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PERFORMANCE OF AGRO-WASTE SUGARCANE BAGASSE ASH IN CONCRETE UNDER DURABILITY TESTS

Neha Bhardwaj, Senthil Kasilingam✉

Department of Civil Engineering, Dr B R Ambedkar National Institute of Technology Jalandhar, Punjab, India

ABSTRACT

The concrete industry frequently uses waste material known as sugarcane bagasse ash (SCBA) because of its excellent pozzolanic qualities. Cement is a rare and essential component of concrete construction that is in high demand all over the world. Meanwhile, carbon dioxide (CO_2) is generated widely due to the infrastructure development in the construction sector. To lower CO_2 emissions, concrete must contain less cement. Replacing some of the cement in concrete with agricultural wastes such as rice husks and sugar cane bagasse significantly reduces the material's environmental impact. Therefore, this study focuses on the durability performance of concrete with sugarcane bagasse ash as a partial replacement for cement at 5%, 10% and 15% by weight. The durability of the concrete was studied through the electrical resistivity test, rapid chloride infiltration test, initial surface absorption test, as well as carbonation after 7 days and 28 days. It was observed that the SCBA is a pozzolanic substance with good binder qualities that may be utilised in concrete mixtures to partially replace costly cement.

Keywords: agro-waste, sugarcane bagasse ash, durability, concrete

INTRODUCTION

The most popular construction material is concrete. The demand for ordinary portland cement (OPC) is rising at an alarming rate, with its production predicted to increase by over 50% between 2017 and the end of 2050. For every tonne of OPC produced, an estimated 1 tonne of carbon dioxide (CO_2) will be released (Mohammadinia et al., 2018). Various research studies have investigated the possibility of using processed or unprocessed ash as a cement replacement material (CRM), while there is an abundance of agro-industrial, agricultural and industrial by-products. Fly ash, silica fume, and ground granulated blast furnace slag (GGBS) are well-known CRMs that have shown potential in high-performance concrete. India is the world's second-largest producer of bagasse ash from sugarcane (SCBA) after Brazil. Typically, alternate products for building materials in the construction industries are made from industrial and agricultural waste. The primary goal of employing these components in concrete is to avoid damaging the environment when these waste products are disposed of. Global sugarcane production is nearly 1,500 million tonnes, whereas India produces 8.8 million tonnes of SCBA and almost 670 million tonnes of bagasse ash as a by-product. Worldwide sugar production is explained in Figure 1. By recycling the waste from the industrial and agricultural sectors, researchers are working to create infrastructure and protect the environment

Neha Bhardwaj https://orcid.org/0000-0002-0144-8486; Senthil Kasilingam https://orcid.org/0000-0001-5051-0920
✉kasilingams@nitj.ac.in

from the dangerous contamination of silica, various oxides, and unburned particles (Joshaghani & Moeini, 2017). According to Rahimah, Nasir and Kusbiantoro (2015), ash burned at extremely high temperatures will not exhibit high reactivity. According to Cordeiro, Andreão and Tavares (2019), SCBA's crystalline characteristics were changed to an amorphous state by calcining it at 600°C. This enhances the pozzolanic property of the ash.

Reducing the adverse environmental effects and, consequently, pollution is the primary goal of using industrial and agricultural waste in concrete, and SCBA is one of the primary agriculture by-products that has mineral applications. Producing cement involves profound environmental effects as it produces a significant amount of carbon emissions along with other compounds. According to current research, using SCBA instead of cement increases the pozzolanic property and produces good results for compressive strength (Jha Sachan & Singh, 2021).

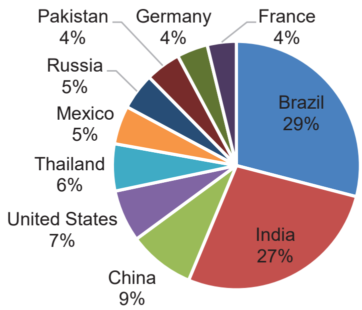

Fig. 1. Worldwide production of sugar in 2024

Source: own work.

