The Effect Of Addition Of Polypropylene Fibers On Crushed Glass Concrete Mixed

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Abstract. The solution of environmental problems with a lot of indutrial and household waste by recycling waste such as rubber tires, glass fragments, tile fragments, ceramic fragments and fly-ash. This study aims develop new innovation of concrete mixing using household waste by substituted 15% glass crushed of the total weight of fine aggregate to polypropylene fibers concrete to get compressive strength. The result showed that BK and BS have a higher compressive strength than BN with the precentage increase of 13.82% and 18.53% at day 28. This study become a solution of waste problems by utilizing glass waste as an alternative to added concrete is very effectively.

Keywords: polypropylene fibers; crushed glass; concrete mixed

1. Introduction

The solution of environmental problems with a lot of indutrial and household waste are a challenge to solved it. Green construction is a hot issue for the last recently years. Green construction as a result from Green materials thereof recycling of industrial and household waste as a solution for it. Indutrial and household waste such as rubber tires, glass fragments, tile fragments, ceramic fragments, fly-ash, etc. This research used recycling materials is crushed glass with addition polypropylene fibers in concrete mixing. This study aims develop new innovation of concrete mixing using household waste. The development of concrete fibers is progressing and is proven to be able to improve the performance of concrete such as CFRP [1], Polypropylene and etc. In previous studies glass concrete mix with substitution in fine aggregate of 15% was able to increase the strength of concrete compared to normal concrete [2], [3], [4]. However, the use of crushed glass of more than 20% can reduce the strength of concrete and used crushed glass can make concrete works easily [5]. Polypropylene fibers can be found on everyday necessities where they are made of plastic [6]. Concrete with a mixture of Polypropylene fibers can increase the compressive strength of concrete [7].

2. Materials and method

2.1. Speciments and materials

The speciments are used in this study are concrete cyllinders with addition crushed glass and polypropylene fibers.

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Cyllinders Speciments

(a) **(b)** **(c)**

Figure 1. Polypropylene fibers (a,b) and crushed glass (c)

This study uses glass has become a waste. The glass is fine crushed based the requirements of passing the fine aggregate with granules between 0.15 mm and 5 mm. Then the crushed glass is substituted by 15% of the total weight of fine aggregate. The concrete mix design is 30 MPa. The polypropylene fibers used are already in the marketplace is SIKA fibre. Terms of use of SIKA fiber in concrete is 600 grams / m3. The amount of polypropylene fibers recommended by most manufacturers for use in paving mixtures and most other mixtures is 0.1 percent by volume of concrete (0.889 to 0.949 kg per cubic meter) [8]. SIKA fiber used is in proportion to the volume of concrete. Speciments category consists of normal concrete (BN) with 9 specimens, concrete mixture of 15% glass (BK) with 9 specimens, concrete mix glass of 15% + polypropylene fiber (BS) with 9 specimens. For all specimens tested based on the characteristics of concrete age on day 7, day 14 and day 28. Furthermore, comparing the compressive strength of concrete based on the characteristics of the constituent concrete material and the age of the concrete.

2.2. Method

Speciments was tested on Universal Testing Machine (UTM) to get compression strength and the setting up showed at Figure 2.

Figure 2. Setting up cyllinders compression test

3. Results and discussion

3.1. Result test of normal concrete compression strength (BN)

Comparing result of *normal concrete compression strength (BN)* for day 7, day 14, and day 28 at Table 1,2, and 3.

Table 1. Normal concrete compression strength (BN) for day 7

No. Sample	diameter (mm)	Area (mm^2)	Compression Strength (*fc'*) (MPa)
BN1	150	17662.5	18.31
BN2	150	17662.5	18.02
BN3	150	17662.5	18.22
Average			18.18

Table 2. Normal concrete compression strength (BN) for day 14

No. Sample	diameter (mm)	Area (mm^2)	Compression Strength (*fc'*) (MPa)
BN4	150	17662.5	22.43
BN5	150	17662.5	22.34
BN6	150	17662.5	23.12
Average			22.63

Table 3. Normal concrete compression strength (BN) for day 28

No. Sample	diameter (mm)	Area (mm^2)	Compression Strength (*fc'*) (MPa)
BN7	150	17662.5	28.05
BN8	150	17662.5	28.19
BN9	150	17662.5	29.71
Average			28.65

From Tables 1,2 and 3, it showed that the average compressive strength of BN for day 7 is 18.18 MPa, the average compressive strength of BN age of 14 days is 22.63 MPa, and the average BN compressive strength of day 28 is 28.65 MPa. The increasing percentage compressive strength of concrete age of 7 days to 14 days is 24.47% and the increasing percentage compressive strength of concrete age of 14 days to 28 days is 26.60%. Compression Strength of Normally cyllinders has increase from 7 days, 14 days and the maximum strength at 28 days is 28.65 MPa. It described that the compression strength test moving as like as age of the cyllinders.

3.2. Result test concrete mixture of 15% glass (BK)

Comparing result of *concrete mixture of 15% glass (BK)* for day 7, day 14, and day 28 at Table 4,5, and 6.

