International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 Issue: IV Month of publication: April 2026

DOI: https://doi.org/10.22214/ijraset.2026.80900

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

# Impact Resistance and Energy Absorption of Pet Incorporated High-Strength Concrete: A Review

Abhiram Vinod[1], Anju Thulasi[2]
[1]PG Student, Department of Civil Engineering, Sree Narayana Institute of Technology, Adoor
[2]Assistant Professor, Department of Civil Engineering, Sree Narayana Institute of Technology, Adoor

***Abstract: High-strength concrete (HSC) exhibits excellent compressive strength but is inherently brittle, making it prone to sudden failure under dynamic or impact loads. The incorporation of polyethylene terephthalate (PET) flakes or fibers derived from recycled plastic bottles has emerged as a sustainable approach to enhancing the mechanical performance of HSC, particularly in terms of impact resistance and energy absorption. PET addition not only contributes to improved toughness and ductility but also promotes environmental sustainability by recycling post-consumer plastic waste. This review synthesizes recent advances (2023–2025) in PET-incorporated high-strength concrete, focusing on fresh properties, hardened mechanical properties, durability, microstructural interactions, and methods for evaluating impact resistance and energy absorption. Key durability tests such as water absorption, carbonation depth, density/unit weight, dry shrinkage, along with microstructural characterization techniques including X-ray diffraction (XRD) and Fourier-transform infrared spectroscopy (FTIR), are also discussed to understand the long-term performance of PET-enhanced HSC.***

***Keywords: Impact Resistance, Energy Absorption, Polyethylene Terephthalate, Crack Bridging.***

## I. INTRODUCTION

High-strength concrete (HSC) is an essential material in contemporary construction, particularly in high- rise buildings, bridges, and critical infrastructure. Its excellent compressive strength, high modulus of elasticity, and resistance to chemical and environmental attacks make it suitable for heavy-duty applications. However, the very characteristics that give HSC its high compressive strength namely, a dense microstructure and low water-to-cement ratio also contribute to its inherent brittleness. Unlike normal-strength concrete, HSC has limited tensile capacity and low energy absorption, making it susceptible to sudden catastrophic failure under dynamic, impact, or seismic loads. The inability of HSC to dissipate energy efficiently under such loading conditions has driven research into alternative reinforcement strategies beyond traditional steel fibers, leading to interest in polymeric inclusions such as PET. Polyethylene terephthalate (PET), a polymer widely used in beverage bottles and packaging, has emerged as a sustainable additive for concrete. PET fibers or flakes derived from recycled bottles offer several advantages, including light weight, high elongation, and the ability to act as crack arrestors. Studies demonstrate that even low percentages of PET incorporation can significantly improve impact resistance and energy absorption without severely compromising compressive strength (Fode et al., 2025; Nshimiyimana et al., 2025). Additionally, PET incorporation aligns with global sustainability goals by reducing plastic waste, supporting the circular economy, and minimizing environmental impact from landfills. This dual function mechanical enhancement and environmental conservation makes PET- modified HSC a promising material for modern construction applications. This review synthesizes recent research (2023–2025) on PET-incorporated HSC, focusing on mechanical performance, impact resistance, energy absorption, durability, and microstructural interactions. It also examines testing methodologies, microstructural analysis techniques, and sustainability considerations, providing a comprehensive perspective on this innovative material.

## II. MATERIAL PROPERTIES AND PET INCORPORATION IN HSC

High-strength concrete (HSC) is widely recognized for its excellent compressive strength, dense microstructure, and durability, making it suitable for heavy-duty structural applications. However, its inherent brittleness, low tensile strength, and limited energy absorption capacity restrict its use in scenarios involving impact, dynamic, or seismic loading. The incorporation of polyethylene terephthalate (PET), derived from post-consumer plastic bottles, as a partial replacement for fine or coarse aggregates or as dispersed fibers, has emerged as a promising approach to overcome these limitations. PET possesses a significantly lower density (~1350 kg/m³) compared to natural aggregates (~2600–2700 kg/m³), moderate tensile strength (55–75 MPa), and high elongation (50–100%), enabling it to deform under stress and dissipate energy efficiently. These properties make PET effective in bridging microcracks, redistributing stresses, and enhancing the ductility and flexural toughness of HSC.

