ISSN: 2455-6203
International Journal of Science Management & Engineering Research (IJSMER)
Volume: 09 | Issue: 02 | July - 2024 www.ejournal.rems.co.in
Date of Submission: 25/06/2024 Date of Acceptance: 28/06/2024 Date of Publish: 15/07/2024

Exploring Bamboo Fiber and Manufactured Sand Integration in Concrete as an Alternative to Natural Sand- A Review

Anjali Thakur, Hariram Sahu
Scholar, Assistant Professor, Department of Civil Engineering, School of Engineering
Eklavya Uniersity, Damoh, (M.P.)

Abstract
In today's construction industry, concrete plays a vital role, with materials used in its production evolving to include higher quality cement and coarse aggregates. Sand, a crucial component of concrete, is primarily sourced from natural reservoirs, leaving its grade beyond our control. This trial exploration work investigates concrete cubes of M-20 & M-25 grade, aiming to analyze various properties such as compressive strength and workability. This study reviews literature pertaining to advancements in concrete technologies and the utilization of fibers and materials in the construction industry.

Keywords: Alternative Materials, Bamboo Fiber, M-Sand, Sustainable Construction, Natural Sand Substitute, Environmental Impact, Mechanical Properties, Durability, Structural Performance, Compressive Strength, Eco-friendly Construction, Sustainable Building Materials.

I. Introduction

In today's ever-evolving construction landscape, concrete remains a cornerstone, enabling the realization of a multitude of infrastructure projects worldwide. The pursuit of excellence in concrete construction has spurred ongoing advancements in materials, techniques, and technologies. Among the critical elements influencing concrete's characteristics, aggregates hold particular significance. Comprising both coarse and fine particles, aggregates form a substantial portion of concrete volume. Historically, natural aggregates extracted from riverbeds, quarries, and gravel pits have been the preferred choice. However, the indiscriminate extraction of natural aggregates has raised environmental alarms, prompting a shift towards sustainable alternatives. Manufactured sand (M-sand) has emerged as a promising substitute for natural sand in concrete production. Produced through the crushing and processing of rock or quarry stones, M-sand offers several advantages. It reduces reliance on finite natural resources and minimizes environmental degradation linked to sand mining. Additionally, M-sand can be tailored to meet precise particle size and shape requirements, ensuring consistent quality and performance.

Research into the properties and applications of M-sand in concrete construction has gained momentum in recent years. Studies have delved into various aspects, including workability, strength, durability, and environmental impact. By scrutinizing factors like particle morphology, gradation, and mineral composition, researchers strive to optimize M-sand's performance and bolster its suitability as a viable alternative to natural sand.

The integration of M-sand into concrete mixtures holds promise for advancing sustainability and resilience in construction practices. As the industry embraces innovative solutions, M-sand stands poised to play a pivotal role in shaping the future of concrete construction, offering a pathway towards greener, more efficient, and more durable infrastructure development.

II. Literature Survey

Yadav et al. (2019) conducted a comprehensive study on the "Utilization of M Sand and Fly Ash for Sustainable Concrete Construction" in the Journal of Sustainable Civil Engineering Materials. The research delved into the incorporation of M sand and fly ash as alternative materials in concrete production, aiming to promote sustainability in construction practices. The study explored the effects of these alternative materials on concrete properties such as strength, durability, and environmental impact. Through laboratory experiments and performance evaluations, the researchers provided

ISSN: 2455-6203
International Journal of Science Management & Engineering Research (IJSMER)
Volume: 09 | Issue: 02 | July - 2024 www.ejournal.rems.co.in
Date of Submission: 25/06/2024 Date of Acceptance: 28/06/2024 Date of Publish: 15/07/2024

insights into the feasibility and effectiveness of utilizing M sand and fly ash for sustainable concrete construction. The findings and recommendations presented in this study contribute valuable knowledge to the field of sustainable civil engineering materials.

Mishra et al. (2019) conducted a comprehensive study titled "Evaluation of Compressive Strength of Concrete Incorporating M Sand and Bamboo Fiber" published in the Journal of Civil Engineering and Environmental Sciences. This research aimed to investigate the impact of incorporating M sand and bamboo fiber on the compressive strength of concrete.

The study involved laboratory experiments where concrete mixtures containing varying proportions of M sand and bamboo fiber were prepared and tested. Compressive strength tests were conducted on the concrete specimens to assess their mechanical performance.

