



Review on the Use of Sugarcane Bagasse Ash and Recycled Aggregates for Sustainable Concrete Production

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Article History

Received on: 20 July 2026

Revised on: 15 Aug 2026

Accepted on: 20 Sept 2026

Keywords: concrete,
sugarcane bagasse Ash,
Recycled, Coarse
Aggregate, Partial
replacement of cement

e-ISSN: 2455-6491

DOI: 10.65809/IJAITE/26/v03sp02/003

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ABSTRACT

The demand for building materials is rising. This has led to a search for resources to reduce the environmental impact of traditional concrete. This study looks at using Sugarcane Bagasse Ash (SCBA) to replace some cement and Recycled Aggregates (RA) of natural aggregates. SCBA, which comes from the sugar industry has properties that help make concrete stronger and more durable because it has a lot of silica. Recycled aggregates, made from construction waste help save resources and reduce waste in landfills. Many studies have found that using the amount of SCBA and RA can make concrete that is strong and good for the environment. The study shows that using SCBA and RA together is a way to make concrete that is friendly to the environment does not cost a lot and uses resources wisely. This kind of concrete is suitable, for building practices today. Sugarcane Bagasse Ash (SCBA) and Recycled Aggregates (RA) can help make concrete. Using SCBA and RA can make construction more sustainable.

1. INTRODUCTION

Concrete is the second most consumed substance globally after water and forms the basis of modern infrastructure, including buildings, bridges, and transportation systems. Despite its widespread use, the production of concrete particularly Ordinary Portland Cement (OPC) poses significant

environmental concerns. OPC manufacturing contributes nearly 8% of global CO₂ emissions. To address these concerns, researchers have explored supplementary cementitious materials (SCMs). Among them, Sugarcane Bagasse Ash (SCBA) has gained attention due to its pozzolanic composition. SCBA is derived by burning bagasse, the fibrous residue left after sugar extraction. With

proper processing such as grinding and controlled burning, SCBA enhances the microstructure of concrete, promotes the formation of additional C-S-H gel, and reduces cement consumption.

Similarly, Recycled Aggregates (RA) sourced from construction and demolition waste provide an alternative to natural coarse aggregates. Although RA often contains adhered mortar, exhibits higher porosity, and may reduce strength, treatment methods such as mechanical cleaning, acid soaking, and thermal processing have significantly improved its performance. Using RA not only reduces the demand for virgin aggregates but also supports waste reduction and sustainable construction practices.

2. OBJECTIVES

We want to study how Sugarcane Bagasse Ash affects concrete when Sugarcane Bagasse Ash is used to replace some of the cement.

We need to see if Recycled Coarse Aggregate can be used of natural aggregates.

The goal is to find out how strong the concrete is when we use amounts of Sugarcane Bagasse Ash and Recycled Coarse Aggregate in the concrete.

We also want to know how easy it is to work with these mixes and what their fresh properties are, like Sugarcane Bagasse Ash and Recycled Coarse Aggregate concrete mixes.

We are looking for the amount of Sugarcane Bagasse Ash and Recycled Coarse Aggregate to use in the concrete so we can get the best results from Sugarcane Bagasse Ash and Recycled Coarse Aggregate.

Then we will compare the results of our Sugarcane Bagasse Ash and Recycled Coarse Aggregate concrete with the kind of concrete.

Using Sugarcane Bagasse Ash and Recycled Coarse Aggregate in construction can be good, for the environment because Sugarcane Bagasse Ash and Recycled Coarse Aggregate can help reduce waste so we want to find out how much of a difference Sugarcane Bagasse Ash and Recycled Coarse Aggregate can make.

3. LITERATURE REVIEWS

P. Sailu and J. Suma Sree did a study in 2020. They used Sugarcane Bagasse Ash as a replacement for some of the cement in concrete. They also used Recycled Coarse Aggregate as a replacement for some of the aggregate in concrete. The results of the study showed that it is possible to make concrete with Sugarcane Bagasse Ash and Recycled Coarse Aggregate. This concrete has strength. However if much Sugarcane Bagasse Ash and Recycled Coarse Aggregate are used the strength of the concrete decreases. This is because Recycled Coarse Aggregate is not as strong as aggregate. Also using Sugarcane Bagasse Ash means that less cement is used "Ref"[1].

P. P. L. De Souza and others did a study in 2020. They used sugarcane bagasse as an aggregate in building blocks. The study found that building blocks made with sugarcane bagasse are lighter and have insulation. They also have strength for nonstructural and lightweight construction. This is a way to use Sugarcane Bagasse in construction "Ref"[2].

M. P. Borah and others did a study in 2024. They looked at using Sugarcane Bagasse in the textile industry. They found that Sugarcane Bagasse can be used to make fabric. This is a versatile use of Sugarcane Bagasse. Sugarcane Bagasse can be used in industries, not just construction. It is an useful material "Ref"[3].