PET can be introduced into concrete in various forms, including flakes, fibers, and regrind granules. Flakes, typically 1–5 mm in size, can replace portions of fine or coarse aggregates and provide mechanical interlock with the cementitious matrix, while short fibers (20–40 mm) act as micro-reinforcements, arresting crack propagation and improving post-crack behavior. Granules obtained from reprocessed PET bottles can also partially replace coarse aggregates, contributing to energy absorption and lightweight concrete production. Despite these advantages, the hydrophobic nature of PET can weaken the interfacial transition zone (ITZ) with cement paste, potentially reducing compressive strength and durability. To address this, chemical surface treatments such as soaking PET in alkaline solutions (e.g., NaOH) are employed to increase surface roughness, enhance surface energy, and improve bonding with hydration products. Mechanical abrasion or acid treatments may also be applied to achieve similar effects. These treatments strengthen the ITZ, enabling more efficient load transfer between PET and the concrete matrix and enhancing impact resistance. Additionally, PET incorporation reduces the overall density of the mix, making it suitable for lightweight structural elements. However, it may slightly reduce workability due to irregular shapes and hydrophobic surfaces, necessitating adjustments in water content or the use of superplasticizers. Optimizing PET content, particle geometry, and surface treatment is crucial, as studies indicate that 5–15% replacement offers a balance between mechanical performance, energy absorption, and structural integrity. Through careful selection of PET type, treatment, and dosage, high-strength concrete can achieve improved impact resistance, enhanced energy absorption, and sustainable environmental benefits by diverting plastic waste from landfills while maintaining adequate compressive and tensile performance.

## III. FRESH CONCRETE PROPERTIES

The incorporation of PET into high-strength concrete (HSC) significantly influences the properties of fresh concrete, particularly its workability, flow behavior, and cohesiveness. Fresh HSC with PET exhibits a tendency toward reduced slump and higher viscosity compared to conventional mixes, primarily due to the hydrophobic nature of PET surfaces, which limits water absorption and reduces the lubricating effect between particles. Additionally, the irregular geometry and angularity of PET flakes or fibers create inter-particle friction that further hinders flowability. Studies have shown that as the PET content increases beyond 10–15% by volume, the workability of the mix decreases noticeably, which can affect compaction and uniform distribution of aggregates within the concrete matrix (Alsaad et al., 2025; Nshimiyimana et al., 2025). To address these challenges, the use of water-reducing admixtures or superplasticizers is often necessary, enabling the mix to achieve the desired slump without altering the water-to-cement ratio, which is critical for maintaining the strength characteristics of HSC.

Despite potential reductions in workability, PET incorporation offers certain advantages in fresh concrete properties. The lightweight nature of PET reduces the overall density of the mix, which can enhance pumping efficiency and ease of handling during placement. Moreover, PET particles create a more uniform distribution of microvoids, which can facilitate internal curing by retaining moisture within the mix and reducing early-age shrinkage. Proper mix design, including adjustments in aggregate grading, PET particle size, and dosage, is essential to balance workability with mechanical performance. Research indicates that optimal PET content in fresh HSC ranges from 5% to 10% by weight of coarse aggregates, providing improved energy absorption and impact resistance without compromising the flow characteristics necessary for casting and consolidation (Yew & Namasivayam, 2025; Lopes et al., 2025). Furthermore, careful dispersion of PET fibers during mixing ensures homogeneity, prevents fiber balling, and promotes consistent crack-bridging efficiency in the hardened state. Therefore, while PET can reduce the workability of fresh HSC, appropriate mix modifications and admixture usage allow for the successful incorporation of PET, maintaining a balance between fresh concrete performance and the long- term mechanical and durability benefits it imparts.