Through systematic analysis and comparison of the test results, the researchers evaluated the influence of M sand and bamboo fiber on the compressive strength of concrete. The study also examined other factors such as workability, durability, and environmental sustainability associated with the use of these alternative materials in concrete production.
Furthermore, the research explored the potential benefits and challenges of incorporating M sand and bamboo fiber in concrete mixtures, providing valuable insights into their suitability as sustainable alternatives to traditional construction materials.
The findings of this study contribute to the body of knowledge in civil engineering and environmental sciences, offering valuable information for engineers, researchers, and practitioners involved in sustainable construction practices.

Marcalíková et al. (2019) conducted a study focusing on the mechanical properties of two types of steel fibers utilized in reinforced concrete. The research employed the same concrete mixture for both types of steel fibers, with variations in their shapes. One type consisted of short and straight fibers, while the other comprised 3D steel fibers. Steel fiber reinforced concrete was prepared with dosages of 40 and 75 kg of steel fibers per cubic meter. The experiment encompassed the determination of several strength parameters, including compressive strength, a three-point flexural test, and a splitting tensile strength test. The results of the study were compiled, along with fracture mechanics parameters essential for structural modeling.

Deepa and Kumar (2018) conducted an experimental investigation on Hybrid Fiber Concrete utilizing GGBS (Ground Granulated Blast Furnace Slag) and M Sand. The authors emphasized the potential of advancements in concrete technology to reduce reliance on natural resources and energy sources, consequently mitigating environmental pollution.

The study addressed the significant environmental impact of the substantial volume of GGBS generated by industries. Conventional concrete's drawbacks, such as low tensile strength and brittle failure, were highlighted. To enhance concrete ductility and energy absorption, fiber-reinforced concrete was introduced.

The investigation aimed to assess the effects of incorporating GGBS and M Sand as partial replacements for cement and fine aggregate, respectively, alongside an optimal percentage of polypropylene and steel fibers. Concrete of M30 grade was designed for this purpose. Various percentages of GGBS replacement for cement (0%, 10%, 20%, and 30%) were considered, along with the utilization of M Sand as fine aggregate and optimal fiber percentages of polypropylene (0.4%) and steel fiber (0.6%). The study focused on investigating the strength properties of the concrete, exploring the potential benefits of utilizing GGBS and M Sand alongside fiber reinforcement.

Roy et al. (2018) conducted an experimental investigation into the impact of steel fibers on concrete when M-Sand is utilized as a substitute for natural sand. The study focused on fiber-reinforced concrete with M-Sand, analyzing the compressive and tensile strengths of M25 and M30 concrete grades with varying percentages of steel fiber (ranging from 0% to 2%). Chemical admixtures were employed to enhance concrete workability. The investigation involved testing a total of 96 specimens through compressive strength and split tensile tests. The findings revealed that incorporating steel fibers into fresh concrete increased compressive strength by resisting cracks, thereby enhancing durability. Additionally, replacing river sand with M sand provided satisfactory strength, offering a viable alternative to river sand. Moreover, the utilization of steel fiber reinforcement admixture improved both compressive and flexural strengths of the concrete.

Vaishali et al. (2018) conducted a study titled "Effect of Manufactured Sand on Mechanical Properties of Concrete." The widespread use of natural river sand in construction was challenged by excessive mining, leading to environmental imbalances and a decline in sand quality with increased silt and clay content. Although researchers proposed Manufactured Sand (M-sand) as an alternative, its practical application remained limited, complicated by variations in M-sand properties across different locations.

To address these concerns, the study investigated the full replacement of river sand with M-sand in concrete. M-sand samples from three distinct localities were collected and subjected to testing. Using an M20 concrete mix with a water-cement ratio of 0.45, three sets of samples containing different M-sand variants were prepared and analyzed for workability and mechanical properties.
Results from slump tests revealed that river sand exhibited higher workability compared to M-sand. However, assessments of mechanical properties showed promising outcomes. Concrete incorporating M-sand sourced from Karur exhibited notable improvements, with a respective increase of 10.71%, 12.15%, and 8.22% in compressive strength, split tensile strength, and flexural strength compared to conventional concrete after 28 days of curing.

Shah et al. (2018) conducted a comprehensive study titled "Study on the Effect of M Sand and Nano-Silica on Concrete Properties," published in the Journal of Sustainable Engineering and Technology. The research aimed to explore the influence of both Manufactured Sand (M Sand) and Nano-Silica on various properties of concrete, with a focus on sustainability and environmental considerations.
The investigation involved systematic experimentation to analyze the impact of incorporating M Sand and Nano-Silica on concrete properties. M Sand, known for its eco-friendly characteristics and potential as a sustainable alternative to natural sand, was evaluated for its effects on concrete workability, compressive strength, tensile strength, and durability.

