

RECYCLED PLASTICS IN CONSTRUCTION: AN UNSEEN AND SUSTAINABLE INTEGRATION

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Abstract

Plastic waste has become one of the most pressing global challenges, significantly impacting terrestrial and marine ecosystems. Indonesia, as the second-largest producer of plastic waste worldwide, faces substantial difficulties in managing this issue. This study aims to explore the utilization of recycled plastics in the construction sector as an innovative and sustainable solution. The methodology employed is a literature review, analyzing secondary data from nine key journals and related research reports. The types of plastics examined in this study include High-Density Polyethylene (HDPE), Low-Density Polyethylene (LDPE), Polyethylene Terephthalate (PET), and Polypropylene (PP). These plastics are utilized as composite materials in the production of paving blocks, concrete, bricks, road pavements, and soil stabilization. The research findings indicate that recycled plastics can partially replace conventional materials, such as cement and coarse aggregates, without compromising material quality. Additional advantages include cost savings in production, reduction in carbon emissions, and improved efficiency in construction materials. In conclusion, the utilization of recycled plastics presents a sustainable solution for addressing plastic waste while supporting environmentally friendly infrastructure development. However, successful implementation requires the development of material standards, more efficient processing technologies, and collaboration among governments, industries, and communities. Further research is needed to optimize performance, evaluate long-term environmental impacts, and ensure the widespread application of this technology.

Keywords: Construction, Infrastructure, Plastic waste, Recycling.

INTRODUCTION

Plastic has become an indispensable part of daily life. Initially introduced as a substitute for organic materials to enhance product durability, plastic is now widely utilized due to its flexibility and resilience. Advances in plastic processing technology have further expanded its applications across various industries, underscoring the critical role of this material in modern life (Arwini, 2022).

The escalating volume of plastic waste has emerged as a global challenge with significant repercussions for terrestrial and marine ecosystems. Research conducted by the Indonesian Institute of Sciences (LIPI) revealed that during the COVID-19 pandemic, plastic waste volume increased by 96%, paralleling a 62% surge in online shopping activities. A substantial portion of this waste originated from food delivery services, which contributed 47% of the total increase. This trend has led to a rise in household waste, including food packaging, bubble wrap, and used face masks. According to data from the Indonesian Plastic Industry Association (Inaplas) and the Central Statistics Agency (BPS), Indonesia generates approximately 64 million tons of plastic waste annually, with 3.2 million tons ending up in the ocean. This waste contaminates soil and water and fragments into microplastics (<5 mm), posing significant risks to aquatic biota (Arbintarso *et al.*, 2022).

The growing accumulation of plastic waste presents an increasingly urgent issue, particularly due to its non-biodegradable nature and annual growth. Data from *ScienceMag* indicate that global

plastic waste production surged dramatically from 2 million tons in 1950 to 381 million tons in 2015, representing an over 190-fold increase. A 2016 World Bank report estimated that plastic waste constituted approximately 12% of total environmental pollution, with projections suggesting a 70% increase by 2050. This escalation is driven by rapid population growth and high consumption levels in sectors such as culinary and technology industries, which contribute significantly to plastic waste generation. The consequences include environmental contamination of terrestrial and aquatic ecosystems, clogged waterways leading to flooding, and plastic waste serving as a vector for disease transmission. Furthermore, low public awareness regarding proper waste disposal exacerbates this situation (Hakim, 2019).

Indonesia ranks as the second-largest contributor to plastic waste in aquatic environments globally, producing approximately 187.2 million tons annually. A significant source of this plastic waste originates from the retail sector, where around 10.95 million plastic bags are generated by 100 stores belonging to the Indonesian Retail Entrepreneurs Association (APRINDO), covering an area equivalent to 65.7 hectares. The increasing volume of plastic waste has profound environmental impacts, necessitating urgent attention to mitigate its adverse effects (Nirmalasari *et al.*, 2021).