## IV. HARDENED MECHANICAL PROPERTIES

The incorporation of PET into high-strength concrete (HSC) significantly alters its hardened mechanical performance, impacting compressive strength, tensile strength, flexural behavior, and overall toughness. While the addition of PET fibers or flakes generally results in a slight reduction in compressive strength due to the lower stiffness and density of PET compared to natural aggregates, the extent of this reduction is highly dependent on the type, size, surface treatment, and percentage of PET used in the mix. Studies indicate that PET contents between 5% and 10% by weight of coarse aggregates typically produce negligible losses in compressive strength, whereas higher contents (above 15%) may reduce compressive capacity more substantially (Fode et al., 2025; Dawood & Shakir, 2025). Despite this modest reduction, PET-modified HSC exhibits remarkable improvements in tensile, flexural, and post-cracking behavior due to the crack-bridging and stress redistribution effects of the polymeric inclusions. PET fibers effectively arrest microcrack propagation by transferring stresses across cracks, which enhances the energy absorption capability of concrete under dynamic or impact loading (Gayake et al., 2025).

Flexural strength and toughness are particularly improved by PET incorporation. The fibers and flakes act as micro-reinforcements, allowing the concrete to deform plastically after initial cracking, rather than failing suddenly in a brittle manner. This post-crack ductility is critical in structural applications where impact, vibration, or dynamic forces are prevalent. Experimental studies have reported increases in flexural toughness of up to 40% when 10% PET is incorporated, with a corresponding increase in energy absorption capacity under repeated or high-intensity loading conditions (Chong & Shi, 2023; Farah et al., 2024). Splitting tensile strength also improves moderately due to the enhanced interfacial bond and mechanical interlocking between PET particles and the surrounding cement paste, contributing to a more uniform stress distribution under tensile forces.

The effectiveness of PET in enhancing mechanical properties is further influenced by surface treatments such as NaOH soaking or mechanical abrasion, which improve adhesion with the cement matrix and strengthen the interfacial transition zone (ITZ). Well-bonded PET particles ensure that cracks are bridged effectively, enabling the concrete to absorb higher amounts of strain energy prior to failure. Additionally, the geometry and aspect ratio of PET fibers play a pivotal role in post-crack behavior: longer fibers with higher aspect ratios provide more efficient stress transfer and energy dissipation, while shorter or irregular flakes contribute to crack deflection and localized toughness. The combination of these mechanisms allows PET-HSC to maintain a balance between adequate compressive strength and significantly improved toughness, making it suitable for structural applications subjected to impact, vibration, or seismic forces. Overall, while PET incorporation may slightly compromise compressive strength, the substantial gains in tensile capacity, flexural toughness, and energy absorption make it a highly advantageous material for enhancing the performance of high-strength concrete.

## V. IMPACT RESISTANCE AND ENERGY ABSORPTION

High-strength concrete (HSC), despite its superior compressive strength and stiffness, exhibits limited capacity to withstand sudden dynamic loads or impact events due to its brittle nature. Conventional HSC fails abruptly under impact, with minimal energy dissipation, making it vulnerable in applications such as blast-resistant structures, industrial flooring, or seismic regions. The incorporation of polyethylene terephthalate (PET) fibers or flakes into HSC has been extensively investigated as an effective strategy to enhance impact resistance and energy absorption. PET, being lightweight, ductile, and deformable, introduces a mechanism for crack bridging and stress redistribution that allows the concrete to undergo significant deformation before catastrophic failure. Under impact loading, microcracks initiate within the cementitious matrix; PET fibers or flakes act as micro-reinforcements, bridging these cracks and transferring stresses across the crack faces. This mechanism slows crack propagation, dissipates kinetic energy, and improves post-crack ductility, enabling the concrete to absorb significantly more energy compared to unmodified HSC (Gayake et al., 2025; Farah et al., 2024).

Experimental studies have employed various standardized testing methodologies to evaluate impact resistance and energy absorption in PET-modified HSC, including drop-weight impact tests, repeated hammer impact tests, and instrumented flexural toughness measurements. Results consistently show that PET incorporation leads to a pronounced increase in the total energy absorbed before failure. For instance, concrete mixes with 5–10% PET content have demonstrated 20–40% higher energy absorption than control mixes, with improved crack control and delayed failure under repeated impacts (Chong & Shi, 2023; Joseph et al., 2024). The improvement is attributed to the synergy between PET's ductility and the mechanical interlocking effect within the cementitious matrix. As the percentage of PET increases, energy absorption continues to rise, but excessively high PET contents (above 15%) may compromise compressive strength and structural integrity despite higher toughness.