Table 4. *concrete mixture of 15% glass (BK)* for day 7

No. Sample	diameter (mm)	Area (mm^2)	Compression Strength (*fc'*) (MPa)
BK4	150	17662.5	24.37
BK5	150	17662.5	23.20
BK6	150	17662.5	24.96
Average			24.17

Table 5. *concrete mixture of 15% glass (BK)* for day 14

No. Sample	diameter (mm)	Area (mm^2)	Compression Strength (*fc'*) (MPa)
BK4	150	17662.5	26.61
BK5	150	17662.5	26.88
BK6	150	17662.5	20.91
Average			24.80

Table 6. *concrete mixture of 15% glass (BK)* for day 28

No. Sample	diameter (mm)	Area (mm^2)	Compression Strength (*fc'*) (MPa)
BK4	150	17662.5	31.89
BK5	150	17662.5	32.42
BK6	150	17662.5	33.53
Average			32.61

From Tables 4,5 and 6, it showed that the average compressive strength of BK for day is 24.17 MPa, the average compressive strength of BK for day 14 is 24.80 MPa, and the average compressive strength of BK for day 28 is 32.61 MPa. The percentage of the increasing strength in compressive strength of the concrete age of 7 days to 14 days is 2.61% and the percentage of the increasing strength in compressive strength of the concrete age of 14 days to 28 days is 31.49%. From these results provide an explanation that the increasing strength of compressive strength of concrete at the age of 7 days to 14 days is not as strentgh as the compressive strength of concrete 14 days to 28 days.

3.3. Result test concrete mix glass of 15% + polypropylene fiber (BS)

Comparing result of *concrete mixture of 15% glass (BK)* for day 7, day 14, and day 28 at Table 7,8, and 9.

Table 7. concrete mix glass of 15% + polypropylene fiber (BS) for day 7

No. Sample	diameter (mm)	Area (mm^2)	Compression Strength (*fc'*) (MPa)
BS1	150	17662.5	28.06
BS2	150	17662.5	27.39
BS3	150	17662.5	22.58
Average			26.01

Table 8. concrete mix glass of 15% + polypropylene fiber (BS) for day 14

No. Sample	diameter (mm)	Area (mm^2)	Compression Strength (*fc'*) (MPa)
BS1	150	17662.5	27.97
BS2	150	17662.5	31.07
BS3	150	17662.5	29.12
Average			29.38

Table 9. concrete mix glass of 15% + polypropylene fiber (BS) for day 28

No. Sample	diameter (mm)	Area (mm^2)	Compression Strength (*fc'*) (MPa)
BS1	150	17662.5	35.65
BS2	150	17662.5	33.95
BS3	150	17662.5	32.28
Average			33.96

From Tables 4,5 and 6, it showed that the average compressive strength of BS for 7 days is 26.01 MPa, the average compressive strength of BS day 14 is 29.38 MPa, and the average

compressive strength of BS day 28 is 3.61 MPa. The percentage of the increasing strength in compressive strength of the concrete age of 7 days to 14 days is 12.95% and the The percentage of the increasing strength in compressive strength of the concrete age of 14 days to 28 days is
15.58%.

3.4. Disscusion

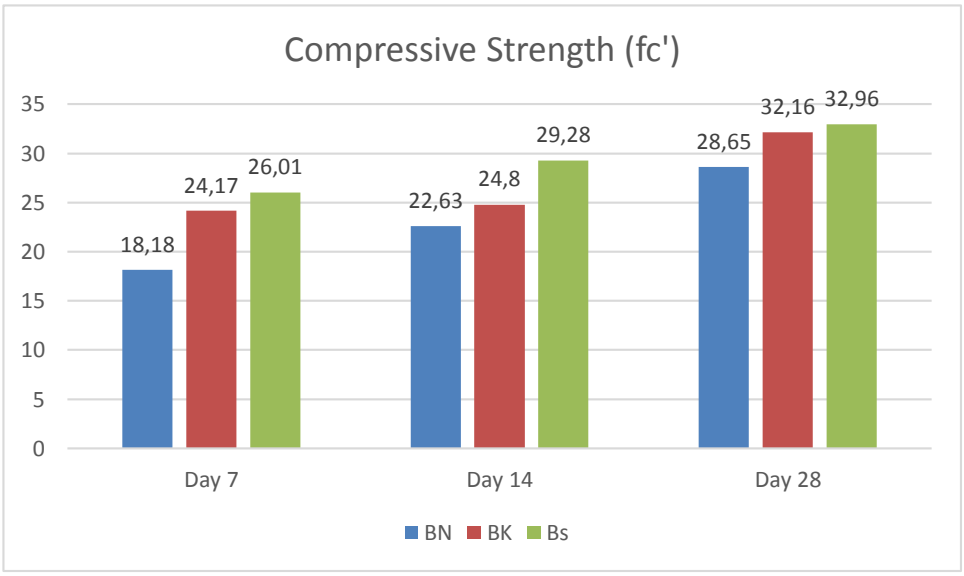

Figure 4. compressive strength chart

Based on figure 4 comparison of the compressive strength of day 7 concrete for BN is 18.18 MPa, BK is 24.17 MPa, and BS is 26.01 MPa. It shows that BK and BS have higher compressive strength than BN with the percentage increase of 32.94% and 43.07%. Furthermore, the compressive strength of day 14 for BN is 22.63 MPa, BK is 24.80 MPa, and BS is 29.38 MPa. It shows that BK and BS have a higher compressive strength than BN with the presentage increase of 9.59% and 29.83%. And finally the compressive strength day 28 for BN is 28.65 MPa, BK is 32.61 MPa, and BS is 33.96 MPa. It shows that BK and BS have a higher compressive strength than BN with the precentage increase of 13.82% and 18.53%. The compressive strength of BK and BS is higher than normal concrete due to reduced sand by 15% which is likely that the sand still has mud content. This causes the strength of concrete to increase due to glass crushed and polypropylene fibers able to work well as fillers in concrete mixtures.

4. Conclusion

The results of the study concluded that BK and BS have higher compressive strength compared to BN, with an increase percentage of 13.82% and 18.53%. This study become a solution of waste problems by utilizing glass waste as an alternative to added concrete is very effectively.

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