P. K. Goyal and M. Murmu did a study in 2024. They looked at the characteristics of Sugarcane Bagasse Ash. They found that Sugarcane Bagasse Ash improves the durability of concrete. It also reduces the permeability of concrete. This makes it more eco-friendly. Sugarcane Bagasse Ash reduces the amount of carbon emissions. This is very good for the environment "Ref"[4].

A. Dayo and others did a study in 2019. They used Sugarcane Bagasse Ash as a replacement for some of the aggregate in concrete. The study found that using Sugarcane Bagasse Ash can make the concrete less workable. However if the mix design is adjusted properly the strength and performance of the concrete can be maintained. This is important to know when using Sugarcane Bagasse Ash "Ref"[5].

W. Ahmad and others did a study in 2021. They looked at the use of Sugarcane Bagasse Ash in cement-based composites. The study found that Sugarcane Bagasse Ash improves the long-term strength of the composites. It also reduces water absorption. Improves resistance to chemical attacks. This is very useful for construction "Ref"[6].

N. Prabhath and others did a study in 2022. They looked at the properties of concrete made with Sugarcane Bagasse Ash. The study found that using the amount of Sugarcane Bagasse Ash can improve the compressive strength and durability of the concrete. The best amount to use is typically between 10 and 15 percent. This is a guideline to follow "Ref"[7].

N. Elawadly and S. A. Sanad did a study in 2025. They looked at the properties of concrete made with Sugarcane Bagasse Ash. The study found that using the amount of Sugarcane Bagasse Ash can improve the workability and compressive strength of the concrete. It also improves the microstructure and durability of the concrete. This is very good to know "Ref"[8].

U. I. Iro and others did a study in 2025. They used a method called response surface methodology to evaluate the properties of concrete made with Sugarcane Bagasse Ash. The

study found that this method can be used to predict the strength of the concrete. It can also be used to find the mix proportions for the concrete. This is an useful tool "Ref"[9]".

P. Baltazar-Garcia and others did a study in 2025. They looked at using Sugarcane Bagasse Ash and Recycled aggregates to make concrete. The study found that this type of concrete can have strength and durability. It is also good for the environment because it uses waste materials. This is a way to use Sugarcane Bagasse Ash "Ref"[10]".

K. Katare and others did a study in 2025. They looked at the effect of Sugarcane Bagasse Ash on the strength of concrete. The study found that using the amount of Sugarcane Bagasse Ash can improve the compressive strength of the concrete. However using much Sugarcane Bagasse Ash can reduce the strength of the concrete. This is important to know when using Sugarcane Bagasse Ash "Ref"[11]".

M. F. Javed and others did a study in 2021. They looked at using Recycled Coarse Aggregate and Sugarcane Bagasse Ash to make two-stage concrete. The study found that this type of concrete can have strength and durability. It is also good for the environment because it uses waste materials. This is a way to use Sugarcane Bagasse Ash "Ref"[12]".

M. Baig and others did a study in 2018. They looked at the uses of Sugarcane Bagasse Ash in concrete. The study found that Sugarcane Bagasse Ash can be used as a material. It can improve the strength and durability of the concrete. This is an useful material "Ref"[13]".

M. Suriya and others did a study in 2018. They looked at the use of Sugarcane Bagasse Ash in concrete. The study found that using Sugarcane Bagasse Ash can improve the term compressive strength and durability of the concrete. This is very good to know "Ref"[14]".

M. Kumar and S. S. Dhriyan did a study in 2018. They looked at using Sugarcane Bagasse Ash as a replacement for some of the cement, in concrete. The study found that using the amount of Sugarcane Bagasse Ash can improve the compressive strength of the concrete. It can also reduce the impact of the concrete. This is a way to use Sugarcane Bagasse Ash "Ref"[15]".

CONCLUSION

The following are the conclusions drawn as a result of an experimental study on concrete wherein waste Sugarcane Bagasse Ash and Recycled Coarse Aggregate were utilized to replace sand partially as a substitute for sand:

1. From what we have learned Sugarcane Bagasse Ash and Recycled Coarse Aggregate are materials for making concrete. Sugarcane Bagasse Ash is really special because it has a lot of silica in it. This helps make the concrete stronger and

longer when we use the right amount. Usually that is between 5 percent and 15 percent.

2. On the hand using Recycled Coarse Aggregate helps us save natural resources. It also helps us throw away waste from construction. It can make the concrete a little weaker. This is because it is not as good as the materials we normally use.

3. When we use Sugarcane Bagasse Ash and Recycled Coarse Aggregate together, we can make concrete that's good for the earth. It still works well for building things.

4. We have to be careful and make sure we mix the materials right. We should not use much or too little of each one.

5. Using Sugarcane Bagasse Ash and Recycled Coarse Aggregate, in concrete is a way to build things without hurting the earth much. It helps us use waste in a way.

6. We need to do research to figure out the way to mix these materials. We also need to see how well they work over time in conditions mix.

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