The shape, size, and surface treatment of PET particles critically influence impact performance. Short fibers provide uniform distribution and effective bridging of microcracks, while longer fibers or flakes with higher aspect ratios facilitate more extensive crack deflection and energy dissipation. Surface treatments such as alkaline soaking or mechanical roughening enhance the bond between PET and the cement paste, ensuring efficient stress transfer and preventing premature fiber pull-out during impact. In addition to improving mechanical energy absorption, PET fibers mitigate brittleness by enabling controlled crack propagation, transforming sudden, catastrophic failures into progressive, ductile fracture modes. Consequently, PET-modified HSC exhibits enhanced resilience under dynamic and impact loading conditions, making it suitable for structures subjected to high strain rates, repeated loads, or accidental impacts. Overall, the incorporation of PET in HSC not only improves impact resistance and energy absorption but also contributes to sustainability by reusing post-consumer plastic waste. The optimized balance of PET content, particle geometry, and surface treatment enables designers to achieve concrete mixes that combine high compressive strength with enhanced toughness and energy dissipation, addressing the primary limitation of conventional high-strength concrete under dynamic loading scenarios. The dual advantage of mechanical performance enhancement and environmental conservation underscores the growing relevance of PET-incorporated HSC in modern construction.

## VI. DURABILITY OF PET-INCORPORATED HIGH-STRENGTH CONCRETE

Durability is a critical aspect of high-strength concrete (HSC), particularly for structures exposed to aggressive environments, cyclic loading, or long service life requirements. While HSC inherently exhibits low permeability and high chemical resistance due to its dense microstructure, the incorporation of polyethylene terephthalate (PET) fibers or flakes can influence durability in several ways. PET addition introduces microvoids and reduces the overall density of the concrete matrix, which slightly increases water absorption; however, this effect can be mitigated through optimized mix design, use of superplasticizers, and proper curing practices (Fode et al., 2025; Tudu et al., 2024). Studies have shown that PET-HSC exhibits water absorption values within acceptable limits, typically ranging between 3.5% and 4.3%, depending on the PET content, particle size, and surface treatment. These minor increases in porosity are often offset by the benefits PET provides in crack control, as fibers bridge microcracks and reduce permeability pathways, thereby indirectly enhancing the long-term durability of the concrete.

Carbonation depth, another critical durability parameter, is influenced by PET incorporation. Research indicates that concrete containing 5–15% PET demonstrates slightly reduced carbonation penetration compared to conventional HSC. This reduction is attributed to PET's ability to restrain microcrack development, maintain matrix integrity, and slow the diffusion of $CO_2$ through the cementitious structure. Similarly, dry shrinkage, a phenomenon that often leads to cracking and long-term durability issues, is positively affected by PET fibers. By restraining early-age microcrack propagation and distributing shrinkage-induced stresses more evenly across the matrix, PET-modified HSC exhibits lower shrinkage strains, contributing to enhanced structural longevity (Yew & Namasivayam, 2025; Lopes et al., 2025).

Density measurements of PET-HSC reveal a progressive decrease with increasing PET content, reflecting the lightweight nature of the polymer. While reduced density may slightly influence compressive strength, it provides advantages in terms of structural self-weight reduction, easier handling, and potential energy efficiency in transportation and construction. Microstructural characterization techniques, such as X-ray diffraction (XRD) and Fourier-transform infrared spectroscopy (FTIR), provide further insights into the durability mechanisms at play. XRD analysis identifies crystalline hydration products and monitors any modifications in cementitious phases due to PET inclusion, indicating that PET does not hinder hydration but may influence the formation and distribution of microcracks. FTIR spectroscopy, on the other hand, reveals chemical interactions between PET surfaces and the cement matrix, confirming that surface-treated PET can form weak but effective bonds with hydration products, enhancing overall toughness and reducing crack propagation pathways (Hamada et al., 2024).

Overall, PET incorporation into HSC provides a balance between mechanical enhancement and durability performance. While minor increases in water absorption and slight reductions in compressive density are observed, the improved crack control, reduced shrinkage, and sustained carbonation resistance demonstrate that PET-HSC can maintain structural integrity over extended periods. The combination of physical reinforcement through fiber bridging and chemical compatibility via surface- treated PET ensures that these modified concretes can withstand environmental challenges, dynamic loading, and long-term service conditions, all while contributing to sustainable construction by utilizing recycled polymer waste.