A larger number of and different cement (cementitious) materials have been used recently in an effort to lower the amount of cement used and, thus, CO_2 emissions. Meanwhile, there is a huge amount of agricultural waste (AW), which is often in the form of ash following its use in generating energy, as a result of the significant increase in demand for agricultural products. Ashes from agricultural waste were combined with clay and lime, then mixed for two days to create a strongly linked cement-like substance (Heniegal, Ramadan, Naguib & Agwa, 2020). Ash from various agricultural wastes has lately been shown by researchers to be a feasible material for use in the concrete industry. Due to their high concentrations of CaO, SiO_2, Al_2O_3, and Fe_2O_3, agricultural wastes can partially replace conventional stabilisers like cement and quicklime. Green concrete, which is more sustainable and kinder to the environment, can be produced in the concrete industry by using agricultural residual ash (Zeyad, Johari, Tayeh & Yusufet, 2016; Amin, Tayeh & Agwaet, 2020). For pozzolan materials, the most often used specification is ASTM C618-22 (ASTM International [ASTM], 2022). The total oxide concentrations in the chemical compounds SiO_2, Al_2O_3, and Fe_2O_3 must be greater than 70% in order for a material to be considered pozzolanic and have CO_2 and CaO contents (Thomas et al., 2021). From previous studies, it was concluded that bagasse ash – by-product of sugarcane processing – contains high amounts of silica (SiO_2) and alumina (Al_2O_3), which is similar to cement. It was also confirmed that once bagasse ash is finely ground, it can meet the pozzolanic activity requirements as per ASTM C618-22 and, as per previous research, has comparable or even superior strength to conventional concrete. This has been observed when the replacement amount is 5–20%. Bagasse ash reduces water absorption and increases its resistance to sulphate chloride attacks, while also reducing the concrete's porosity.

MATERIAL AND METHODS

The following materials were utilised to make the concrete mixes in the lab. According to Indian standard recommendations, OPC of grade 43 is used along with sand, gravel, superplasticiser, water and SCBA as a partial replacement of the cement by weight.

Cement. In this experimental study, grade 43 OPC was used, meeting the IS 269:2015 specifications (Bureau of Indian Standards [BIS], 2015) and possessing a specific gravity of 3.15. A residue of 8.5% remained on the 90 µm IS-sieve (Indian Standard sieve) and 33% was the usual consistency of the selected OPC. The cement's physical characteristics after conducting the necessary tests were as follows.

Fine aggregate. According to IS 383:2016 (BIS, 2016), Zone II river sand with particle sizes smaller than 4.75 mm but larger than 600 µm was utilised as a fine aggregate in this investigation. The specific gravity of the sand is 2.51, its fineness modulus is 2.65, and its water absorption rate is 1.3%. The bulk density of the fine aggregates was found to be 1,545 $kg \cdot m^{-3}$. The sand was found to be free of silt, clay, and biological contaminants.

Gravel. Natural gravel that was crushed into 4.75 mm and 20 mm sizes and was in compliance with IS 383:2016 specifications was utilised as the coarse aggregate. Its 2.69 specific gravity was determined to be acceptable. The water absorption was 0.7%, and the fineness modulus was 7.1. This large aggregate has a bulk density of 1,610 $kg \cdot m^{-3}$.

Water. Concrete mixing water should not contain any unwanted organic materials or excessive amounts of inorganic components. Concrete can also be made from water that satisfies specified requirements, such as being devoid of organic waste and having a pH of 6–8. Sodium and potassium carbonates and bicarbonates influence the setting time of cement. The specimen was cast and cured using tap water that conformed to IS 456:2000 specifications (BIS, 2000).

