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Use of Waste Materials in Concrete

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ABSTRACT

Millions of tons of waste are produced in the world each year and most of it is not recyclable. Furthermore, recycling waste consumes energy and produces pollution. In addition, accumulation of waste in the suburbs and the disposal of waste are very dangerous for the environment. Using waste material in concrete production is an appropriate method for achieving two goals: eliminating waste and adding positive properties in concrete. Since the green concrete industry is expanding, it is necessary to evaluate concrete that contains waste from all aspects in order to determine its capability. This literature study consists of two parts i.e. the use of waste as a substitute for cement and as a substitute for aggregates. Leading waste material that has been used as substitutes is highlighted and the characteristics of the resulting concrete are evaluated. Ductility, strength, durability, etc. of concrete may be improved using waste materials.

Keywords: Concrete, recycling, durability, ductility, waste

INTRODUCTION

Concrete, one of the most important construction materials in the construction of infrastructure and development facilities, has the potential for significant and positive environmental participation. Concrete, as a constructive material, has been used in construction industry for about two centuries. Approximately, the whole bulk of the concrete is used in one year is more than one ton apiece. The modern life style along with the new technologies caused more waste materials production for which the disposing problem exist. Most of the waste materials are non-disposable and remain for hundreds and thousands of years in the environment. These non-biodegradable waste materials along with population growth have caused the environmental crisis all around the world. Many of them are stuffed in the dump place or they are outpoured in the dustbins illegally. As it is impossible to use only waste material instead of cement in construction, waste material can be reused as an aggregate. Aggregates occupy about 70% of the volume of concrete, thus a large amount of it can be reused. To avoid consumption of raw materials that are already scarce, this option is crucial, especially for European countries that are facing mineral deficiency.

WASTE MATERIAL AS AGGREGATE REPLACEMENT

RECYCLED CONCRETE

Research into the use of demolished concrete as aggregate for the new concrete production goes back to the end of World War II. Experiments on the use of concrete waste in the production of concrete began in 1993. Evaluation of different concrete mixtures containing fine-grain concrete waste concluded that the addition of a superplasticiser improved the concrete shrinkage (Merlet & Pimiento, 1993). Other experiments showed that drying shrinkage of concrete containing 30% of fine-grain concrete waste with a constant water-cement ratio and varying amounts of water reducer, is equal to the loss of natural aggregate concrete in180 days (Zega & di Maio , 2011). It should be noted that, by adding fly ash as an alternative to cement, it is possible to reduce the shrinkage of concrete that is due to the addition of waste aggregate (Jeong , 2011).Some studies were done on the effects of increasing the coarse recycled concrete aggregates on mechanical characteristics and deformation caused by shrinkage (Cartuxo et al.,2015). In another study considering two samples with clay brick powder as cement and recycled concrete aggregates, mechanical properties were investigated. Results showed that clay brick powder compensated the decreasing of compressive strength due to the use of recycled aggregates because this powder can fill the porosity of concrete well (Letelier et al., 2017).

Research conducted from 1993 up to now indicates that concrete waste is reusable in concrete production. However, depending on the project, type and amounts should be specified precisely and it is noted that this waste is susceptible to carbonate reaction and may cause corrosion of the reinforcement, so the carbonation depth should be measured.

TILE AND SANITARY CERAMICS

A tile is a piece of artificial stone with thickness of a few millimeters and a glassy, soft and smooth surface on one side. Ceramic is a non-metallic and non-organic material. It is classified in two categories of crystalline and non-crystalline. Tile and ceramic waste is created during the transfer process, during or after burning, due to human error, manufacturing error or use of in appropriate material and much of it is due to the destruction of buildings (Tavakoli et al., 2012). Many studies have been done to dump this waste in concrete. The results of experiments showed that it would be feasible to use tile waste in concrete as pozzolan or aggregate (Ay & Unal, 2000; Portella et al., 2006). Using white ceramic aggregates as fine aggregate and substituted with ratios of 10% to 50% , the quality of concrete improved (Lopez et al., 2007). Moreover, if porcelain sanitary waste is used as coarse aggregate in concrete at a rate of 3% to 9%, its resistance is more than that of concrete without additives at a rate of 2% to 8% (Guerra et al ., 2009) . If the curing process takes a long time, about 28 days, and 15% to 20% of aggregates containing porcelain sanitary waste are used, then the concrete's resistance may be increased (Medina et al., 2012; Medina et al., 2012). Heidari et al. (2013) examined the effect of ceramic aggregates in concrete. For this purpose, ceramic was used as both coarse grain at a rate of 0% to 40% and sand at a rate of 0 to 100%. Figure 1 shows the size of the ceramic particles used in these studies.