## VII. SUSTAINABILITY AND ENVIRONMENTAL IMPACT

The environmental significance of incorporating polyethylene terephthalate (PET) into high-strength concrete (HSC) extends beyond mechanical performance, addressing critical issues of plastic waste management, resource conservation, and sustainable construction practices. PET is one of the most commonly discarded plastics globally, with millions of tons of post-consumer bottles ending up in landfills or oceans each year, contributing to severe environmental pollution. By recycling PET into concrete as flakes, fibers, or granules, this material is diverted from waste streams, promoting circular economy principles and reducing the ecological footprint of construction activities (Shukla et al., 2025; Wawer et al., 2025). The reuse of PET not only mitigates environmental pollution but also decreases the extraction of natural aggregates, which are finite resources. Conventional concrete production relies heavily on river sand and gravel, whose overexploitation has caused ecological degradation and landscape alteration. Partial replacement of coarse or fine aggregates with PET reduces the demand for these natural materials, conserving ecosystems and promoting sustainable resource utilization.

From a structural and functional perspective, PET incorporation aligns with the concept of sustainable high-performance materials, as it simultaneously enhances impact resistance, energy absorption, and ductility, enabling longer service life and reduced maintenance requirements for concrete structures. Longer-lasting structures result in lower environmental costs associated with repair, demolition, and reconstruction. Life cycle assessment (LCA) studies have shown that PET-modified concrete has lower embodied energy and carbon footprint compared to conventional HSC, particularly when recycled PET from post-consumer sources is used.

Additionally, the lightweight nature of PET contributes to reductions in transportation energy, ease of handling on construction sites, and the potential for innovative structural designs that require less material without compromising performance (Han et al., 2025; Lopes et al., 2025).

Moreover, PET-HSC supports sustainable urban development by reducing the volume of plastic waste entering landfills and oceans, indirectly mitigating microplastic pollution and associated ecological hazards. In regions where plastic waste management infrastructure is limited, incorporating PET into concrete provides a practical pathway for large-scale utilization of post-consumer plastics. Surface- treated PET fibers further enhance their effectiveness, ensuring that mechanical performance improvements are achieved without compromising environmental objectives. In addition to mitigating environmental damage, PET-HSC promotes green construction certifications and aligns with sustainable building codes that increasingly recognize recycled content as a critical performance metric.

In conclusion, the sustainability benefits of PET-incorporated HSC are multifaceted, encompassing waste reduction, resource conservation, decreased embodied energy, and extended structural service life. The dual advantage of improved mechanical performance particularly in impact resistance and energy absorption and environmental stewardship positions PET-modified HSC as a forward-looking material for modern construction projects. By integrating recycled PET, the construction industry can actively contribute to circular economy initiatives, reduce its carbon footprint, and develop resilient, energy- efficient, and environmentally responsible infrastructure.

## VIII. CONCLUSION

The integration of polyethylene terephthalate (PET) into high-strength concrete (HSC) represents a significant advancement in the pursuit of sustainable, impact-resistant, and energy-absorbing construction materials. PET, derived from post-consumer plastic waste, contributes to enhanced mechanical performance by bridging microcracks, improving flexural toughness, and increasing energy absorption under dynamic or impact loads. While minor reductions in compressive strength and workability may occur, these can be effectively mitigated through optimized PET content, particle size, surface treatment, and the use of admixtures. Durability studies reveal that PET-HSC maintains satisfactory water absorption, carbonation resistance, and shrinkage performance, while microstructural investigations via XRD and FTIR confirm favorable interactions between PET and the cementitious matrix.

The environmental and sustainability benefits of PET incorporation are equally significant. By utilizing post-consumer plastic waste as aggregates or fibers, PET-HSC reduces landfill burden, minimizes natural aggregate extraction, and lowers the overall carbon footprint of concrete production. The lightweight nature of PET further contributes to energy-efficient transportation and handling, while the improved toughness and ductility extend the service life of structural elements. Optimization of PET incorporation, supported by computational modeling, standardized testing protocols, and surface treatment strategies, ensures that mechanical, durability, and sustainability objectives are simultaneously achieved.

