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A Review on Sustainable Paver Blocks Using Plastic Waste and Sugarcane Bagasse Ash

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ABSTRACT

Plastic waste and sugarcane bagasse ash are increasing every year and causing problems for the environment. In many places, these materials are thrown away and not used properly. Because of this, researchers are trying to find a simple way to reuse them. One useful method is to use them in making paver blocks. In this paper, some previous studies are reviewed to understand how plastic waste and sugarcane bagasse ash can be used in construction. From these studies, it is seen that melted plastic can act like a binder and help in holding sand and ash together. It is also found that the strength of paver blocks mainly depends on how the materials are mixed. If the proportion is proper, the blocks can give good strength, but if too much ash is added, the strength may reduce. Based on this understanding, it is planned to prepare paver blocks using recycled plastic waste, sand, and sugarcane bagasse ash. These blocks are expected to be strong enough for light traffic use like footpaths and gardens. This method can also help in reducing waste and making construction more environment friendly.

1. INTRODUCTION

Plastic waste is a big problem today. Plastic is used in almost everything, but it does not decompose easily. Because of this, it keeps increasing in the environment and causes pollution on land and in water. In the same way, sugar factories also produce a waste material called sugarcane bagasse ash. This ash is usually thrown away and not used properly, which creates disposal problems. So, handling both plastic waste and sugarcane bagasse ash is becoming more difficult day by day.

Nowadays, people are trying to find ways to reuse these waste materials instead of just dumping them. One good idea is to use them in construction work. Paver blocks are widely used in places like footpaths, parking areas, and walkways, so they can be a useful option for using such waste. Normally, paver blocks are made of cement, sand, and aggregates, but cement production consumes

a lot of energy and also causes pollution. That is why it is important to find other materials that can reduce the use of cement and make construction more eco-friendly.

Some studies have shown that plastic waste can be melted and used as a binding material. When mixed with sand and then cooled, it helps in holding the particles together. In the same way, sugarcane bagasse ash can be used as a filler material to improve the quality of the blocks. Research also shows that the strength of paver blocks depends on the mix proportion. If the materials are used in the right amount, good strength can be achieved, but if the proportion is not correct, the strength can reduce. So, it is important to find the right combination of plastic, sand, and bagasse ash.

This paper studies previous research to understand how these materials work together and to find a suitable method for making low-cost, eco-friendly paver blocks that can be used in real construction work.

2. LITERATURE REVIEW

Kalyani et al. explained in their review paper that waste plastic can be used in making paver blocks. Plastic can be melted or shredded and used instead of cement or aggregates. This helps in reducing plastic waste and makes the blocks eco-friendly. The study also showed that these plastic-based paver blocks have good strength and absorb less water. When materials like sugarcane bagasse ash (SCBA) or fly ash are added, the strength and durability of the blocks improve further. Overall, the study suggests that using waste materials in construction is a good solution for environmental problems [1].

Praveen Kumar et al. carried out an experimental study using waste plastic chips and sugarcane bagasse ash in paver blocks. In this study, some part of cement was replaced with SCBA and 5% plastic chips were added in place of aggregates. The results showed that the mix with 15% SCBA and 5% plastic chips gave strength close to normal paver blocks. It was also observed that strength increases with curing time, but if SCBA content becomes more than 20%, the strength decreases. These paver blocks were found suitable for footpaths and low load areas [2].

Valarmathy et al. studied the use of HDPE plastic waste along with M-sand and bagasse ash in the production of paver blocks. In this study, plastic waste was used as a binding material, while M-sand and bagasse ash were used as filler materials. Different tests were carried out to evaluate the performance of the paver blocks. The results showed that the blocks made with HDPE plastic, M-sand, and bagasse ash had better durability and lower water absorption compared to conventional paver blocks. The study also highlighted that using these waste materials helps in reducing environmental pollution. Finally, the authors concluded that HDPE plastic waste and bagasse ash can be effectively used to produce eco-friendly paver blocks [3].