Additionally, Nano-Silica, a nanomaterial with unique properties such as high surface area and reactivity, was introduced into the concrete mix to examine its role in enhancing mechanical and durability properties. The study aimed to assess the synergistic effects of combining M Sand and Nano-Silica on concrete performance, considering factors such as strength development, microstructure, and resistance to environmental degradation. Laboratory experiments were conducted using standardized testing procedures to measure the performance of concrete specimens incorporating different proportions of M Sand and Nano-Silica. These experiments included tests for slump, compressive strength, split tensile strength, and durability indicators such as resistance to chloride ion penetration and sulfate attack. The findings of the study provide valuable insights into the potential of M Sand and Nano-Silica as sustainable additives in concrete production. By elucidating their effects on concrete properties, the research contributes to the ongoing efforts in the construction industry to develop environmentally friendly and high-performance concrete materials. Through rigorous experimentation and analysis, Shah et al. aimed to contribute to the advancement of sustainable engineering practices and technologies, promoting the adoption of eco-friendly materials in concrete construction for a more resilient and environmentally conscious built environment.

Neeraja et al. (2017) embarked on a study exploring the strength characteristics of concrete through the incorporation of M-Sand and coconut fibers. The aim was to evaluate the potential of M-Sand and coconut fibers as concrete constituents. The study involved the production of approximately 90 specimens using both hand and machine mixing methods, with M-35 grade concrete utilized. Initially, samples were prepared using 100% river sand, and subsequent mixes incorporated varying proportions of river sand replaced by M-Sand (20%, 40%, 60%, 80%, and 100%).

After curing the samples for 7 or 28 days, tests were conducted to assess the maximum compressive, tensile, and flexural strengths of the different concrete mixes. The findings indicated that the addition of M-Sand notably enhanced the compressive, tensile, and flexural strengths, with maximum strength achieved at 80% M-Sand replacement.

Furthermore, the introduction of coconut fibers significantly improved the engineering properties of the concrete, particularly tensile and flexural strengths. However, it was observed that the compressive strength decreased as the percentage of coconut fibers varied from 0.2% to 1.0%. This decrease was attributed to the increased void ratio in the concrete due to the addition of coconut fibers.

Uttamraj and Rafeeq (2017) conducted an experimental study focusing on the utilization of M sand and Recron 3S fiber in M30 concrete. The author investigated the influence of various proportions of M sand and natural sand substitution on the fresh and hardened properties of concrete. This included assessing parameters such as workability, compressive strength, split tensile strength, and flexural strength.

In the initial phase, natural sand was replaced by robo sand in proportions of 0%, 50%, and 100% in M30 design mix. Concrete specimens, comprising 18 cubes (150mm x 150mm x 150mm), 18 cylinders (150mm x 300mm), and 18 prisms (150mm x 150mm x 700mm), were cast and tested at 7 and 28 days. In the subsequent phase, Recron 3S was incorporated into concrete containing 100% M sand at varying percentages (0%, 0.5%, 1%, 1.5%, and 2%). Concrete specimens, consisting of 27 cubes (150mm x 150mm x 150mm), 27 cylinders (150mm x 300mm), and 27 prisms (150mm x 150mm x 700mm), were cast and tested at 7 and 28 days.
The study concluded that concrete specimens with 0% replacement of robo sand exhibited higher compressive strength compared to those with 50% and 100% replacement.

Manogna and Guruprasad (2017) conducted an experimental study on the properties of PFRC (Plastic Fiber Reinforced Concrete) using M-Sand. The authors highlighted the increasing scarcity of river sand, necessitating the exploration of alternative materials. Manufactured sand emerged as a viable substitute for river sand, offering a finely crushed aggregate produced under controlled conditions from suitable sand source rocks. Moreover, the authors underscored the environmental concerns associated with non-biodegradable plastics, which can adversely affect soil fertility.

The study involved the design mix of M25 grade concrete, considering replacements of 0%, 20%, 40%, 60%, 80%, and 100% of M-Sand for laboratory analysis. Various tests, including slump tests, compressive strength tests for cubes, split tensile strength tests for cylinders, sieve analysis, and specific gravity tests for both fine and coarse aggregates and M-Sand, were conducted. The results were compared with established standards to ascertain the desired parameters.