Waste management encompasses reduction efforts through restrictions, recycling, and reuse, as well as handling processes, including sorting, collection, transportation, treatment, and final processing. Article 28H, paragraph (1) of the 1945 Indonesian Constitution guarantees the right of every citizen to a clean and healthy environment, obligating the government to provide public services for waste management. Consequently, the government bears responsibility for waste management, although operational implementation may involve collaboration with private entities. Therefore, waste management must be conducted comprehensively and integrative, from collection to final processing (Hakim, 2019).

This study aims to explore the potential use of plastic waste in construction materials such as paving blocks, concrete, and asphalt mixtures. The primary focus is on practical and efficient applications of plastic waste, alongside an evaluation of the mechanical and physical properties of construction materials containing plastic waste, including flexibility, durability, and load resistance, to optimize their performance. Environmental impact is a key consideration, particularly in terms of reducing pollution in terrestrial and marine ecosystems and addressing waste accumulation. The study also seeks to address challenges related to consistency in quality and production costs, supporting the development of more sustainable and environmentally friendly infrastructure by converting plastic waste into valuable construction materials.

LITERATURE REVIEW

This research draws upon nine key journals that document the successful implementation of recycled plastic materials in the construction sector, as detailed within their findings. Only references that consistently demonstrate positive outcomes without encountering failures in construction processes have been included. This approach ensures that the literature analysis focuses on valid and relevant empirical evidence, providing a robust foundation for discussing the potential of recycled plastic as a sustainable material in infrastructure development. The selected journals highlight various applications, including paving blocks, concrete, bricks, road pavements, and soil stabilization, each offering practical solutions to the challenges posed by plastic waste. The details of these journals are presented as follows:

Table 1. Relevant research findings

No	Conclusions
1.	Research findings highlight the utilization of various types of plastic waste (LDPE, PET, and HDPE) for producing paving blocks, lightweight bricks, and biofuel as alternative energy sources. Testing results indicate a compressive strength of 8.2 MPa for paving blocks made with 75% plastic waste and biofuel with a density of 0.708 g/ml, suitable for industrial applications, despite lacking oxygen compounds (Kurniawidi <i>et al.</i> , 2021).
2.	According to the Indonesian National Standard (SNI 03-0349-1989), normal bricks from this study are classified as grade III, while those mixed with 5%-25% plastic fall into grade IV. In terms of water absorption, all samples, both normal and plastic-mixed, meet grade I standards with absorption rates below 25%. This indicates that adding plastic waste maintains absorption standards, although it reduces compressive strength (Padang <i>et al.</i> , 2024).
3.	This study examines the use of HDPE plastic waste as a substitute for coarse aggregates in concrete. Results show that concrete mixed with HDPE waste has a lower compressive strength compared to conventional concrete, with 11.08 MPa for a 20% HDPE mix and only 2.67 MPa for knot-shaped HDPE. Therefore, its use is more suitable for lightweight structural elements such as precast panels and ornaments (Rahmadiny <i>et al.</i> , 2019).
4.	Findings demonstrate that LDPE (Low-Density Polyethylene) exhibits the highest load resistance of up to 160,069.39 Pa compared to PP and LDPE+PP (50:50) blends. The type of plastic does not significantly affect density; instead, the percentage of adhesive determines density via calcium carbonate (CaCO ₃) content. The optimal composition is 70% LDPE + 30% adhesive, resulting in high load resistance and a density of 1.05 g/cm ³ , which is lighter than conventional bricks (Prakoso & Udjiana, 2020).
5.	Pen 60/70 asphalt meets specifications for asphalt concrete binder course (AC-BC) mixtures, with an optimal asphalt content (KAO) of 5.35% and the best optimal plastic content (KPO) of 3.30% at KAO + 0.5. Adding recycled plastic as an additive increases stability to 1481.83 kg with 90.34% durability. This mixture complies with field application specifications and can withstand traffic loads (Fitri <i>et al.</i> , 2018).
6.	Domestic waste bricks are produced using a simple "Lego method" with three treatments and four repetitions. The best results are achieved from mixtures with the least amount of domestic waste. This process provides an alternative brick solution that efficiently utilizes waste (Nasihah <i>et al.</i> , 2020).
7.	□ The best compressive strength of plastic bricks is obtained with a P50/B50 mixture (50% recycled PET plastic and 50% clay brick waste), while the lowest water absorption is found in the P90/B10 mixture (90% plastic and 10% clay waste). All variations are free from harmful salts and exhibit good physical properties, although minor cracks occur due to imperfect cooling. These findings indicate the potential of plastic bricks as an eco-friendly construction alternative (Anis & Arnandha, 2018).