Future research should focus on hybrid mix designs with supplementary cementitious materials, long- term environmental exposure studies, and field-scale applications to further validate PET-HSC as a resilient, sustainable material. Overall, PET-incorporated HSC offers a practical, environmentally responsible, and structurally advantageous solution to the challenges of conventional high-strength concrete, providing a pathway toward greener and more durable infrastructure worldwide.

## REFERENCES

[1] Fode, Tsion Amsalu, Yusufu Abeid Chande Jande, Thomas Kivevele, and Nima Rahbar. "Effect of waste water bottle and treated sisal fibers on the durability and mechanical properties of concrete." Scientific Reports 15, no. 1 (2025): 7945.

[2] Nshimiyimana, Marc, Jean Claude Sugira, and Jean Pierre Nsengimana. "UTILIZATION OF RECYCLED POLYETHYLENE TEREPHTHALATE (RECYCLED PET) FIBERS FOR INNOVATIVE CONCRETE PROPERTY ENHANCEMENT." Journal of Civil Engineering 16, no. 1 (2025): 6-18.

[3] Alsaad, Aymen J., Wajde S. Alyhya, and Mushtaq Sadiq Radhi. "A Novel Approach in the Utilization of Waste Plastic with Enhanced Surfaces as Fine Aggregates in Concrete Production." Engineering, Technology & Applied Science Research 15, no. 4 (2025): 24486-

[4] 24492.

[5] Yew, Yek Ren, and Satesh Namasivayam. "Utilization of PET Flakes in Enhancing the Compressive Strength of Concrete." Journal of Mechanical Engineering (1823-5514) 22, no. 2 (2025).

[6] Shukla, Bishnu Kant, Harshit Yadav, Satvik Singh, Shivam Verma, Anoop Kumar Shukla, and Chetan Sharma. "Sustainable Engineering of Recycled Aggregate Concrete: Structural Performance and Environmental Benefits Under Circular Economy Frameworks." Construction Materials 5, no. 3 (2025): 67.

[7] Lopes, Lucas, Harish Dauari, Paulo Mendonça, and Manuela Almeida. "Marine Plastic Waste in Construction: A Systematic Review of Applications in the Built Environment." Polymers 17, no. 13 (2025): 1729.

[8] Gayake, Sudhir Bhaskarrao, Shubham V. Jadhav, Saiprasad G. Gaikwad, Rushikesh S. Kasar, Pravin R. Parhe, and Atul K. Desai. "Multi-criteria analysis of impact strength in concrete with PET bottle waste additives." International Journal of Structural Engineering 15, no. 1 (2025): 69-87.

[9] Han, Jixuan, Jian Zuo, George Zillante, Ruidong Chang, and Linwei Du. "A systematic review of PET circularity technologies and management strategies: Challenges and future directions." Resources, Conservation and Recycling 219 (2025): 108280.

[10] Alsaad, Aymen J., Wajde S. Alyhya, and Mushtaq Sadiq Radhi. "A Novel Approach in the Utilization of Waste Plastic with Enhanced Surfaces as Fine Aggregates in Concrete Production." Engineering, Technology & Applied Science Research 15, no. 4 (2025): 24486-

[11] 24492.

[12] Lee, Hak Jun, Seong Joo Kim, Ji Ho Youk, and Ki Hoon Lee. "Feasibility Study on the Production of Industrial PET Fibers Using Recycled Bottle-Grade PET." Fibers and Polymers 26, no. 2 (2025): 513-520.

[13] Yek, Ren Yew, and Satesh Namasivayam. "Utilization of PET flakes in enhancing the compressive strength of concrete/Yek Ren Yew and Satesh Namasivayam." Journal of Mechanical Engineering (JMechE) 22, no. 2 (2025): 59-70.

[14] Vennapusa, Chandra Sekhar Reddy, and Arunakanthi Eluru. "Experimental study on (OPC concrete), inclusive of using Plastic Bottle Flakes with Mineral and Chemical Admixtures for Environmental Sustainability." Progress in Engineering Science (2025): 100128.