Sugarcane bagasse ash (SCBA). After the juice is extracted from sugar cane, the remaining fibrous agricultural waste is called bagasse. First, sugarcane was washed under running water to eliminate impurities like sand that can alter the reactivity of the ash. The SCBA possesses pozzolanic qualities. After burning dry bagasse at 500°C, bagasse ash is produced. Its particular surface area, absorbance, surface response, etc., are improved after burning. It is classified as solid waste and is frequently dumped in landfills. The silica content present in SCBA is around 62%, along with small amounts of Al_2O_3, CaO, Fe_2O_3, and K_2O. A 10% loss of ignition (LOI) suggests a significant concentration of organic materials that has not been burned. Quartz and cristobalite are the two main crystalline phases that can be found in sugarcane bagasse ash (SiO_2). The SCBA utilised in this study was transported from a nearby sugar plant in Kapurthala, Punjab. Following sufficient grinding, the SCBA's specific surface area was 2,550 $m^2 \cdot kg^{-1}$, its bulk density was 580 $kg \cdot m^{-3}$, and its specific gravity was 2.4.

Superplasticiser. Superplasticisers assist in enhancing the early flowability properties of concrete and enable water content reductions of up to 30% without affecting the workability. A poly naphthalene sulphonate superplasticiser was utilised in this investigation at a dosage of 1% of the cement's weight, having a specific gravity of 1.1.

RESULTS AND DISCUSSION

Four different M40-grade mixes were prepared in accordance with IS 10262:2019 specifications (BIS, 2019). Specimens in the form of 100 × 100 m cylinders and 150 mm cubes were cast using these mixes (Table 1) and kept in curing tanks for up to 28 days.

Table 1. Mix design

Name	Type of mix	w/c	Cement [kg]	SCBA [kg]	Water [l]	Gravel [kg]	Sand [kg]	Superplasticiser [ml]
Mix 1	100% OPC	0.36	412	–	148	1,257	666	4.12
Mix 2	5% SCBA + 95% OPC	0.36	391.4	20.6	148	1,257	666	4.12
Mix 3	10% SCBA + 90% OPC	0.36	370.8	41.2	148	1,257	666	4.12
Mix 4	15% SCBA + 85% OPC	0.36	350.2	61.8	148	1,257	666	4.12

OPC – ordinary portland cement, SCBA – sugarcane bagasse ash.

Source: own work.

Mechanical tests on concrete

Compressive strength testing is the most popular since it directly relates to the strength of the structure. All the samples created for the strength tests are 150 × 150 × 150 mm cubes that were cast using various mixtures. The mixture information is shown in Table 1. The samples were demoulded and placed in a curing tank after 24 h, then at 7 days and 28 days, cubes of curing material were extracted for testing in a compression testing machine. It was found that all the blended mixes (Mixes 2–4) had good strengths comparable to the base mix (Mix 1). To properly evaluate how SCBA affects concrete's qualities and draw conclusions on how these mineral-based additives affect concrete's durability, the specimens were tested using a variety of standard testing methods at intervals of up to 28 days.

Compressive strength of blended concrete

In order to examine the behaviour of the three blended concretes and one conventional concrete, 150-millimetre cubes were cast for each of the four mixes. Following the casting process, the specimens were demoulded and allowed to cure in potable water for a day. After the 7 days and 28 days that are advised for curing, the cubes were removed from the water and allowed to air dry before being exposed to high temperatures. At 7 days and 28 days, the 150-millimetre sample cubes were subjected to compressive strength testing for every age and percentage cement replacement configuration. Only Mix 3 exhibited better compressive strength after 7 days and 28 days (Fig. 2) compared to the other mixes, according to the compressive strength test findings.

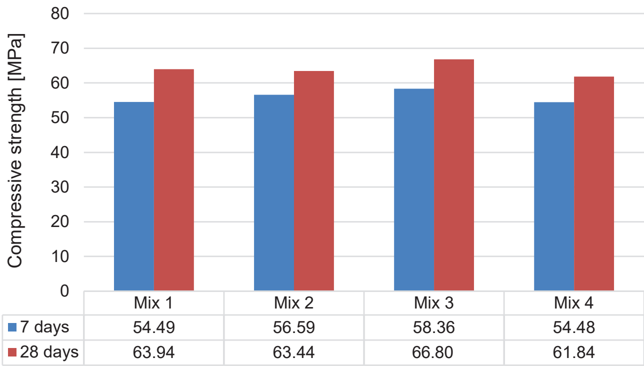

Fig. 2. Compressive strength test results after 7- and 28-day curing periods for all blended concrete samples

Source: own work.