- Banjarmasin's soft clay soil has a moisture content of 21.82%, a liquid limit of 39.77%, a plastic limit of 18.82%, and a plasticity index of 18.11%. Adding PET waste measuring 2.0 cm x 2.0 cm with a 3% mixture achieves the
8. highest unconfined compressive strength of 1.366 kg/cm², enhancing soil cohesion but reducing the shear angle (ϕ). These results demonstrate the positive impact of PET waste on improving the mechanical properties of soft clay soil (Muzaidi *et al.*, 2022).
The use of plastic waste in construction addresses solid waste issues, reduces the exploitation of raw materials, and supports the circular economy. Plastic waste can serve as an alternative binder, aggregate, and fiber in
 9. composite materials with acceptable performance, while also creating new income opportunities. Despite limitations, continuous research and evolving regulations are expected to drive broader adoption of plastic waste in construction (Awoyera & Adesina, 2020).
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Research on melting plastic to create construction blocks or panels offers an innovative solution to reducing plastic waste while enhancing material efficiency in the construction sector. One application involves producing paving blocks made from up to 75% recycled plastic combined with roof tile waste. These products achieve an average compressive strength of 11.5 MPa, meeting the SNI 03-0691-1996 standard for class D concrete. Plastic acts as a substitute for cement and serves as the primary adhesive, with soaking and drying processes ensuring material strength that complies with standards (Kurniawidi *et al.*, 2021).

The utilization of HDPE (High-Density Polyethylene) plastic waste as a partial substitute for fine aggregates in concrete blocks aims to reduce plastic waste's environmental impact and create eco-friendly construction materials. Research findings indicate that substituting HDPE up to 25% generally reduces the compressive strength of concrete blocks, with the most significant decline of 15.15% observed at 5% substitution. This reduction is attributed to the irregular shape of HDPE flakes, which weakens their adhesion with cement. Additionally, HDPE substitution increases water absorption rates by up to 79.37% at 5% substitution due to voids created by the HDPE flakes. Despite this, all HDPE-substituted blocks comply with grade I standards for water absorption (below 25%) and fall into grade IV for compressive strength per SNI 03-0349-1989. These findings highlight the potential of plastic in concrete applications while emphasizing the need for optimization to maintain structural quality (Padang *et al.*, 2024).

Further research explores the use of HDPE plastic waste as an alternative replacement for coarse aggregates in concrete. Results reveal that concrete mixed with HDPE waste exhibits reduced compressive strength compared to conventional concrete. For concrete containing 20% HDPE waste, the compressive strength reaches 11.08 MPa, while concrete with knot-shaped HDPE waste demonstrates an even lower strength of 2.67 MPa. However, heat treatment of the concrete up to 90°C improves compressive strength to 13.16 MPa. Due to its lower compressive strength, HDPE-based concrete is recommended for lightweight structural elements such as precast panels, concrete frames, cladding, or ornaments, rather than for primary structural components (Rahmadiny *et al.*, 2019).

In addition to HDPE, the utilization of LDPE (Low-Density Polyethylene) and PP (Polypropylene) plastic waste as construction materials has been explored through plastic extrusion methods, enhanced with calcium carbonate (CaCO₃) and rubber waste to improve durability.

Research findings indicate that LDPE outperforms both PP and their blends, achieving the highest compressive strength of 160,069.39 Pa with a composition of 70% LDPE and 30% adhesive. Additionally, its density of 1.052607 g/cm³ is lighter compared to standard concrete blocks (2.2–2.4 g/cm³). LDPE has proven to be more effective as a construction material due to its superior load-bearing capacity, while PP demonstrates limitations in strength and efficacy. Furthermore, selecting plastic materials that have not undergone more than two recycling processes is recommended to maintain the quality of the resulting construction materials (Prakoso & Udjiana, 2020).