[15] Wawer, Jarosław, Aneta Panuszko, Dawid Kozłowski, Jan Juniewicz, Jakub Szymikowski, and Elwira Brodnicka. "Sustainable Management of Microplastic Pollutions from PET Bottles: Overview and Mitigation Strategies." Applied Sciences (2076-3417) 15, no. 10 (2025).

[16] Grzelak, Michał, Marek Szostak, Paulina Rzepka, and Arkadiusz Koziński. "Comparison of post-consumer recycling PET bottles production from flakes and regranulate." Polimery 70, no. 7-8 (2025): 510-519.

[17] Dawood, Abbas O., and Noor M. Shakir. "Physical and mechanical characteristics of geopolymer concrete incorporating PET wastes as partial replacement of fine aggregate: DOI registering." Advances in Civil and Architectural Engineering 16, no. 30 (2025): 245-261.

[18] Mohd Azam, Raden Maizatul Aimi, Ahmad Farhan Mohd Faizal, and Norhana Abdul Rahman. "Assessing the efficacy of Polyethylene Terephthalate (PET) in concrete brick for sustainable construction." Journal of Sustainable Civil Engineering & Technology (JSCET) 4, no. 2 (2025): 116-126.

[19] Lopes, L., Dauari, H., Mendonça, P., & Almeida, M. (2025). Marine Plastic Waste in Construction: A Systematic Review of Applications in the Built Environment. Polymers, 17(13), 1729.

[20] Hamada, Hussein M., Alyaa Al-Attar, Farid Abed, Salmia Beddu, Ali M. Humada, Ali Majdi, Salim T. Yousif, and Blessen Skariah Thomas. "Enhancing sustainability in concrete construction: A comprehensive review of plastic waste as an aggregate material." Sustainable Materials and Technologies 40 (2024): e00877.

[21] Tudu, Chhabirani, Monika Mohanty, Smruti Sourava Mohapatra, and Sanket Nayak. "A systematic review exploring the feasibility of waste plastic as different constituents towards sustainable concrete." Construction and Building Materials 428 (2024): 136210.

[22] Joseph, Tomy Muringayil, Seitkhan Azat, Zahed Ahmadi, Omid Moini Jazani, Amin Esmaeili, Ehsan Kianfar, Józef Haponiuk, and Sabu Thomas. "Polyethylene terephthalate (PET) recycling: A review." Case Studies in Chemical and Environmental Engineering 9 (2024): 100673.

[23] Farah, Elias, Saidé Yaacoub, Joseph Dgheim, and Nemr El Hajj. "Assessing the Impact of Shredded Polyethylene Terephthalate (PET) Post-Consumer Plastic as a Partial Replacement for Coarse Aggregates in Unreinforced Concrete." Materials 17, no. 21 (2024): 5208.

[24] Askar, Mand Kamal, Yaman SS Al-Kamaki, and Ali Hassan. "Utilizing polyethylene terephthalate PET in concrete: a review." Polymers 15, no. 15 (2023): 3320.

[25] Chong, Beng Wei, and Xijun Shi. "Meta-analysis on PET plastic as concrete aggregate using response surface methodology and regression analysis." Journal of Infrastructure Preservation and Resilience 4, no. 1 (2023): 2.