Compared to normal concrete after 28 days of curing, it was determined that the influence of SCBA at a 10% cement replacement was considerable. The significant increase in compressive strength may be due to improved particle packing and the formation of strong hydration products. It was also observed that increasing the percentage of bagasse ash reduced the compressive strength of the concrete after 7 days and 28 days of curing.

Tensile strength test results of blended concrete

Tensile strength is the concrete's capability to withstand an amount of force or resist a tensile force applied to a concrete sample without breaking. The split tensile strength percentages after 7 days and 28 days of curing are shown in Figure 3. Mix 3 exhibited a higher tensile strength value than the other three blended concretes. The increase in strength after 28 days of curing was due to a better stress distribution and increased tensile strength resulting from the fine bagasse ash particles filling in the concrete's voids, increasing its density, and decreasing microcracks. It was observed that there was an approximately 30–35% increment in tensile strength after 7 days of curing.

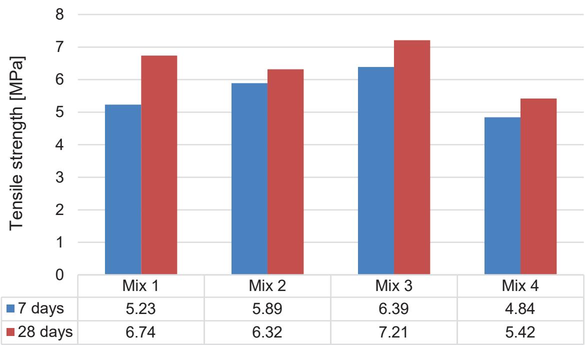

Fig. 3. Split tensile strength result after 7- and 28-day curing periods for all blended concrete samples

Source: own work.

Durability tests on blended concrete

Electrical resistivity test

To evaluate the concrete's resistance to corrosion, the AASTHO TP 95 (American Association of State Highway and Transportation Officials [AASHO], 2011) and ASTM C 1202-10 (ASTM, 2010) standards governed this test, known as the initial surface absorption test (ISAT). One of the non-destructive techniques for assessing the durability and quality of concrete is the electrical resistivity test. This test is beneficial in determining the uniformity, permeability, and probability of reinforcing corrosion. A four-probe apparatus is placed on a damp surface during the procedure. The two exterior probes are placed along the sample, allowing current to flow through the sample while the inside probes maintain the required potential difference. The electrical resistivity test examines how well the concrete can tolerate corrosive solutions passing through it since it depends on the pace at which ions travel. The corrosion risk is assessed using the threshold values listed in ASTM C 1202-10. Higher moisture and ion contents are indicated by a low resistivity value, which could accelerate the corrosion of embedded steel reinforcement. In this research, as per the ASTM standard, our resistivity value lied between 20 $k\Omega \cdot cm^{-1}$ and 50 $k\Omega \cdot cm^{-1}$, which means it has very little possibility of corrosion. Electrical resistivity readings were obtained 7 days and 28 days after curing. When compared to the base mixture, the resistivities of all three blended mixes significantly improved. The resistivity at 28 days was 6% higher for 10% SCBA-blended concrete than for 15% SCBA-blended concrete, with their similar values being 69.2% and 79.5%, respectively, whereas 5% SCBA displayed an observed value of 72.4% (Fig. 4).

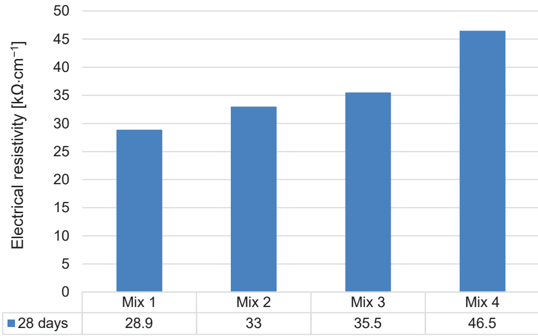

Fig. 4. Electrical resistivity results after 28-day curing period for all blended concrete samples

Source: own work.