The researchers concluded that manufactured sand serves as an excellent alternative to river sand, offering finely crushed aggregate produced under controlled conditions. They reiterated the environmental concerns associated with non-biodegradable plastics and their potential adverse effects on soil fertility. The detailed experimental investigation focused on plastic fiber reinforced concrete, involving the partial replacement of natural sand with manufactured sand at different percentages (0%, 20%, 40%, 60%, 80%, 100%), along with the addition of a fixed percentage (0.5% of the weight of cement) of plastic fibers (PP fibers).

Vishal Gadgihalli et al. (2017) conducted an analysis on the properties of concrete utilizing manufactured sand as fine aggregates. They emphasized the pivotal role of aggregates in concrete, serving as structural fillers that cement paste coats and binds together. With government regulations prohibiting the use of river sand due to

ISSN: 2455-6203
International Journal of Science Management & Engineering Research (IJSMER)
Volume: 09 | Issue: 02 | July - 2024 www.ejournal.rems.co.in
Date of Submission: 25/06/2024 Date of Acceptance: 28/06/2024 Date of Publish: 15/07/2024

its detrimental effects on soil erosion, the study explored the viability of manufactured sand as a substitute.

The analysis focused on studying the properties of concrete using manufactured sand as coarse aggregate, particularly examining its impact on concrete strength and the temperature emitted during the chemical reaction with normal Portland cement. The results indicated a reduction in temperature emitted due to the exothermal reaction of concrete when using manufactured sand as coarse aggregate. However, it was noted that this substitution led to a decrease in compressive strength compared to normal concrete, particularly when no admixtures were used to enhance concrete properties.

Suresh and Revathi (2017) delved into "High Performance Concrete with M-Sand and Its Further Aspects," examining the prevalent use of river sand as fine aggregate in concrete manufacturing by building constructors. However, the escalating construction activities have led to a substantial increase in demand for good quality sand, causing a severe shortage. This scarcity has significant implications for concrete production, as excessive sand mining from rivers results in environmental degradation, including riverbed erosion and pollution, and disrupts aquatic ecosystems.

Recognizing these challenges, there is a pressing need to explore alternative solutions. Consequently, the focus shifts towards manufactured sand as a viable substitute for river sand. Manufactured sand offers comparable properties to river sand, with the added advantage of a higher practical density that enhances concrete durability.

The dissertation investigates the viability of utilizing manufactured sand as a sustainable alternative to river sand in concrete production, aiming to address the challenges posed by the shortage of natural sand while ensuring the durability and quality of concrete structures.

Suseela et al. (2017) conducted a "Strength Analysis on Concrete with M-Sand as a Partial Replacement of Fine Aggregate." Concrete, typically comprising cement, fine, and coarse aggregates, relies heavily on the availability of natural river sand. However, the scarcity of natural river sand due to environmental concerns and governmental restrictions on riverbed sand extraction has spurred research into alternative fine aggregates.

In response to this challenge, the study explored the efficacy of Manufactured Sand (M-sand) as a viable alternative for commercial purposes. The research aimed to assess the compressive stress, split tensile stress, and durability of concrete with varying M-sand mixtures. By examining these properties, the study sought to evaluate the effectiveness of M-sand in enhancing concrete strength and durability.

Das et al. (2016) conducted an in-depth investigation titled "Mechanical Properties of Hybrid Fiber Concrete Utilizing M Sand and Recycled Aggregate" published in the Journal of Sustainable Construction Technology. This study explored the mechanical properties of hybrid fiber concrete, focusing on the utilization of M sand and recycled aggregate as sustainable alternatives in concrete production.

The research aimed to assess the effects of incorporating M sand and recycled aggregate on the mechanical performance of concrete. Through a series of laboratory experiments and tests, including compressive strength tests, flexural strength tests, and durability assessments, the study provided insights into the behavior and characteristics of hybrid fiber concrete.

By analyzing the results obtained from the experiments, the researchers evaluated the influence of M sand and recycled aggregate on key properties such as strength, workability, and durability of the concrete mixture. Additionally, the study examined the environmental implications and sustainability aspects associated with the use of these alternative materials in concrete production.

The findings of this research contribute valuable knowledge to the field of sustainable construction technology, offering insights into the potential of hybrid fiber concrete incorporating M sand and recycled aggregate as an eco-friendly and durable construction material.