The use of plastic waste in road construction has also been shown to enhance pavement material quality while addressing environmental issues. Recycled plastic can be melted into construction blocks or panels capable of withstanding extreme conditions. In AC-WC (Asphalt Concrete–Wearing Course) mixes, the addition of PVC (Polyvinyl Chloride) plastic at 2-6% improves the residual stability of the mixture, although stability declines when the plastic content exceeds 6%. Similarly, adding recycled plastic to 60/70 penetration asphalt at 0.5-2% of asphalt weight significantly improves road material quality (Fitri *et al.*, 2018).



Source: dw.com/L. Galuh



Source: Antara Foto/M Risyal
Hidayat/Spt.



Source:
kumparan.com/Dok. PUPR

Figure 1. Left to right: Paving block with plastic waste mixture, crushed plastic bottle waste, plastic asphalt at the Tangerang-Merak rest area.

One study shows that plastic waste can be processed into environmentally friendly bricks using a simple method and a lego-like shape (can be assembled). This process uses a composition of sand, cement, and plastic, which is varied to optimize product quality. The research results indicate that samples with a lower proportion of plastic exhibit the best compressive strength, reaching up to 11.5 kg, and are lighter in weight. This innovation has great potential to support infrastructure development in rural areas of Indonesia, particularly in utilizing domestic waste to produce sustainable construction materials (Nasihah *et al.*, 2020).

Another study developed technology for utilizing recycled PET (Polyethylene Terephthalate) plastic for brick production. A mixture of PET and clay brick waste in a 50:50 ratio resulted in the highest compressive strength of 17.049 MPa, surpassing the SNI 15-2094-2000 class 150 standard. The lowest water absorption was found in the mixture of 90% PET and 10% clay, with a value of 0.686 gr/dm²/min. This research shows the great potential of using plastic for construction efficiency, although challenges such as burning temperature stability and gas emissions need to be addressed to ensure sustainability (Anis & Arnandha, 2018).

In addition to brick production, PET plastic can also be used to improve the mechanical properties of soft clay, such as in the Banjarmasin area, which often faces this issue in road construction. The addition of 3% PET plastic pieces to soft clay increased the unconfined compressive strength to 1.366 kg/cm², compared to 0.976 kg/cm² in clay without the mixture. The study also noted that larger plastic pieces could improve the soil's load-bearing capacity. With this

utilization, soil stabilization using plastic waste not only provides a sustainable solution for infrastructure development in problematic areas but also helps reduce environmental pollution caused by plastic waste (Muzaidi *et al.*, 2022).



Source: krjogja.com/Agusigit



Source: Liputan6.com/Harun Mahbub

Figure 2. Left to Right: paving blocks mixed with plastic waste, crushed plastic bottle waste.

A study highlights the significant potential of certain types of plastic waste, including High-Density Polyethylene (HDPE), Low-Density Polyethylene (LDPE), Polyethylene Terephthalate (PET), and Polypropylene (PP), in supporting sustainable construction applications. HDPE waste is often used as an aggregate in concrete or asphalt mixtures, while the flexible nature of LDPE makes it suitable for manufacturing bricks and blocks. Although PET has limited potential for recycling into new plastics, it has been utilized as a fiber reinforcement in concrete and as an insulation material with enhanced thermal properties. Meanwhile, PP has shown promising results as a substitute for traditional aggregates in cement mixtures, contributing to reduced material weight and lower consumption of natural resources (Awoyera & Adesina, 2020).

Table 2. Categories of plastic waste utilization

Types of Plastic	Potential Construction Applications
HDPE	Concrete or asphalt
LDPE	Bricks or blocks
PET	Cement-based mixtures
PP	Replacement for traditional aggregates in cement-based mixtures

RESEARCH METHOD

This study employs a descriptive qualitative methodology with a literature review approach to analyze the utilization of plastic waste in the construction sector as an effort to support sustainable infrastructure. Secondary data were gathered from various academic sources, including scientific journals, articles, and relevant research reports, using keywords such as plastic waste, recycling, construction, sustainable infrastructure, and innovative technologies. The literature collection process was systematically conducted via searches on Google Scholar. Based on the selection process, nine representative journals were included in this article, providing diverse perspectives and research findings on technological innovations in plastic waste utilization.