Rapid chloride penetration test

A primary cause of corrosion in reinforced concrete is the penetration of chloride ions. To determine how resistant concrete is to chloride ion infiltration, the rapid chloride infiltration test (RCPT) is utilised. This is a popular technique for evaluating concrete's resistance to the infiltration of chloride ions. It offers an indirect measure of concrete's durability, particularly in situations where corrosion of steel reinforcing from chloride is a problem (e.g., sea constructions, bridges). The ASTM C 1202-10 guidelines were adhered to in this work. A 50-millimetre-thick cylindrical concrete disc was submerged for six hours in a 3% NaCl solution and a NaOH solution with two cells with 0.3N 60 V flowing through it (Fig. 5). Analysis of the 28-day data revealed that the RCPT values of the SCBA 10% mix were remarkably high, as seen in Figure 5, while the RCPT values of the SCBA 5% and 15% mixes were lower. This could be due to the SCBA particles, which drastically changed the concrete's pore structure. As per the ASTM C 1202-10 standard, the RCPT value shows that it has very low concrete chloride permeability; the RCPT value decreased due to pozzolanic reactions in the blended concrete with a higher SCBA percentage. The same trend is observed by Ramasamy (2012).

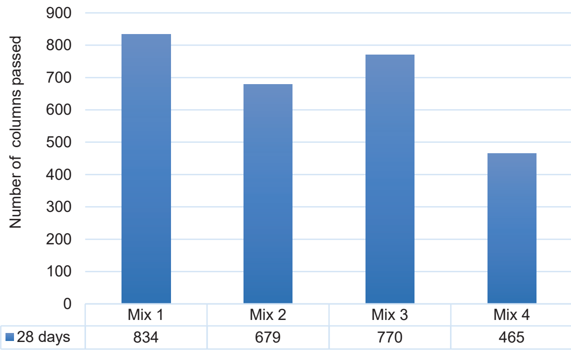

Fig. 5. Test results after 28 days of chloride penetration for all blended concrete samples

Source: own work.

Initial surface absorption test (ISAT)

The initial surface absorption test (ISAT) was conducted following the BS 1881-208:1996 standard (BSI, 1996). To determine the concrete's ability to absorb surface water, the rate of water penetration per unit area of concrete can be determined using a constant water head of 18–20 cm (Fig. 6). The penetrability characteristics of the surface zone have a major influence on concrete's performance in difficult conditions. There is a significant reduction in the corrosion of reinforced concrete members if the concrete covering is less permeable to strong fluids.

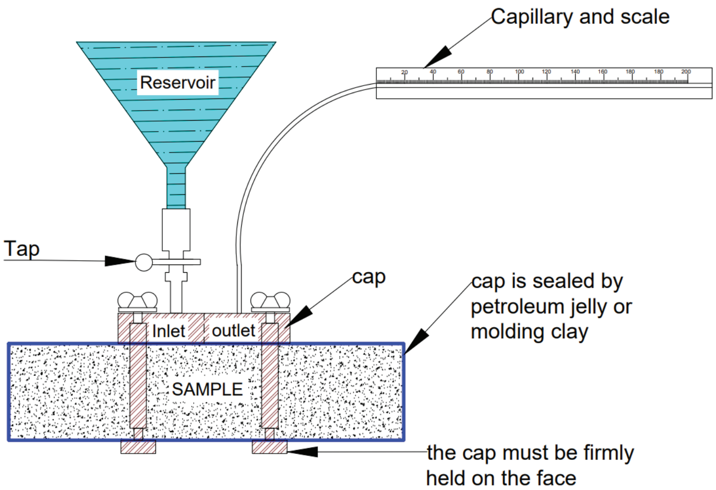

Fig. 6. Setup for initial surface absorption test

Source: Balakrishna, Mohamad, Evans and Rahmanown (2018).