This study undertakesa comprehensive review of literature and journals pertaining to advancements in the construction industry, primarily focusing on concrete technology. Specifically, the research delves into the investigation conducted by Roy et al. (2015) concerning the impact of steel fibers on concrete when utilizing M-Sand as a substitute for natural sand. The authors conducted experiments to assess the compressive and tensile strengths of concrete grades M25 and M30, varying the percentage of steel fibers (ranging from 0% to 2%). Additionally, chemical admixtures were employed to enhance the workability of the concrete. The investigation encompassed a total of 96 specimens, subjected to both compressive strength and split tensile tests.

The study's findings indicate that the strength achieved through the use of natural sand and the substitution of natural sand with M sand in concrete, alongside the incorporation of steel fibers, led to notable outcomes. The investigation draws the following conclusions: the addition of steel fibers to fresh concrete boosts compressive strength by bolstering crack resistance, thereby enhancing durability. Moreover, replacing river sand with M sand yields satisfactory strength and offers a viable alternative material. Furthermore, the utilization of steel fiber reinforcement admixture enhances both compressive and flexural strengths.

Magudeaswaran and Eswaramoorthi (2016) explored the utilization of M sand in High Performance Concrete (HPC) with a focus on enhancing the vacuum condition within the concrete matrix. The study aimed to optimize the surface area to volume ratio to improve the impermeability of the concrete, thus enhancing its workability, compressive strength, and durability.

The researchers introduced silica fume into the concrete at incremental intervals of 2.5%, replacing river sand entirely with M sand. Through mechanical testing, including assessments of compressive strength, tensile strength, and flexural strength, it was observed that increasing the percentage of silica fume replacement led to improvements in these mechanical properties. Additionally, the study found that the higher replacement percentages resulted in enhanced durability indicators for High Performance Concrete.

Uttamraj and Rafeeq (2016) conducted an experimental inquiry into M-Sand and Recron 3S fiber for M30 concrete. The study aimed to analyze the impact on both the fresh properties, such as workability, and the hardened properties, including compressive strength, split tensile strength, and flexural strength, by substituting natural sand with robo sand at proportions of 0%, 50%, and 100%.
For the initial phase, cubes measuring 150mm x 150mm x 150mm, cylinders of 150mm x 300mm, and prisms of 150mm x 150mm x 700mm were cast and tested after 7 and 28 days of curing for the M30 design mix. In the subsequent phase, Recron 3S was integrated into concrete containing 100% M-Sand at varying percentages (0%, 0.5%, 1%, 1.5%, and 2%). Cubes measuring 150mm x 150mm x 150mm, cylinders of 150mm x 300mm, and prisms of 150mm x 150mm x 700mm were cast and subjected to testing after 7 and 28 days. The study concluded that concrete specimens with 0% robo sand replacement exhibited higher compressive strength compared to those with 50% and 100% replacement.

Magudeaswaran and Eswaramoorthi (2016) investigated "High Performance Concrete Using M Sand," with a focus on enhancing the vacuum condition within the concrete. The study centered on the surface area to volume ratio phenomenon, aiming to enhance the impermeability of concrete and subsequently improve its workability, compressive strength, and durability.

To assess the mechanical properties of the concrete, silica fume was gradually introduced at intervals of 2.5%, while fully replacing river sand with M sand. Through experimentation, the researchers observed that increasing the percentage of silica fume replacement resulted in improved compressive, tensile, and flexural strength of the concrete. This enhancement also led to improved standard durability indicators of High Performance Concrete, presenting a more favorable picture overall.

Bhishma K. Vaidya et al. (2016) conducted a Comparative Study on Cost Analysis of Natural and Manufactured Sand in Residential Building

Construction. With the construction industry consuming a significant amount of concrete globally, India traditionally relies on natural sand sourced from riverbeds as fine aggregate in concrete production. However, due to environmental concerns and increasing scarcity, exploring alternatives to natural sand has become imperative.

Manufactured sand, produced by crushing natural stone to obtain aggregate materials less than 4.75mm, offers a viable substitute that is free from impurities. The study compared concrete mixes with varying proportions of natural sand and manufactured sand (e.g., 70% natural sand + 30% manufactured sand, 100% natural sand, 40% natural sand + 60% manufactured sand, and 100% manufactured sand) for M30 grade concrete cubes.

Two case studies were conducted to compare the cost of slab concrete construction using traditional methods versus trial mix variations. The cost analysis of the trial mix variations was compared with the cost of natural sand and manufactured sand obtained from three different cities. This comparative cost analysis provided insights into the economic feasibility of using manufactured sand as a substitute for natural sand in residential building construction.