Figure 1. Different sizes of ceramic tile waste (Tavakoli et al., 2013)

The results showed that the use of ceramics did not have a significant negative effect on the properties of concrete. The optimum sample of ceramic as an alternative to sand was about 25 to 50%. The best example of using ceramics as coarse grain used between 10% and 20% of it. Not only was there increase in compressive strength in this instance, there was a decrease in specific weight without a significant negative effect on water absorption. Table 1 and Table 2 show the summary of these results.

Table1 : *Physical and mechanical properties of concrete mixes (PhaseA) (Tavakoli et al., 2013)*

Sample	Slump(mm)	Specific Weight(kg/m^3)	Water Absorption (%)	Average Strength(MPa)	
				7 days	28 days
C	60	2441	5.05	26.9	33.1
CS25	55	2430	4.96	28.1	35.7
CS50	50	2382	4.79	27.2	35.1
CS75	40	2341	5.10	25.8	34.6
CS100	40	2294	5.30	24.1	33.7

Table2: *Physical and mechanical properties of concrete mixes (PhaseB) (Tavakoli et al.,2013)*

Sample	Slump(mm)	Specific Weight (kg/m^3)	Water Absorption (%)	Average Strength(MPa)	
				7 days	28 days
C	60	2441	5.05	26.9	33.1
CG10	50	2427	4.9	28.2	34.8
CG20	50	2407	5.2	27	34.3
CG30	45	2397	5.45	27.2	34.1
CG40	40	2385	5.7	25.7	33

Mechanical strength increased by addition of waste aggregates and it was higher than that of the control sample . In addition, maximum water penetration depth in the waste aggregates in the treated concrete was lower than in ordinary concrete; the amount used was less than 30mm. Thus, the replacement of natural aggregates with waste aggregates can increase water penetration resistance (Medina et al., 2013). In order to create concrete with good performance, concrete with a mixture of 20% natural and ceramic aggregates can be used as it gives the same compressive strength as normal concrete with 100 MPa. The corrosion probability can be reduced by the 180th day of curing and by using 50% of the mixture aggregates (Gonzalez & Etxeberria, 2014). Therefore, it is possible to use tile waste in the form of fine and coarse aggregates. It should be noted that ceramic particles can also be porous or hard, in which case they are not only effective in the process of water absorption, but also in the elasticity of concrete (Anderson et al., 2016).

Generally, tile and ceramics with low specific weight and pozzolanic properties are a good choice for manufacturing concrete, but the results have shown that this material must be tested before concrete production and cannot be relied on to give the results of these preliminary studies because the type of burning of the tile and its constituents and even the type of mixing plan are factors that influence the behavior of the concrete.

STONE DUST

Stone dust, a byproduct of stone crushing is being produced in huge amount in the stone crushing zone of Bangladesh. Disposal of this stone dust has become a major concern of our country. Concrete is a tension-weak building material, fiber can be used to overcome it. The addition of fiber in concrete effectively improves the mechanical properties and strength. Utilization of recycled fiber obtained from condensed milk-can and stone dust will benefit in term of waste reduction, recycling of waste and would provide low-cost construction material. The goal of this investigation is to establish the use of disregarded stone dust for construction purposes as fine aggregate and utilize the condensed milk-can as fiber reinforcement in concrete. This study concentrates on the relative comparison of the compressive strength of concrete cylinder, the flexural strength of rectangular beam and workability in term of slump by using full and partial replacement of sand with stone dust in concrete with 0%, 0.5% and 1% of condensed milk-can fiber based on the weight of cement. The test results show that samples made of full stone dust with 1% fiber give 1.05% higher compressive strength than samples made of sand with no fiber at 28 days. Besides, the use of stone dust and 1% fiber has increased flexural strength by 11.12% at 28 days.