At 28 days, the 10-minute ISAT values of SCBA mixed concrete exhibited a 54.8% improvement, as shown in Figure 7. It becomes more difficult to transport fluid in blended mixes because the pozzolanic processes tend to refine the capillary pore system. Similar patterns were observed by Chi (2012) and Olufemi (2017).

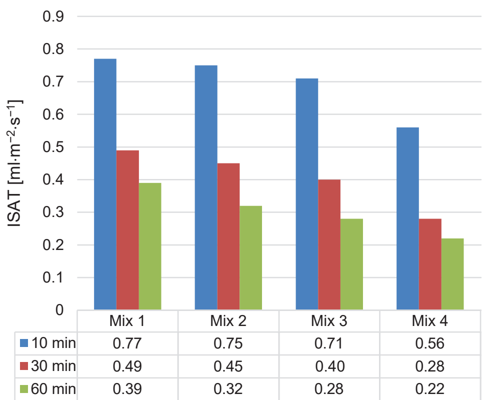

Fig. 7. Initial surface absorption test results after 28 days of curing for all blended concrete samples

Source: own work.

Carbonation test

This is one method for determining how deeply carbonation has occurred in concrete. In concrete, carbonation occurs when the calcium hydroxide [$Ca(OH)_2$] and atmospheric CO_2 mix to form calcium carbonate ($CaCO_3$). The pH of the concrete is lowered by this procedure, which may cause the embedded steel reinforcement to corrode. Table 2 shows the measured carbonation depths for the different mixes. The $Ca(OH)_2$ in concrete has a tendency to maintain a pH of 12.5–13.5, reducing corrosion. An acidic environment is produced while the carbonation process continues, which significantly raises the risk of corrosion.

Table 2. Carbonation depth

Mix	Carbonation depth [mm]	
	after 7 days	after 28 days
1	0	0
2	0	0
3	0	0
4	0	2

Source: own work.

To evaluate the carbonation of the samples, five sides of 100-millimetre concrete cubes coated with epoxy paint and exposed to CO_2 were used (Figs 8 and 9). The samples were placed in a carbonation chamber with a CO_2 concentration of 4–5% and a relative humidity of 55–65%. after removing them from carbonation chamber, the samples are cut in half and phenolphthalein is sprayed on the sample. The depth of the carbonation was measured at predetermined intervals. It was discovered that the 2 mm carbonation depth in Mix 4 with 15% SCBA was equal to up to 28 days of CO_2 exposure, as shown in Table 2.

Fig. 8. Specimens coated with epoxy

Source: own work.

Fig. 9. Phenolphthalein sprayed on samples

Source: own work.

CONCLUSIONS

The mechanical and durability test results are satisfactory, indicating that SCBA can be used to replace fine aggregate in concrete. One of the best substitutes for fine aggregate is found to be SCBA. It is also one of the workable options for making use of leftover ash, as opposed to disposing of it to landfill. The SCBA must be correctly calibrated at 600°C for two days in order to achieve all these optimal results, which makes it stronger and more resilient than regular concrete. This change also has no detrimental effects on the environment.

The findings make it reasonable to draw the following conclusions:

– Without changing the water-to-cement ratio, the ideal proportion of SCBA (10% replacement of cement) significantly increases the workability of concrete compared to the control mix.
– The split tensile test findings indicate that a 10% replacement of cement will result in the maximum strength gain. Therefore, 10% is the ideal percentage for SCBA to replace the cement in the concrete. When 10% replacement of SCBA is used, the overall strength of the concrete's mechanical properties – compressive strength and tensile strength – increases by approximately 8–10% when compared to the control mix. The water absorption and porosity also increased with the increasing SCBA ratio.
– The RCPT values were found to be 'very low' for Mix 4 compared to the other mixes. Comparing SCBA-mixed concrete with the base mix, the 28-day RCPT value decreased by 54.6%. Likewise, it was determined that the 10% SCBA substitution enhanced the concrete's resistance to corrosion.
– It was observed that Mix 4 had carbonation of 2 mm at 28 days, while Mixes 1–3 had a 0-millimetre carbonation depth at 28 days. Additionally, it was observed that Mix 4 had carbonation of 2 mm at 7 days and 28 days. Finally, it was noted that the initial surface absorption test (ISAT) findings for Mixes 1, 2, and 3 were found to be reduced in comparison to Mix 4.