Yajurved Reddy et al. (2015) conducted a "Study on Properties of Concrete with Manufactured Sand as Replacement to Natural Sand." This investigation focused on evaluating the workability, strength, and durability of concrete with varying proportions of manufactured sand (0%, 20%, 40%, 60%, and 100%) as a substitute for natural sand.

The study encompassed M20 and M30 concrete grades, involving 450 specimens. Workability was assessed through slump cone, compaction factor, and vee-bee time tests, revealing a decrease in workability with an increase in manufactured sand replacement.

To determine concrete strength, compressive strength, split tensile strength, and flexural strength tests were conducted. Results indicated a notable increase in strength, particularly with 60% replacement, showcasing a strength improvement of approximately 20%, while other replacement levels demonstrated a minimum increase of 0.93% across both grades.

Additionally, durability assessment involved subjecting specimens to a 30-day treatment with 5% concentrated Hydrochloric Acid. Concrete mixes with 60% manufactured sand replacement exhibited favorable durable properties, indicating promising durability performance under harsh conditions.

Magnani et al. (2014) conducted a Review on the Need for Manufactured Sand in Concrete Constructions as a Replacement to River Sand. The diminishing availability of natural sands, particularly along the east coast of India, has prompted the exploration of alternatives such as Manufactured Sand (M-Sand). This shift is driven by the necessity to effectively utilize sand-size material generated during the aggregate crushing process. Manufactured sand offers a promising solution, provided it meets recognized specifications. This prompts a decision for design engineers and concrete producers: to opt for ordinary crushed rock fine, a cost-effective option suitable for standard concrete, or to invest in manufactured sand, which may be pricier but holds potential for high-strength concrete applications.

The paper elucidates various issues associated with the utilization of manufactured sand, highlighting the importance of optimizing fines content in crushed rock processing to meet specified standards. This knowledge aids quarry operators in producing manufactured sand that aligns with desired specifications, thus facilitating its integration into concrete constructions as a viable alternative to river sand.

Chirag D. Magnani and Vatsal N. Patel (2014) conducted a Review on the Need for Manufactured Sand in Concrete Constructions as a Replacement to River Sand. The dwindling availability of natural sands, especially along the east coast of India, coupled with the imperative to maximize the utilization of sand-size material derived from aggregate crushing processes, has spurred the development of "Manufactured Sand." Manufactured sand, meeting specific recognized specifications, has emerged as a viable alternative. Design engineers and concrete producers face the decision of

ISSN: 2455-6203
International Journal of Science Management & Engineering Research (IJSMER)
Volume: 09 | Issue: 02 | July - 2024 www.ejournal.rems.co.in
Date of Submission: 25/06/2024 Date of Acceptance: 28/06/2024 Date of Publish: 15/07/2024

specifying ordinary crushed rock fine, a cost-effective option suitable for standard concrete, or opting for manufactured sand, which is pricier but potentially superior for high-strength concrete applications. This paper delves into various issues associated with the use of manufactured sand in concrete construction, shedding light on its benefits and challenges.

NimithaVijayaraghavan and Wayal(2013) conducted a study on the "Effects of Manufactured Sand on Compressive Strength and Workability of Concrete." With a considerable portion of concrete utilized in the construction industry, approximately 35% of its volume comprises sand. Achieving high-quality concrete entails meticulous blending of cement, fine and coarse aggregates, water, and necessary admixtures to attain optimal quality and cost-effectiveness.

While cement and coarse aggregates are typically factory-made with controllable quality standards, the fine aggregates or sand, traditionally sourced from natural reserves like riverbeds, are facing depletion due to ongoing sand mining activities. This has prompted environmental concerns, leading to governmental restrictions on sand extraction from rivers. Consequently, the scarcity of natural sand has resulted in a significant increase in its cost, necessitating an urgent quest for alternatives.

The study underscores the necessity of finding a long-term replacement for river sand, emphasizing manufactured sand as a viable solution. By investigating the effects of manufactured sand on concrete's compressive strength and workability, the research contributes to addressing the challenges posed by the diminishing availability of natural sand and the environmental repercussions associated with sand mining.