Reddy et al. conducted an experimental investigation on recycled plastic waste as a binder in paver blocks. Plastic waste replaced conventional cement in the mix. The blocks were tested for compressive strength and water absorption. The results showed that the blocks have good durability and lower water absorption. The research highlighted the environmental benefits of recycling plastic waste [4].

Joon et al. studied the use of sugarcane bagasse ash (SCBA) as a partial replacement for cement in the production of paver blocks, especially for low-volume traffic areas like rural and village roads. The main aim of the study was to reduce the use of cement and make use of agricultural waste. The authors explained that SCBA contains a high amount of silica and alumina, which gives it pozzolanic properties. Because of this, it reacts with calcium hydroxide in cement and helps improve the strength and durability of the concrete. The study concluded that SCBA can be effectively used as a partial replacement for cement in paver blocks [5].

Pawed et al. studied the use of fly ash and plastic waste in the production of paver blocks. In this study, plastic waste was used as a binding material, while fly ash was used as a partial replacement material. Various tests were conducted to evaluate the strength and performance of the paver blocks. The results showed that the use of fly ash and plastic waste improved the overall properties of the blocks and also reduced the need for conventional materials. The study concluded that using these waste materials is an effective way to produce eco-friendly and cost-effective paver blocks [6].

Najar et al. studied the use of sugarcane bagasse ash in the construction of low-volume traffic roads. The main aim of the study was to reduce the use of cement and utilize agricultural waste in road construction. The authors explained that bagasse ash contains a high amount of silica, which gives it pozzolanic properties. Because of this, it can react with cement and improve the strength and durability of construction materials. The study concluded that bagasse ash can be effectively used in paver blocks and road construction, especially for low traffic areas, making the construction more economical and eco-friendly [7].

Agyeman et al. studied the use of recycled plastic waste as a binding material for the production of paving blocks. In this research, plastic waste was cleaned, dried, and then heated before being mixed with aggregates in different

proportions to make paving blocks. Various tests were carried out to check compressive strength and water absorption. The results showed that the blocks achieved compressive strength between 7.31 MPa and 8.53 MPa and had very low water absorption of about 0.5%. It was also observed that the blocks gained more than 80% of their strength within one day, which makes them suitable for rapid construction and waterlogged areas. The study concluded that recycled plastic waste can be effectively used as a binding material in paving blocks [8].

Chavda et al. studied the design of pervious paver blocks using sugarcane bagasse ash and recycled asphalt pavement (RAP) aggregates. The main aim of the study was to develop eco-friendly paver blocks with good drainage properties. In this research, bagasse ash was used as a partial replacement for cement, while RAP aggregates were used in place of natural aggregates. Various tests were conducted to evaluate strength and permeability of the paver blocks. The results showed that the developed pervious paver blocks had adequate strength along with good water permeability, making them suitable for drainage applications. The study concluded that the use of bagasse ash and recycled asphalt aggregates helps in reducing environmental impact and promotes sustainable construction [9].

Yadav et al. studied the manufacturing of sustainable paver blocks using plastic waste and sand. In this study, plastic waste was used as a binding material by melting it and mixing it with sand in different proportions. Various tests were conducted to evaluate the strength and performance of the paver blocks. The results showed that the blocks had good compressive strength and low water absorption, making them suitable for practical use. The study concluded that using plastic waste with sand is an effective and eco-friendly method for producing sustainable paver blocks [10].

Anusha et al. studied the use of waste plastic and sugarcane bagasse ash in the production of paver blocks. In this study, plastic was used as a filler material and bagasse ash was used as a partial replacement for cement. Different tests were carried out to check compressive strength at 7, 14, and 28 days. The results showed that the paver blocks gave good strength up to a certain limit of bagasse ash, but when the percentage exceeded around 40%, the strength started decreasing. The study concluded that using plastic waste and bagasse ash helps in reducing environmental problems and can produce eco-friendly paver blocks suitable for low traffic areas [11].