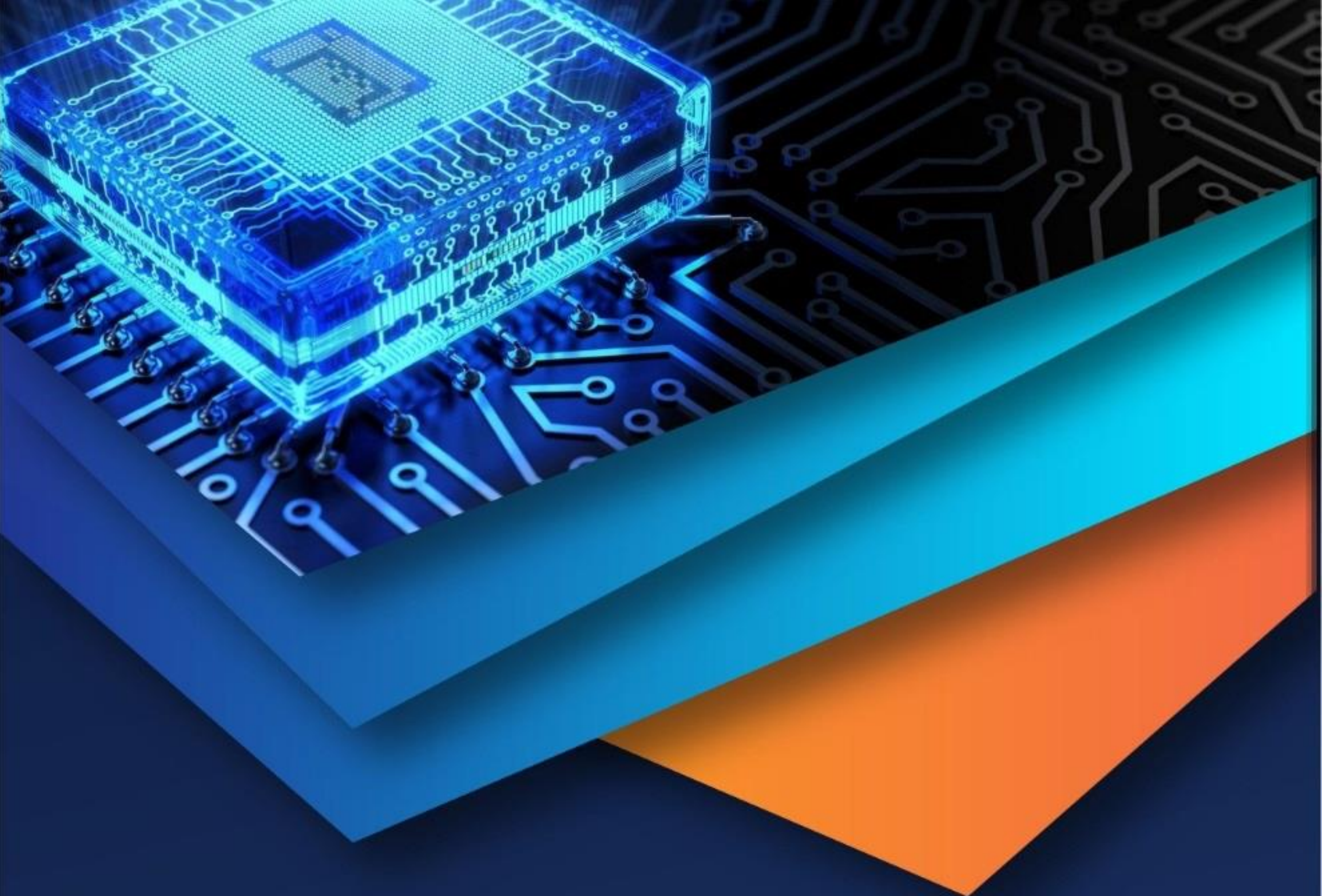
[26] Marinelli, Simona, Samuele Marinello, Francesco Lolli, Rita Gamberini, and Antonio Maria Coruzzolo. "Waste plastic and rubber in concrete and cement mortar: A tertiary literature review." Sustainability 15, no. 9 (2023): 7232.

[27] Lingamen, Renz Brixter B., and Orlean G. Dela Cruz. "Polyethylene Terephthalate (PET) Waste as Partial Aggregate and Reinforcement in Reinforced Concrete: A Review." International Journal of Integrated Engineering 15, no. 2 (2023): 159-171.

[28] Rao, Marabathina Maheswara, Sanjaya Kumar Patro, and Prasanna Kumar Acharya. "Utilisation of Plastic Waste as Synthetic Fiber and Aggregate in Concrete–A Review." The Open Civil Engineering Journal 17 (2023).

[29] Qaidi, Shaker, Yaman Al-Kamaki, Ibrahim Hakeem, Anmar F. Dulaimi, Yasin Özkılıç, Mohanad Sabri, and Vitaly Sergeev. "Investigation of the physical-mechanical properties and durability of high-strength concrete with recycled PET as a partial replacement for fine aggregates." Frontiers in Materials 10 (2023): 1101146.

[30] Kangavar, Mohammad Eyni. "Performance of sustainable concrete incorporating recycled polyethylene terephthalate (pet) granules." (2023).



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY