, pavements.

INTRODUCTION

Sustainable development is important aspect of modern development. The minimization of waste is key to many environmental problems. Many investigations are nowadays focused on use of waste material for various applications. Such wastes are being used for ethanol, starch, acetic acid and manufacturing of other chemical. [1-3] Waste materials are being used as adsorbents for removal of organic matter. [4-7] Removal of heavy metals and phenol was also carried out effectively by various investigators. [8-10] Various raw and waste materials have been tried for bioethanol and biodiesel production. [11-13] The waste plastic can be used for diesel production. Plastic waste is major problem faced by developing countries because of chemical nature of plastic and amount of plastic which is used and then dumped. This plastic can be used with road construction material to strengthen the road. This can solve the problem of the plastic disposal and road development. The present review

aims at summarizing the research on use of waste plastic for different applications.

RESEARCH AND STUDIES ON REUSE OF PLASTIC WASTE

Eneh carried out studies on application of recycled plastics and its composites in the built Environment. [14] He discussed the application of recycled waste plastic and its composite materials in the built environment. In his studies, he compared the benefits of its use to that of new or 'virgin' materials. According to him, recycled plastic materials and composites should replace new materials in the built environment. Rokade investigated use of waste plastic and waste rubber tyres in flexible highway pavements. [15] He prepared the semi dense bituminous concrete (SDBC) mix using Marshall Method of bituminous mix design. In his studies, the various mix design characteristics like Marshall stability value, flow value, bulk density, air voids (Vv), voids in mineral aggregate (VMA), voids filled with bitumen (VFB)

were found out. The results showed that with 5% bitumen content higher value of Marshall Stability value and greater density was achieved.

Poweth et.al. carried out research on use of plastic waste in road construction. [16] Their research was aimed at proposing a new method of disposal of plastic, quarry dust and tyre waste by using them in the sub grade of pavements. For this purpose, they conducted tests including specific gravity, grain size analysis and CBR test. They observed that, as the percentage of plastic waste increases, the maximum dry density decreases, thereby decreasing the CBR value. Also, increase in percentage of quarry dust resulted in increase of maximum dry density and CBR value.

Sarker et. al. carried out investigation on conversion of waste plastic into useful chemical products. [17] In their investigation, the fraction of a liquid produced by the thermal degradation process of waste plastics, containing about 29%, naphtha chemical, was subjected to thermal reactions. They used waste plastic material such as high-density polyethylene (HDPE-2), low-density polyethylene (LDPE-4), poly propylene (PP-5) and polystyrene (PS-6). The waste plastic was first converted to slurry, then thermal liquefaction was done at 370–420°C of the slurry followed by distilling, recovering and condensing. Nkwachukwu et.al. discussed sustainable development and plastic recycling in developing countries. [18] Their study indicates that due to poor facilities and awareness, most of these plastics, are currently disposed of in unauthorized dumping sites or burned uncontrollably in the fields. Their paper outlined environmental concerns of so many applications of plastics.

Rai et.al. carried out research on waste plastic mix concrete with plasticizer. [19] They prepared a number of concrete mixes in which sand was partially replaced by waste plastic flakes in varying

percentages by volume. They tested plastic mix concrete with and without super plasticizer at room temperature. They observed that the reduction in workability and compressive strength, due to partially replacement of sand by waste plastic, was minimal and can be enhanced by addition of superplasticizer.

Bhageerathy et.al. investigated application of biomedical plastic waste in bituminous road construction. [20] According to them the quantum of plastic in solid waste is increasing and it is important to recycle it. They also found that the deteriorating quality of roads was another area of concern. They tested autoclaved medical plastic waste in the form of shredded syringes in road construction. They investigated the performance of the bituminous mix modified with bio-medical plastic waste. They also determined the properties of Plastic Coated Aggregate (PCA). They found that PCA had better properties compared to normal mix. Sharma and Soni carried out review on production of alternative diesel fuel from waste oils. [21] The main focus of their paper was finding alternative fuel resources and utilizing them to eliminate their negative effects. They analyzed the properties of the oils derived from waste plastic pyrolysis oil, used engine oil and waste tyre oil. They concluded that the produced diesel from plastic pyrolysis oil, waste engine oil and waste tyre oil, are technically suitable, economically viable and less responsible to pollute environment.

Chavan carried out research on use of plastic waste in flexible pavements. [22] She cut plastic waste into a size such that it passes through 2-3mm sieve using shredding machine. The aggregate mix was heated and the plastic was effectively coated over the aggregate. The plastic coated mix was used with bitumen for road construction. They observed that use of the innovative technology will not only strengthen the road construction but also

increase the road life as well as will help to improve the environment. She concluded that using plastic waste in mix will help for reduction in need of bitumen by around 10%. Wayal and Wagle carried out research on use of waste plastic and waste rubber in aggregate and bitumen for road materials. [23] In their research they used polymer and crumbed rubber as a binder with respect to aggregate and bitumen. They tested the material for crushing value, impact value, abrasion value, and specific gravity, bitumen penetration value, ductility, softening point. They found that the use of waste plastics and rubber tyres in the form of powder for flexible pavement material is one of the best methods for easy disposal of wastes.

Sasane et.al. also investigated application of waste plastic as an effective construction material in flexible pavement. [24] According to them, use of plastic as an innovative technology not only strengthened the road construction but also increase the road life. They observed that the increase of waste plastic in bitumen increases the properties of aggregate and bitumen. They also found that coating of polymer on the surface of the aggregate resulted in many advantages. It improved the quality of flexible pavement. Raut et.al. carried out review on use of waste plastic bottles as construction material. [25] According to them, cost of the houses can be brought down by using waste plastic material along with construction material. Also according to them, the bottle houses are bio-climatic in design, which means that when it is cold outside is warm inside and vice versa.

Abatneh and Sahu carried out preliminary study on the conversion of different waste plastics into fuel oil. [26] Their work was aimed at the conversion of waste plastics into fuel oil. Their work was focused on thermal cracking of waste plastic to change them into usable resources. They observed that the reduction in the yield of the oil was due to

the effectiveness of the reactor seal which means the gases which are going to be condensed are leaking out. They also observed that the temperature at which the first droplet of oil was obtained, is determined for the respective plastic type being cracked. Swami et.al. carried out investigation on use of plastic in bituminous road. [27] According to them, the use of waste plastics on the road has helped to provide better place for burying the plastic waste without causing disposal problem. It also provided better roads.

Majka and Pielichowski investigated waste plastics for efficient flood protection systems. [28] In their article, they presented a new idea of plastics waste management, based on the production of composite materials with improved properties for flood protection systems. The concept of waste polymer reuse, which gives a new light for recycling and many new applications was presented by them.

CONCLUSION

The problem of plastic waste can be minimized by reuse of plastic. Waste plastic can be used for synthesis of products like ethanol. The use of plastic for road construction is widely investigated area. The strength of the roads constructed with plastic mixed bitumen was found to be more than that constructed with usual material. The conversion of plastic waste into fuel oil was also successfully carried out by few investigators. It can be concluded that use of waste plastic can minimize the disposal problem and add to economical aspects of fuel synthesis and various construction activities.

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