Isal et al. studied the use of sugarcane bagasse ash (SCBA) and sawdust in concrete paver blocks. In this study, SCBA was used as a partial replacement for cement, while sawdust was used as an additional material in the mix. Different tests were conducted to evaluate the strength and performance of the paver blocks. The results showed that using SCBA and sawdust can produce paver blocks with acceptable strength and reduced weight. The study also highlighted that these materials help in utilizing waste effectively and reduce environmental impact. The authors concluded that SCBA and sawdust can be used to develop eco-friendly and lightweight paver blocks suitable for non-heavy load applications [12].

3. SUMMARY OF LITERATURE REVIEW

Table 1: Summary of Major Studies Considered in this Review

Sr. No.	Author	Materials Used	Work Done	Key Findings
1	Kalyani et al. [1]	Plastic waste, SCBA	Review on paver blocks	Plastic can be used as binder; good strength and low water absorption observed
2	Praveen Kumar et al. [2]	Plastic chips, SCBA, cement	Experimental study	15% SCBA + 5% plastic gave strength close to normal blocks
3	Valarmathy et al. [3]	HDPE, M-sand, SCBA	Paver block production	Improved durability and reduced water absorption
4	Joon et al. [4]	SCBA, cement	Replacement study	SCBA improved strength due to pozzolanic properties
5	Agyeman et al. [8]	Recycled plastic, aggregates	Plastic binder blocks	Achieved good strength and very low water absorption
6	Chavda et al. [9]	SCBA, RAP aggregates	Pervious paver blocks	Provided good strength with drainage properties

4. IDENTIFIED RESEARCH GAP

After going through the above studies, it is seen that many researchers have used waste plastic, sugarcane bagasse ash (SCBA), fly ash, and other waste materials in paver blocks. These studies show that the strength and durability of paver blocks can be improved and that it also helps in reducing environmental waste. However, some gaps remain in the research:

1. Most studies do not clearly give the best or optimized mix proportion for good performance.
2. Very little information is available about the long-term performance and field behaviour of these paver blocks.

3. The combined effect of plastic waste with SCBA and fly ash together is not properly studied.
4. There is limited study on how these paver blocks perform in harsh weather and extreme conditions.
5. Most of the work is done only in laboratories, with little focus on real site applications.

5. RESEARCH CONTRIBUTION

This research focuses on making eco-friendly paver blocks using recycled plastic granules, sand, and sugarcane bagasse ash (SCBA) using different percentage-by-weight combinations. The main contributions of this work are:

1. Cement and water are not used in this study; instead, recycled plastic is melted and used as the main binding material.
2. Paver blocks are prepared using different mix ratios by weight: Mix 1 – 70% plastic, 20% sand, 10% SCBA; Mix 2 – 60% plastic, 25% sand, 15% SCBA; Mix 3 – 50% plastic, 30% sand, 20% SCBA.
3. These different percentage combinations are tested to check which mix gives better performance.
4. The prepared paver blocks are tested for compressive strength, water absorption, density, abrasion resistance, and cost effectiveness.
5. This study helps in understanding the effect of changing material percentages on block quality.
6. The main aim is to find the best mix ratio for strong, durable, low-cost, and eco-friendly paver blocks using waste materials.

CONCLUSION

This review shows that waste plastic, sugarcane bagasse ash (SCBA), and sand have good potential to be used in paver block manufacturing. Instead of disposing of plastic and agricultural waste, they can be reused in construction. In this method, plastic is melted and acts as the main binding material, while SCBA and sand help in improving the overall structure and performance of the blocks. The study also indicates that proper selection of mix proportion plays an important role in achieving good quality paver blocks. Recycled plastic can effectively work as a binding material after melting, which reduces the need for cement and supports waste utilization. SCBA helps in utilizing agricultural waste and improves the overall sustainability of the construction material. Sand contributes to strength and provides proper balance and stability in the mix.The performance of paver blocks depends mainly on the correct proportion of plastic, sand, and SCBA used together.When the mix is properly designed, the blocks show good strength, low water absorption, and suitable durability for basic applications. This method helps in reducing environmental issues caused by plastic waste and industrial/agricultural by-products.Such paver blocks can be effectively used in areas like footpaths, gardens, parking spaces, and other light traffic zones.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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