Authors' contributions

Conceptualisation and methodology: N.B.; investigation: N.B.; data curation: N.B.; writing – original draft preparation: N.B.; writing – review and editing: S.K.; visualisation: S.K.; project administration: S.K.

All authors have read and agreed to the published version of the manuscript.

REFERENCES

Amin, M., Tayeh, B. A. & Agwa, I. S. (2020). Effect of using mineral admixtures and ceramic wastes as coarse aggregates on properties of ultrahigh-performance concrete. *Journal of Cleaner Production*, *273*, 123073. https://doi.org/10.1016/j.jclepro.2020.123073

American Association of State Highway and Transportation Officials [AASHO] (2011). *Standard method of test for surface resistivity indication of concrete's ability to resist chloride ion penetration* (AASHTO TP 95). AASHTO. Retrieved from https://www.transportation.org

ASTM International [ASTM] (2010). *Standard test method for electrical indication of concrete's ability to resist chloride ion penetration* (ASTM C 1202-10). ASTM International. Retrieved from https://www.astm.org

ASTM International [ASTM] (2022). *Standard specification for coal fly ash and raw or calcined natural pozzolan for use in concrete* (ASTM C618-22). ASTM International. Retrieved from https://www.astm.org

Balakrishna, M., Mohamad, F., Evans, R. D. & Rahman, M. (2018). Assessment of water absorption of concrete by Initial surface absorption test. *Engineering, Environmental Science, Materials Science.*

British Standards Institution [BSI] (1996). *Testing of concrete. Part 208: Recommendations for the measurement of hardened concrete by ultrasonic pulse velocity* (BS 1881-208:1996). British Standards Institution. Retrieved from https://www.bsigroup.com

Bureau of Indian Standards [BIS] (2000). *Code of practice for plain and reinforced concrete* (IS 456:2000). Bureau of Indian Standards. Retrieved from https://www.bis.gov.in

Bureau of Indian Standards [BIS] (2015). *Ordinary Portland Cement – Specification* (IS 269:2015). Bureau of Indian Standards. Retrieved from https://www.bis.gov.in

Bureau of Indian Standards [BIS] (2016). *Specification for coarse and fine aggregates for concrete* (IS 383:2016). Bureau of Indian Standards. Retrieved from https://www.bis.gov.in

Bureau of Indian Standards [BIS] (2019). *Concrete mix proportioning – guidelines* (IS 10262:2019). Bureau of Indian Standards.

Chi, M. (2012). Effects of sugar cane bagasse ash as a cement replacement on properties of mortars. *Materials Science, Engineering, Environmental Science*, 279–285. https://doi.org/10.1515/SECM-2012-0014

Cordeiro, G. C., Andreão, P. V. & Tavares, L. M. (2019). Pozzolanic Properties of Ultrafine Sugar Cane Bagasse Ash Produced by Controlled Burning. *Heliyon*, *5* (10), e02566. https://doi.org/10.1016/j.heliyon.2019.e02566

Heniegal, A. M., Ramadan, M. A., Naguib, A. & Agwa, I. S. (2020). Study on Properties of Clay Brick Incorporating Sludge of Water Treatment Plant and Agriculture Waste. *Case Studies in Construction Materials*, *13*, e00397. https://doi.org/10.1016/j.cscm.2020.e00397

Jha, P., Sachan, A. K. & Singh, R. P. (2021). Bagasse Ash (ScBa) and Its Utilization in Concrete as Pozzolanic Material: A Review. *Lecture Notes in Civil Engineering*. https://doi.org/10.1007/978-981-33-6969-6_41

Joshaghani, A. & Moeini, M. A. (2018). Evaluating the Effects of Sugarcane-Bagasse Ash and Rice-Husk Ash on the Mechanical and Durability Properties of Mortar. *Journal of Materials in Civil Engineering*, *30* (7), 1943–5533. https://doi.org/10.1061/(ASCE)MT.1943-5533.0002317

Mohammadinia, A., Arulrajah, A., D'Amico, A. & Horpibulsuk, S. (2018). Alkali-activation of fly ash and cement kiln dust mixtures for stabilization of demolition aggregates. *Construction and Building Materials*, *186*, 71–78. https://doi.org/10.1016/j.conbuildmat.2018.07.103

Olufemi, F. S. (2017). Initial Surface Absorption of Cement Combination Concretes Containing Portland Cement, Fly Ash, Silica Fume and Metakaolin. *International Journal of Sustainable Construction Engineering & Technology*, *8* (2). https://doi.org/10.9744/ced.20.2.96-101

Rahimah, E., Nasir, S. & Kusbiantoro, A. (2015). Silica Extraction and Incineration Process of Sugarcane Bagasse Ash (ScCBA) as Pozzolanic Materials: A Review. *Journal of Materials in Civil Engineering*, *V11*, 7304–7308.

Ramasamy, V. (2012). Compressive Strength and Durability Properties of Rice Husk Ash Concrete. *KSCE Journal of Civil Engineering*, *16*, 93–102. https://doi.org/10.1007/S12205-012-0779-2

Thomas, B. S., Yang, J., Bahurudeen, A., Abdalla, J. A., Haweeleh, R. A., Hamada, H. M., Nazar, S. V. J. & Ashish, D. K. (2021). Sugarcane Bagasse Ash as Supplementary Cementitious Material in Concrete – A Review. *Materials Today Sustainability*, *V15*. https://doi.org/10.1016/j.mtsust.2021.100086

Zeyad, A. M., Johari, M. M. A., Tayeh, B. A. & Yusuf, M. O. (2016). Efficiency of Treated and Untreated Palm Oil Fuel Ash as A Supplementary Binder on Engineering and Fluid Transport Properties of High-Strength Concrete. *Construction and Building Materials*, *125*, 1066–1079. https://doi.org/10.1016/J.CONBUILDMAT.2016.08.065

WŁAŚCIWOŚCI POPIOŁU Z WYTŁOKÓW Z TRZCINY CUKROWEJ Z AGROODPADÓW W TESTACH TRWAŁOŚCI

STRESZCZENIE

Przemysł betonowy coraz częściej włącza do produkcji materiały odpadowe takie jak popiół z wytłoków z trzciny cukrowej (SCBA) ze względu na jego doskonałe właściwości pucolanowe. Cement, kluczowy i rzadki składnik w produkcji betonu, jest bardzo poszukiwany na całym świecie. Rozwój sektora budowlanego w znacznym stopniu przyczynia się do emisji dwutlenku węgla (CO_2), co podkreśla potrzebę zmniejszenia zawartości cementu w betonie w celu złagodzenia tych emisji. Zastąpienie części cementu w betonie produktami ubocznymi rolnictwa, takimi jak łuski ryżowe i wytłoki z trzciny cukrowej, może znacznie zmniejszyć wpływ materiału budowlanego na środowisko przyrodnicze. W niniejszym badaniu zbadano trwałość betonu z SCBA jako częściowym zamiennikiem cementu na poziomach 5%, 10% i 15% wagowo. Trwałość betonu oceniono za pomocą kilku testów, w tym: rezystywności elektrycznej, tzw. szybkiej penetracji chlorków (RCPT), początkowej absorpcji powierzchniowej (ISAT) i karbonatyzacji po 7 dniach i 28 dniach. Zaobserwowano, że SCBA ma dobre właściwości wiążące i może być stosowany w mieszankach betonowych w celu częściowego zastąpienia kosztownego cementu.

Słowa kluczowe: agroodpady, popiół z trzciny cukrowej, trwałość, beton