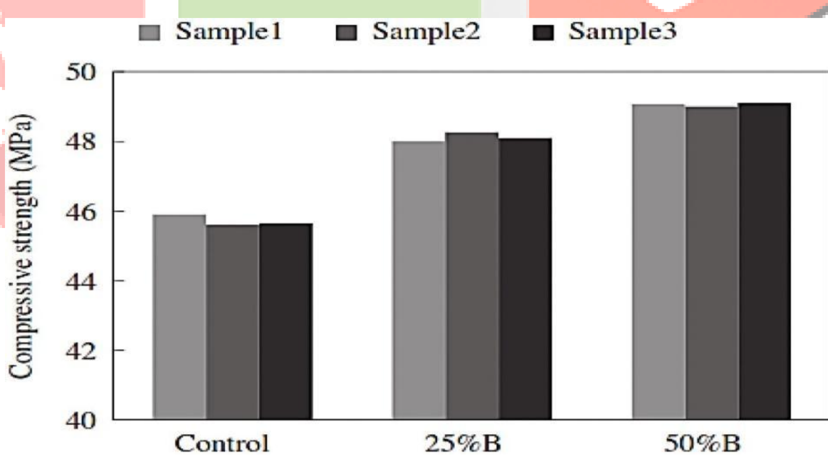
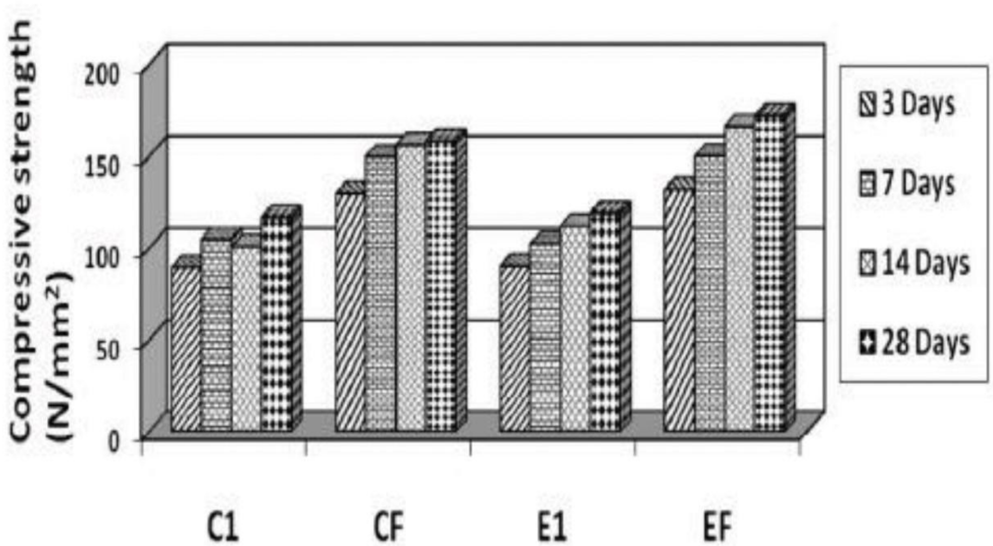


Figure 2.The 28-day compressive strength of the samples

CLAY BRICKS

Fired bricks are burnt in a kiln and most of them contain silica, alumina, lime, iron oxide and magnesia. Because of this chemical structure, the use of bricks in concrete production seems to be practical. Researchers have suggested different mixtures to create this type of concrete. One study showed that the compressive strength of this concrete has a downward trend. This reduction was equal to 10% to 35% for coarse aggregates and 30% to 40% for fine aggregates (Akhtaruzzaman & Hasnat, 1983). Using clay bricks as sand in concrete increased water absorption and this may affect the durability of concrete parameters, so this subject needs more investigation (Tavakoli et al., 2014). In terms of durability, the concrete containing clay brick waste was no different from the control sample. Nevertheless, the brick aggregates had a negative effect on the durability of the reinforced concrete. A high amount of clay brick aggregate can reduce the corrosion time of bars, although this concrete has better performance in freezing and thawing. As the amount of bricks increase, the stability against the chloride ion penetration reduces. This reduction can be due to the higher absorption of the bricks because of their porosity. The 28-day compressive strength of concrete with brick coarse aggregates was slightly greater than that of the control sample and workability was also improved by increasing the amount of the brick coarse aggregates in the concrete (Adamson et al.,2015). In general, the results showed that using this type of waste was economical and practical. In addition there were no significant negative effects on the concrete. However, bricks are not suitable for use in reinforced concrete because they cause corrosion of bars.

METAL SCRAP One ton of steel produces 17% of slag, which is used in depot sites. Due to the high production of metal products, a plan is required for its use. The major components of slag include the oxides of calcium, magnesium, silicon, iron and other metals, so it seems that the use of this waste is practicable in concrete production. The first step in studying these materials was done by Akinmusuruin 1991 regarding the use of metal slag as an aggregate in the concrete (Akinmusuru,1991).The initial studies proved that slag can be used in the manufacturing of non-structural concretes (Rai et al.,2002), but gradually it was shown that slag conversion to aggregate can be used as a substitute for coarse grain (Tay et al., 2003). In another study, industrial solid waste completely replaced the coarse aggregate and it was proved that this type of concrete had higher shear modulus and chemical stability in acidic and alkaline solutions than ordinary concrete (Ghailan, 2005). Later, the results of using slag in high performance concrete showed that compressive strength, water absorption and tensile strength of this type of concrete were higher than those of the control sample (Demirboğa & Gül, 2006). Slump decreases with the increasing metal waste and, as expected, density and bending strength increase compared to those of the control samples (Ismail & Al-Hashemi, 2008). Studies have shown the possibility of creating concrete with a compressive strength of higher than150MPa by copper slag when copper is used as a substitute for fine grain. With full replacement of standard sand and copper slag, it was concluded that the largest reduction in 28-day compressive strength was about 15 to 25%. Figure 8 shows the results on samples of 100 mm cubes. Mixture 1 is concrete without aggregate and steel fibre, mixture 2 is concrete without sand, mixture 3 is concrete without copper slag and steel fibre and mixture 4 is concrete without copper slag. It can be observed that the control sample immediately breaks at the end of the linear region. These studies also showed that the bending strength of fiber-reinforced concrete is approximately two-times higher than that



of concrete without fibre (Ambily et al., 2015). In a recent study about high-volume slag concrete the results showed that with an increase in slag, carbonation depth increases (Han-Seung & Wang, 2016). In general, what follows from these results is that, due to the hardness and high density of the steel furnace slag compared to those of the natural aggregates, compressive strength and flexural strength of concrete increase. However, it should be noted that this waste can increase the weight of the concrete and may turn the concrete into a non-consumable material for the building industry.

TYRES AND RUBBER

Tyres are rubber pieces that are mounted on vehicle wheels. Tyres are made of natural rubber, styrene-butadiene, polybutadiene, carbon black and silica, which is used in high-performances tyres. The main idea of using this elastomeric material in cementitious matrix is to reduce the stiffness of concrete in order to make it more flexible and to improve its resistance to fire (Olivares & Barluenga,2004). The use of tyre scrap as a substitute for aggregates and cement in concrete is new. Figure 3 shows grading tyres that can be used in concrete.

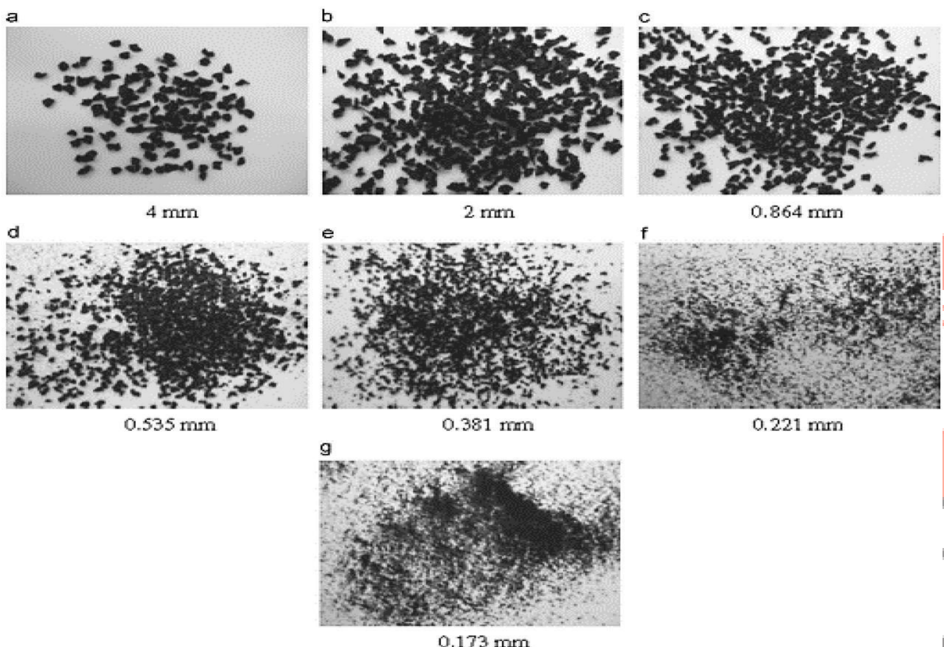
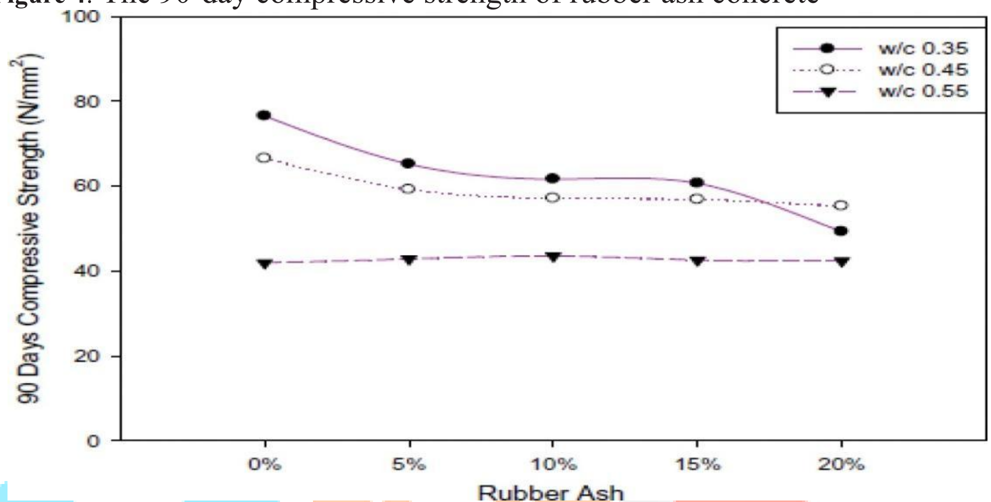


Figure 3: Various sizes of crumb rubber

Olivares and Barluenga (2004) used rubber waste as fibre. The results showed that by increasing the amount of rubber, the performance of concrete decreased. A flexural strength test showed that the concrete samples containing rubber tyre as fibre were stronger by upto 20% compared with the strength of the control samples. This could have been due to the conversion of the concrete to a more flexible material through the addition of rubber fiber. The control samples showed fractures caused by brittleness, and immediately split after cracking, while the samples containing plastic fibre became deformed but did not collapse (Yilmaz & Degirmenci, 2009). Sohrabi and Karbalai (2011) also showed that using silica fume with increased adhesion between the cement paste and rubber particles improved the filling of the pores and increased the compressive strength. The density of this type of concrete is also13% less than that of the control samples (Pelisser et al., 2011). The increase of waste tyres can influence the carbonation depth, especially if the tyres are used as coarse-grained rubber (Bravo & Brito, 2012). Workability is also reduced by keeping the ratio of water to cement and increasing the amount of the ash of rubber. By increasing the percentage of rubber ash for water-to-cement ratios of 0.35 and 0.45, compressive strength was decreased. Figure 4 shows the 90-day compressive strength of cement with various ratios of water-to-cement and rubber ash (Gupta et al., 2014). In freezing-thawing resistance, the experiments showed that replacing or adding fine crumb rubber improved this property (Gesoğlu et al., 2014 a, 2014 b; Thomas & Gupta, 2016). It would seem that the use of tyre waste as an alternative in concrete still needs to be studied and further explored to determine the durability and strength of this material on concrete.

Figure 4: The 90-day compressive strength of rubber ash concrete



AGRICULTURAL WASTE

Between 20 and 30% of agricultural production in the world becomes waste. The using of agricultural product waste has attracted researchers' attention to return the investment to the economic cycle. The most popular agricultural waste is almond and coconut shell.

Almond shell is not very common and it is more used in research to produce light weight concrete. A study by Siamardy and Vahedi (2008) was conducted by using almond shell as the coarse aggregate. Their research showed that this type of concrete had average performance slump, high air content and low density compared to those of ordinary concrete. Another study on coconut shell showed that this material had the capability to produce light concrete with good quality(Gunasekaran,2008). In the long-term experiments, tests carried out in 365 days of concrete, this type of concrete also had good quality. Even the ultimate adhesion strength of this type of concrete is much higher than the theory of adhesion strength (Olanipekun et al., 2006).

Investigating the characteristics of concrete containing coarse grain coconut shell showed that this concrete had lower weight and its mechanical properties were equal to concrete with ordinary coarse aggregate. The long-term compressive strength of concrete containing coconut shell aggregate showed good quality and showed flexural behaviour comparable to that of the control sample (Gunasekaran et al., 2012, 2013; Gunasekaran et al., 2010; Gunasekaran et al., 2011 a, 2011 b). A recent study showed that 40% replacement of conventional aggregate with coconut shell could decrease the compressive strength of concrete by about 22% and to improve this property, reduction of the water-to-cement-ratio was necessary (Kanojia & Jain, 2017). Generally, it can be said that concrete made with coconut shell has higher compressive strength than concrete containing oil palm shell because of the roughness of coconut shell and its better adhesion with cement flakes (Shafigh et al.,2014). The microscopic surface of both materials can be seen in Figure

5 and Figure 6.