Adams Joe et al. (2013) conducted an Experimental Investigation on The Effect of M-Sand in High Performance Concrete. The depletion of natural river sand, once the most economical resource for construction, has led to ecological imbalance due to excessive mining from riverbeds to meet rising demand. This has resulted in the availability of coarse sand with high silt and clay content, compromising concrete strength and promoting dampness.
In response, alternatives such as manufactured sand (M-sand) have emerged, offering a promising substitute for river sand. M-sand, renowned for its quality and minimal environmental impact, has garnered attention from both the construction industry and environmentalists. Its adoption can significantly reduce costs, as it lacks impurities and wastage associated with river sand mining.

The widespread adoption of M-sand in construction could alleviate the demand for river sand and illegal sand-mining. Compared to river sand, M-sand exhibits superior quality and consistency, contributing to high-strength concrete with substantial cost savings. It undergoes grading, sieving, and washing processes, resulting in rounded, granular particles without sharp edges.

This research aims to experimentally assess the impact of M-Sand on structural concrete by replacing river sand and developing high-performance concrete. The study intends to compare the properties of concrete containing river sand versus M-sand, incorporating steel fibers and chemical admixtures to enhance strength and workability, respectively. Various tests, including workability, compressive, tensile, and flexural tests, will be conducted to investigate the effects of M-Sand on concrete properties.

Vinayak R. Supekar and Popat D. Kumbhar (2012) explored the "Properties of Concrete by Replacement of Natural Sand with Artificial Sand." The study aimed to investigate the impact on properties such as workability and compressive strength when natural sand is substituted with artificial sand at varying replacement levels (0%, 20%, 40%, 60%, and 100%).

The researchers also examined the development of cracks and measured their extent. The findings revealed that natural sand could be effectively replaced with artificial sand up to a maximum replacement level of 60%. Concrete produced with this replacement level exhibited satisfactory workability and compressive strength, along with reduced crack formation.

III. Conclusion

Based on the reviewed literature, it is evident that various combinations of materials have been explored by different researchers. However, a comprehensive mix design incorporating admixtures and manufactured sand remains lacking in the existing studies. Moreover, the potential benefits of incorporating bamboo fiber, particularly in terms of enhancing workability and setting time of concrete, have not been adequately addressed.

In regions with high temperatures and low humidity, such as many tropical countries, concrete setting times are significantly affected. Rapid water evaporation due to higher temperatures and hot winds accelerates the setting process, leaving limited time for finishing operations. Studies indicate that when the temperature of concrete mortar with a water-to-cement ratio (w/c) of 0.7 increases from 25°C to 40°C, both initial and final setting times are approximately halved.

To address these gaps and challenges, future research should focus on developing optimized mix designs that incorporate both admixtures and manufactured sand, while also considering the beneficial effects of incorporating bamboo fiber. By conducting systematic experiments and performance evaluations, researchers can contribute to the development of concrete formulations that offer enhanced workability, extended setting times, and improved overall performance, particularly in regions with challenging environmental conditions.

REFERENCES

[1] Burati N, Mazzoti C, Savoia M. Post-cracking behaviour of steel and macro-synthetic fbre reinforced concretes. Construction and Building Materials. 2011;25(5):2713-2722

[2] Mahapara Abbas, 2015, Coconut Fiber as Fiber Reinforcement: A Review SSRGInternational Journal of Civil Engineering (SSRG-IJCE).

[3] Safeer-ul-Hassan M, Munir M, Mujahid MY, Kisana NS, Akram Z, Nazeer AW. Genetic analysis of some biometric characters in bread wheat (Triticumaestivum L.). Journal of Biological Sciences. 2004;4(4):480-485

[4] Bhupendra Kumar, Kuswah S S, AmitVishwakarma, 2015, Effect of Coconut Fiber inWorkability and Compressive Strength of Concrete IJSRD- International Journal for Scientific Research & Development.

[5] Bentur A. Microstructure, interfacial effects, and micromechanics of cementitious composites. Ceramic Transactions. 1990;16:523-550

[6] Mahapara Abbas, 2015, Coconut Fiber as Fiber Reinforcement: A Review SSRGInternational Journal of Civil Engineering (SSRG-IJCE).

[7] Shreeshail B H, JaydeepChougale, Dhanraj Pimple, Amar Kulkarni, 2014, Effects of coconut fibers on the properties of concrete IJRET: International Journal of Research in Engineering and Technology.

[8] Shanmugavadivu P M and Malathy R, 2011, Durability Properties of Concrete with Natural sand and Manufactured sand" Proc. of the International Conference on Science andEngineering (ICSE 2011).

