

Recycle and Reuse of Plastic Industry Waste

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ABSTRACT

The increasing awareness of the environment has contributed to concerns regarding our lifestyles and our indiscriminate disposal of waste. During the last decade, we have been trying to address this complex problem more aggressively. The study has analyzed the generation of plastic waste in plastic industry, along with its associated environmental impact and existing plastic waste management practice. The plastic product produced in industry used for various purposes such as food packaging (HDPE, PET), carry bags (LDPE, PS), carpet (PF, PC, and Acrylic) etc. In India, almost all types of plastic waste are recycled but some specific type of plastic waste is not recycled such as laminated layer of PPE and HDPE. In order to reduce the impact of plastic waste on environment, plastic waste generated in the industry was utilized in preparation of bituminous road for purpose of bonding and resistance against water stagnation. By reusing plastic waste in road construction there will be considerable saving of money.

Index Term— Environment, Plastic Industry, Plastic recycling, reuse, HDPE, PET, LDPE, PS, PF, PC Acrylic

1. INTRODUCTION

Plastics are polymers, a very large molecule made up of smaller units called monomers, which are joined together in a chain by a process called polymerization. The polymers generally contain carbon and hydrogen with other elements such as oxygen, nitrogen, chlorine and fluorine. According to the polymer used and process of polymerization, plastics can be design with a broad variation in properties that can be further modified by the addition of additives such as antioxidants and stabilizers. The industry selected for study is located at Bharuch, Gujarat, India. This plastic industry produces LDPE, HDPE, PET and PS. During manufacturing process, waste to the tune of 2% of total production is generated. This waste is used in construction of bitumen road.

2. MATERIALS AND METHODS

The study was carried out at a plastic industry at Bharuch, Gujarat, India. This plastic industry manufactures PET (Polyethylene Terephthalate), HDPE (High Density Polyethylene), LDPE (Low Density Polyethylene), PP (Polypropylene) and PS (Polystyrene).

Equipment's used for recycling plastic waste are shredder machine and plastic recycling machine.

Materials used for Mix design of bituminous are plastic waste (PET, LDPE, HDPE, and PS), coarse aggregate, fine aggregate, filler material (cement) and bitumen. Table 1 shows exact quantity of materials used in mix design.

Plastic Waste (as % of total aggregate weight)	Weight of Plastic Waste (in Grams)	Weight of Aggregate (in Grams)		Filler (in Grams)
		Fine aggregate	Coarse aggregate	
0	0	427	640	73
1	11.4	427	640	73
3	34.2	427	640	73
5	57	427	640	73

Table 1: Quantity of Raw Material Used

Equipments used for testing of mix design of bituminous are pan, sieve machine, hot air oven, weighing machine, induction coil heater, hammer, standard mould and Marshall Stability Apparatus.

In experimental work, Marshall sampling moulds were prepared using standard procedure (STP204-8). Calculation involved: Total weight of sample = 1140gm, Optimum bitumen content = 5%, Weight of bitumen = 60gm.

The Marshall test was done according to ASTM D6927-06 and Marshall Stability Value (S) and Flow Value (F) is determined. Results are tabulated in Table 2.

Sample No.	Plastic Waste (as % of total aggregate weight)	Marshall Stability Value(s)	Flow Value(F)
1	0	12.66	5.47
2	1	13.80	5.21
3	3	16.77	4.83
4	5	13.37	2.97

Table 2: Marshall Stability Value (S) and Flow Value (F)

3. RESULT AND DISCUSSION

From the experiment it is found that ratio of 3% of plastic waste to the total weight of aggregate gives maximum Marshall Stability Value. So in construction of road if 3% plastic waste is added then there will be saving of bitumen.

The plastic waste which would have otherwise dumped to landfill site is used for construction of road. Current rate of bitumen in market is 35-39Rs/kg. If the plastic waste is added to bitumen, content of bitumen in the mix will decrease to such extent. This experiment proves that it shall be economical to plastic industry as well as road construction industry to use plastic waste for road construction.

4. CONCLUSION

From the study of the behavior of mix design of plastic waste with bitumen, it is observed that Marshall Characteristics of modified mix design is improved. From the experiment it is

observed that the Marshall Stability Value increase with the plastic content up to 3% then starts decreasing. By reusing plastic waste in road construction pollution will be reduced and hence it will be beneficial to environment.

5. REFERENCES

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