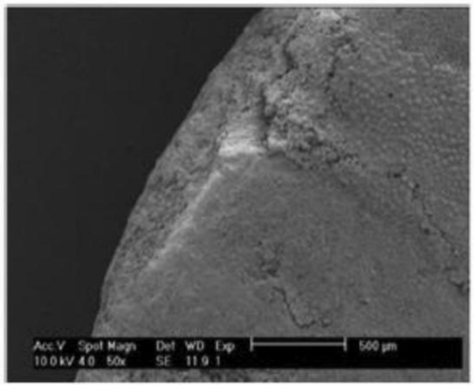


Figure 5: Microscopic images of the surface of an OPS grain in two scales

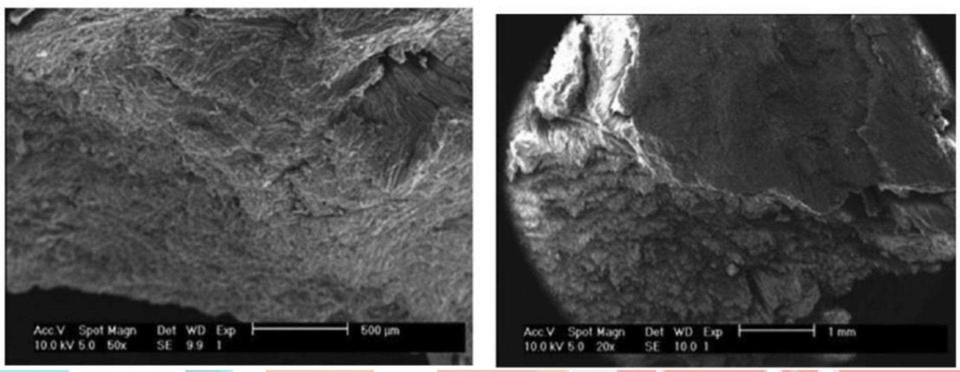


Figure 6: Microscopic images of the surface of coconut shell grain

WASTE MATERIALS AS CEMENT REPLACEMENT

SILICA FUME

Silica fume is a product of electrostatic capturing and tranquilizing of silica dust with gasses discharged from electric arcs or alloys in the production process of silicon metal, particularly ferro silicon alloys. This material has more than 80% non-crystalline silica with a diameter between 0.01 and 0.3 microns, which is about 50 to 100 times smaller than cement particles (Tavakoli et al., 2012). It is a 'super pozzolan' that can improve portland cement production properties. It modifies the physical characteristics of early cement paste and the micro-structural characteristics of cement paste after hardening. Research on the effects of silica fume on concrete started in 1987. The researchers of this study examined the effects of silica fume on high-strength concrete. The highest compressive strength achieved was for a sample containing 15% cement replacement with silica fume due to the filler effect and pozzolanic reactions (Yogendran et al., 1987). Brooks et al. (1998) also examined the factors affecting the high-strength concrete shrinkage containing this material. Mechanical characteristics in the short and long term on the high strength of concrete has also shown that by replacing10% and 15% silica fume with cement, its compressive strength did not increase after 90 days and enhancement of strength occurred at the early curing ages. In addition, initial and final creep decreased with increasing amounts of silica fume (Mazloom et al., 2004). Studies on high performance concrete have shown that increasing the superplasticiser from 5 to 20%and decreasing the water-cement ratio from 0.31 to 0.26 caused an increase in compressive strength from 86 to 97 MPa (Sobolev, 2004). Table 3 shows the compressive strength in this scheme. Ganjian and Pouya (2005) investigated the effects of silica fume on resistance to sulfate attack in sea waters subjected to tidal waves and simulated by dry-wet conditions. The results showed that silica fume had more harmful effects on the durability of concrete (Tanyildizi & Coskun, 2008) but if fly ash were added to silica in concrete, the resistance to sulfate attack would improve (Wang et al., 2017) and in the case of reinforcing concrete to steel fibre containing micro silica, tensile strength significantly increased (Köksal et al., 2008). The simultaneous effects of silica fume and nano silica in concrete were investigated. The results showed that using both of these materials in concrete could increase the compressive strength of the concrete. This was because of the filler ability of the nanoparticles and a decrease in porosity (Heidari & Tavakoli, 2013).

Table3: *Details of HPC mixtures (Heidari & Tavakoli, 2013)*

Proportions(kg/m^3)	SF (5%)	SF (10%)	SF (15%)	SF (20%)
Cement	426	449	468	478
Silica fume	22	50	83	120
Age	Compressive Strength(MPa)			
1 day	16.8	24.1	34.4	45.1
3 days	28.6	42.2	63	84.9
7 days	50.1	67.2	84.8	102.5
28 days	60	80	100	120

As the results showed, although silica fume could improve some of the mechanical features of concrete, it could reduce some durability characteristics. So it is recommended to use other admixtures beside silica fume in concrete to mitigate some of its negative features such as low durability.