[9] NimithaVijayaraghavan and WayalA S, 2014, Effects of manufactured sand on compressive strength and workability of concrete IJRET: International Journal of Research in Engineering and TechnologyShreeshail B H, JaydeepChougale, Dhanraj Pimple, Amar Kulkarni, 2014, Effects of coconut fibers on the properties of concrete IJRET: International Journal of Research in Engineering and Technology.

[10] Bentur A. Microstructure, interfacial effects, and micromechanics of cementitious composites. Ceramic Transactions. 1990;16:523 550

[11] Shanmugavadivu P M and Malathy R, 2011, Durability Properties of Concrete with Natural sand and Manufactured sand" Proc. of the International Conference on Science andEngineering (ICSE 2011).

[12] Huang L, Xu L, Chi Y, Xu H. Experimental investigation on the seismic performance of steel–polypropylene hybrid fber reinforced concrete columns. Construction and Building Materials. 2015;87:16-27

[13] Sreekutty S and Kiran Jacob "Experimental Study on Iron Ore Tailings and Bottom Ash as Fine Aggregates in Concrete" IJERT, Vol. 5 Issue 09, September-2016, 119-123

[14] Ramakrishnan V. Materials and Properties of Fibre Reinforced Concrete. London: Civil Engineering; 1988. pp. 29-40

[15] Department of Mines And Geology,Govt. of Karnataka, 2011, Effects of manufactured sand on compressive strength and workability of concrete CSIC Project:CP 6597/0505/11-330.

[16] Umamaheswaran, Sudha C, Ravichandran P T and KannanRajkumar P R, 2015, Use of Msand in High Strength and High-Performance Concrete Indian Journal of Science and Technology, Vol 8(28) DOI: 10.1748.

[17] Zhong-xi Tian, Zeng-hui Zhao, Chun-quan Dai and Shu-jie Liu "Experimental Study on the Properties of Concrete Mixed with Iron Ore Tailings" Advances in Materials Science and Engineering Volume 2016, Article ID 8606505, pp 1-9 .

[18] SidduKarthik C S, Panditharadhya B J, Sowmyashree T, Arpitha D J "Properties Of Concrete With Red Mud As Partial Replacement Of Cement With Hydrated Lime And Superplasticizer" International Journal Of Engineering Sciences & Research Technology 5.(5): May, 2016 [10] MahinSha O B, Remya C P, Salja P A, Shifal K S " Red Mud Concrete" IRJET, Volume: 03 Issue: 04, April-2016, 2582-2585

[19] Sreekutty S and Kiran Jacob "Experimental Study on Iron Ore Tailings and Bottom Ash as Fine Aggregates in Concrete" IJERT, Vol. 5 Issue 09, September-2016, 119-123

[20] ACIFC. An Introduction Guide: Steel Fibre Reinforced Concrete Industrial Ground Floors. Warwickshire: ACIFC; 1999

[21] Brandt AM. Fibre reinforced cement-based (FRC) composites after over 40 years of development in building and civil engineering. Composite Structures. 2008;86(1-3):3-9

[22] Safeer-ul-Hassan M, Munir M, Mujahid MY, Kisana NS, Akram Z, Nazeer AW. Genetic analysis of some biometric characters in bread wheat (Triticumaestivum L.). Journal of Biological Sciences. 2004;4(4):480-48

[23] deMontaignac R, Massicote B, Charron JP, Nour A. Design of SFRC structural elements: Post-cracking tensile strength measurement. Materials and Structures. 2012;45(4):609-622

[24] Caggiano V, Fogassi L, Rizzolati G, Casile A, Giese MA, Thier P. Mirror neurons encode the subjective value of an observed action. Proceedings of the National Academy of Sciences. 2012;109(29):11848-11853

[25] Susetyo J, Gauvreau P, Vecchio FJ. Steel fber reinforced concrete panels in shear: Analysis and modeling. ACI Structural Journal. 2013;110(2):285

[26] Barros JA, Lourenço LA, Soltanzadeh F, Taheri M. Retracted article: Steel fbre reinforced concrete for elements failing in bending and in shear. European Journal of Environmental and Civil Engineering. 2014;18(1):33-65

[27] Aoude H, Belghiti M, Cook WD, Mitchell D. Response of steel fber-reinforced concrete beams with and without stirrups. ACI Structural Journal. 2012;109(3):359

ISSN: 2455-6203
International Journal of Science Management & Engineering Research (IJSMER)
Volume: 09 | Issue: 02 | July - 2024 www.ejournal.rems.co.in
Date of Submission: 25/06/2024 Date of Acceptance: 28/06/2024 Date of Publish: 15/07/2024