Feasibility of Waste Plastic fibers in Self Compacting Concrete: A Review

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Abstract

This paper contains study on different properties of SCC (Self Compacting Concrete) i.e; physical, chemical and mechanical properties. Due to the increase of fibre content there is a decrement in the loss of weight, loss in compressive strength and chloride penetration. Increase in the segregation resistance is seen when Portland cement is used in place of fly ash.

Keyword: Self-Compacting Concrete, waste plastic fibres, Durability, PET, Fresh Concrete, Workability, Weight loss, Split Tensile Strength

Introduction

SSC is a kind of self dependent concrete which does not need any external mechanical tool to compact. Chloride attack is one of the major concern when we are dealing with the durability of concrete and concrete mix containing GGBS results in the retardation up to 30 to 60 min at normal temperature. Use of plastic waste (PET Bottles) as aggregates on some properties of concrete. Self-compacting concrete is a type of concrete which has ability to flow because of its own weight and it can pass between the bars to fill up the framework. Use of plastic waste instead of sand in the concrete results in the reduction in the of compressive strength of SSC and studies shows that 20% replacement of sand can reduce the compressive strength up to 70%.

Literature Review

Mostafa Jalal [3], performed chloride ion penetration for SCC using titanium dioxide powder which results in durability of Self-compacting concrete. Batayneh by his research told that replacing 20% of sand by plastic waste in making concrete can reduce the compressive strength of SCC up to 70% [4]. According to Al-Manaseer and Dalal, 1997 and 18, limited percentage of coarse aggregate is used in the manufacturing of SCC[5]. Comparison between ‘fibre reinforced concrete’ and ‘SCC’ consisting fibres cut from domestic waste polythene bags is done by Kandaswamy and he got the results that tensile and flexural strength of SCC with fibres is much greater as compared to fibre reinforced concrete[1]. Ozawa described that when Portland cement was used in place of flyash, segregation resistance boosted up[2].

Plastic waste is becoming major concern for its use in the self compacting concrete and light weight concrete[6]. Batayneh told that replacing the aggregates with PET waste (at 20%) can decrease the slump of concrete by 20-58mm[4]. Al-Hadithi showed that waste of plastic bottle in different can enhance the results in...
both compressive and splitting tensile strength[7]. High amount of PET, decreases the compressive strength because of lower plastic elastic modulus of PET [14]. According to Ghernouti [16] and Safi [17] workability of concrete can be increased by including plastic waste. If Alcofine is increased beyond to its limit, strength of SCC is minimized and its both workability and durability is also affected [18]. Using E-plastic waste can improve the total cost and properties of SCC [19].

20% of plastic waste in the concrete results in the loss in compressive strength more than 60% (Al bano et al,2009) [9]. With PET and high heating in concrete, concrete will suffer weakening, which is ultimately the cause of loss due to binding properties of CSH gel [11]. Binding properties of cement can be affected if plastic surface is smooth and ultimately overall strength of concrete can be affected [12, 13]. PET waste affect the compressive strength and density of concrete [24]. Due to high reactivity of silica fume with calcium hydroxide, permits it as a replacement for Portland cement [26]. According to Gupta et al [25], there is a corresponding increase in the segregation index value with the amount of marble powder as a replacement of fly ash[27]. Concrete mix containing GGBS results in the retardation up to 30 to 60 min at normal temperature [25].

The weight of normal weight concrete can be reduced by 2-6% by using waste plastic [29]. Curler, explained that plastic waste is contaminated and very difficult to recycle. Soroushian, explained the recycled plastic effect on the resistance of concrete[30]. Khaloon et al, showed that particles of tire rubber enhance the ductility of concrete in comparison to controlled concrete [13]. Good distribution of plastic waste can help in the reduction of void between granular [14]. Because of low bonding properties of plastic, flexural strength of SSC is affected [19]. Due to higher slump value, more is the ability of concrete to fill formwork under its own weight [21]. L-box height ratio must be equal to or greater than 0.8, to increase the passing ability of Self-compacting concrete [20]. Soroushian et al. (1995) explained that to enhance the toughness of concrete, polypropylene is used [12]. de Assmcao el al. (2004) used product of waste polystyrene cups i.e sodium polystyrene sulfonate (NaPss) as an admixture in concrete [11].

**Result and Discussion**

When the bonding properties of plastic, flexural strength of SCC and when waste plastic is used, weight of normal concrete is reduced by 2-6%. L-box ratio must be equal to or greater than 0.8. When polypropylene is used, toughness of concrete has improved. The results of chloride ion concentration test can be observed that the chloride penetration is reducedwith the increase in percentage of fibre. By replacing the aggregates with PET waste(at 20%) can decrease the slump of concrete by 20-58mm.
Conclusions

Based on the study of research paper the following things can be concluded.

1. It can be concluded that addition of waste plastic fibre into SCC will enhance durability and mechanical property.

2. Plastic waste with SCC is a major concern specially in the economical area.

3. Use of Alccofine should be limited, so that strength of SCC will not get affect.

4. Low Heating should be given to concrete so that it will not suffer the weakning.

References


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