AGRICULTURAL WASTE

From agricultural waste, rice husk ash is the most applicable. The heating value of 1 ton of rice husk is equal to the thermal value of 0.48 tons of coal or 0.36 tons of fuel oil. If rice husk is used for fuel, it burns uncontrolled and many particles change to crystalline, which dramatically reduces pozzolanic activity. Therefore, if rice husk is going to be used in concrete, it must be burnt under controlled conditions and milled in the long run so that its pozzolanic properties increase. In a study, by calcining rice husk in 500 and using micro silica in high-performance concrete, the researchers obtained porosity decreased by development of the hydration of cement. Using these two materials improve the compressive strength and water absorption of concrete (Huang et al., 2017) and it was proved that rice husk ash has high pozzolanic potential (Mehta ,1992).It can also improve resistance to chloride attack, compressive strength and other mechanical properties (Antiohos et al., 2014). Adding a superplasticiser can also increase slump and decrease viscosity. Using rice husk ash can reduce the filling ability of concrete; however, paste viscosity and segregation rose sharply. By combining rice husk ash and flyash the self-compacting and compressive strength properties of concrete improved (Le & Ludwig, 2016). Finally, studies have showed that in countries with limited production, rice husk ash can be a valuable additive in concrete products such as high-strength concrete and reconstructive mortars. Corncob has also been used in some studies. Corncob ash consists of more than 65% silicon dioxide and more than 70% combination of aluminium oxide and silicon dioxide. This reflects that the material is cemented and may have a viscous role in concrete (Adesanya, 1996; Adesanya & Raheem, 2009, 2010).Therefore, the use of these materials in the construction of concrete is practical, but they should be used more carefully in order to preserve their pozzolanic property and to strengthen the microstructure of the concrete.

FLY ASH

In power plants that are fuelled by coal, there are spherical particles in the gas that come from burning coal with a diameter of 0.1 to 0.15 mm; the particles are made up of about 85% of silicon, aluminium , iron, magnesium and calcium. Investigating the effects of fly ash started in 1999, and it was observed that the creep and shrinkage level of flyash samples can be less than those of materials that do not use fly ash (Day, 1990). Also, if the curing temperature increases, the flyash reaction will increase in the cement paste (Hanehara et al.,2001). This is not limited to only the amount of cement hydration but has effects on the type, characteristics, stability and the production process of hydration (Rojas & Cabrera, 2002; Ma, 2013).

According to ASTM C618, fly ash has two classes, Class F and Class C. The main difference between the two is on the levels of calcium, aluminium , silicon and iron content in the ash. Haque et al. (1984) pioneered the investigation of high-volume fly ash concrete. In1987 and 1989, studies explored the incorporation of large quantities of fly ash in concrete. The method was about aerated and non-aerated concrete with 55% weight of flyash substituted for cement in three strength levels of 21, 28 and 35 MPa. The results showed that the initial and final setting were not significantly influenced by replacing flyash with cement by upto 55%. In addition, concrete containing 40 to 60% of fly ash showed lower compressive strength at an early curing age. However, it showed higher compressive strength compared to similar concrete without flyash in 28 days (Naik & Ramme, 1987, 1989). Generally, ClassF fly ash with good pozzolanic activities cause good mechanical properties, durability and low chloride permeability (Malhotra,1990). By using a superplasticiser, poor abrasion resistance was generated compared to concrete without flyash (Bilodeau & Malhotra ,1992). By using 50% fly ash in Class F, an appropriate concrete was obtained for the construction of reinforced concrete structures (Siddique,2004). Chung-Ho et al.(2013) showed that in flyash concrete, setting time and air percentage increased with enhancement of flyash dose. Due to the fact that a high amount of flyash and good pozzolanic activity reacts with CH of cement, the porosity of concrete decreases. Moreover, compressive and flexural strength of concrete shows an on going trend in 91 days and 365 days. Concrete mixtures containing flyash with low loss of ignition had higher mechanical properties compared to concrete mixtures containing fly ash with high loss of ignition; in addition, increasing fly ash in concrete caused higher shrinkage due to drying at different ages (Chung-Ho et al., 2013).

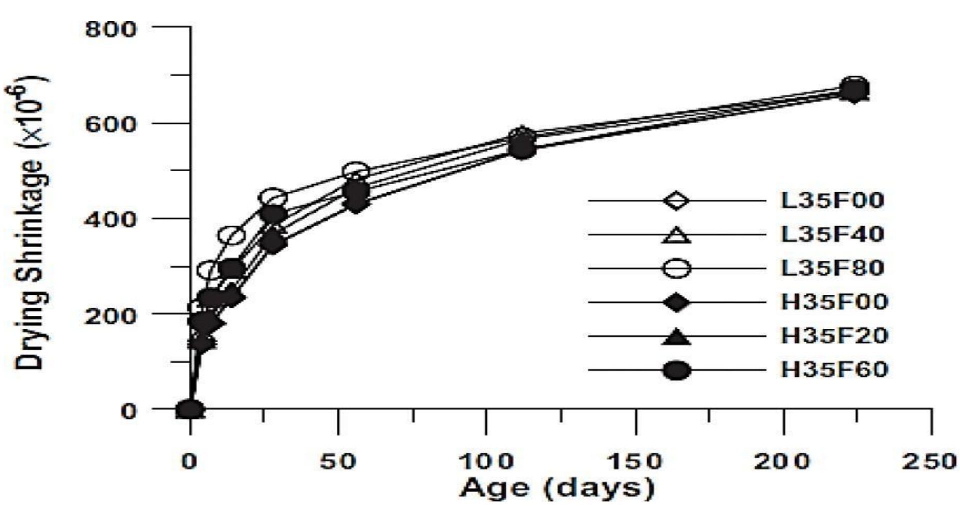


Figure 7 : Development of shrinkage

Investigations have also shown that flyash can increase the compressive strength of concrete on long curing days and improve concrete durability by reducing permeability and increasing density. This type of material, in contrast to concrete waste and brick, is suitable for use in reinforced concrete.

CERAMIC TILE, SANITARY CERAMIC AND CLAY BRICK

The first studies on chemical properties of waste ceramic tiles were done in 2000.The results showed that waste tile has pozzolanic properties and the ability to be used in concrete construction (Shang, 2000; Toledo et al., 2007). Some studies investigated the use of clay brick waste from demolished buildings as a pozzolanic material. The results showed that this material could be replaced in cement (Lin et al., 2010). Tourgal and Jalali (2010) replaced 20% of the samples of ceramic waste as a pozzolan. The experimental results showed that strength equal to 91% of the control sample can be reached by using these materials. It also reduced the permeability of concrete and increased its efficiency. Heidari and Tavakoli (2014) investigated waste ceramic tile concrete with silica fume to determine the effects of pozzolanic tile waste and confirmed pozzolan activity. Tile powder was used in different amounts in the concrete and its properties were measured. The results showed that increasing ceramic tile reduces compressive strength . However, if silica fume is added, the good effects will be doubled and the concrete defects will be covered. In these experiments the highest compressive strength was observed in the for 20% ceramic tile and 15% silica fume, while the lowest compressive strength was related to the 25% ceramic tile and 5% silica fume (Heidari & Tavakoli, 2010).

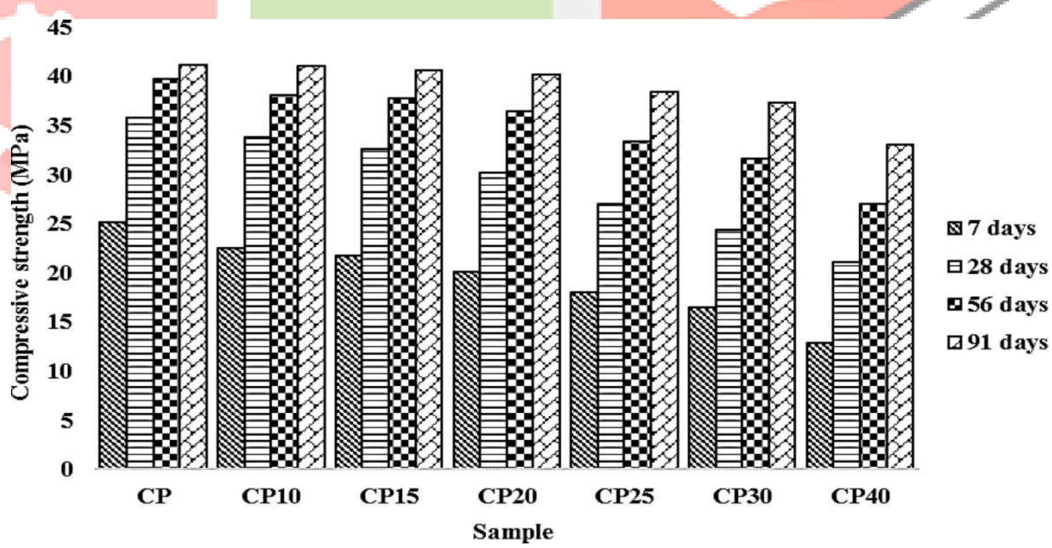


Figure 8 : Compressive strength of samples

CONCLUSION AND FUTURE WORKS

The use of waste materials in concrete was reviewed. The intention of this study was to express the advantages and disadvantages of using waste in concrete, the effect of doing this and introducing materials that can be used in concrete. In order to clarify the details, the reviews were conducted in two parts, considering substitutes as aggregates and substitutes as part of cement. The most important studies in this field were reviewed and the properties of concrete that used waste were investigated. The study showed that waste material can be used in concrete. If waste is used as aggregates in concrete, it can lead to disposal of a large amount of waste. On the one hand, when a material is used as a substitution for cement in concrete, it has two advantages: less use of cement, an element that is very destructive upon the environment and the recycling of waste. It is not possible to make use of every kind of waste on every type of concrete as this may endanger the quality of the concrete, and in turn, is especially harmful to the environment. For functions such as filler, binder and separator, a portion of concrete can be replaced with waste as this causes little damage to the final mixture. On the other hand, usually in the process of production and transportation of waste material, harmful additives are added to the waste that can also be harmful to concrete. Based on literature review, research, it may be seen that concrete using waste material is having lower negative effects and better performance.

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