Through literature analysis, this study focuses on understanding how these technologies can reduce plastic waste and dependence on natural raw materials. Previous research findings indicate that recycled plastics, such as HDPE and LDPE, can partially replace aggregates in concrete or asphalt, potentially enhancing the mechanical properties of these materials. This research aims to

provide a more comprehensive understanding of the use of recycled plastics in construction and the necessary steps to optimize their industrial application.

Additionally, a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) was employed to categorize and assess the factors influencing overall performance by mapping internal strengths and weaknesses alongside external opportunities and threats. The detailed analysis is as follows:

Table 3. SWOT analysis assessment rubric

	Strengths	Weakness
Threats	ST Leveraging strengths to address threats	WT Minimizing weaknesses to mitigate threats
Opportunities	SO Utilizing strengths to seize opportunities	WO Overcoming weaknesses to capitalize on opportunities

RESULTS AND DISCUSSION

The management of plastic waste has become one of the major challenges in efforts to create a more sustainable environment. Innovations in the construction sector offer solutions by utilizing recycled plastics as substitutes or additives in building materials. In addition to reducing the volume of plastic waste, this approach supports the development of cost-effective and highly efficient eco-friendly infrastructure. Below are several findings related to the use of plastic waste in the construction field:

1. Paving Blocks Made from Recycled Plastic Mixture

The use of paving blocks made from up to 75% recycled plastic, with the addition of crushed roof tile waste, can achieve an average compressive strength of 11.5 MPa, which meets the quality standards of SNI 03-0691-1996 for class D concrete. Plastic, serving as a substitute for cement, makes these paving blocks environmentally friendly (Kurniawidi *et al.*, 2021). This demonstrates the potential of utilizing plastic waste not only as an environmental solution but also as an economic value-added opportunity and an efficient, sustainable alternative construction material.

2. Concrete with HDPE Plastic Waste Mixture

The utilization of HDPE plastic waste as a partial substitute for fine aggregates in concrete blocks aims to reduce plastic waste and create environmentally friendly construction materials. Substituting up to 25% HDPE reduces the compressive strength of the blocks, with the greatest decrease of 15.15% observed at a 5% substitution, due to the irregularity of HDPE particles. Additionally, HDPE substitution increases water absorption by up to 79.37% due to the formation of voids from the plastic particles. Although it meets Class I standards for water absorption, the

blocks with HDPE only achieve Class IV for compressive strength based on SNI 03-0349-1989 (Padang *et al.*, 2024).

Another study examined HDPE plastic waste as an alternative coarse aggregate in concrete. The results indicated that concrete with HDPE waste showed a reduction in compressive strength compared to conventional concrete. Concrete with 20% HDPE waste had a compressive strength of 11.08 MPa, while concrete with HDPE waste in the form of pellets had a significantly lower compressive strength of only 2.67 MPa. However, heat treatment of the concrete at temperatures up to 90°C increased the compressive strength to 13.16 MPa. Due to its lower compressive strength, concrete made with HDPE waste is recommended for lightweight structural elements such as precast panels, concrete frames, cladding, or ornaments, rather than for primary structural elements (Rahmadiny *et al.*, 2019).

3. Construction Materials from LDPE and PP Plastic Waste

This study examines the use of LDPE and PP plastic waste as construction materials through a plastic extrusion method, with the addition of calcium carbonate and rubber waste. The results indicate that LDPE outperforms PP, with the highest compressive strength of 160,069.39 Pa at a composition of 70% LDPE and 30% binder, along with a lighter density of 1.052607 g/cm³ compared to conventional concrete blocks. LDPE is more effective in bearing loads, while PP is limited in terms of strength and efficiency. The use of LDPE also results in construction materials with better performance. It is recommended to use plastic that has not been recycled more than twice to maintain material quality (Prakoso & Udjiana, 2020). These findings highlight the significant potential of LDPE as an environmentally friendly construction material.

4. Pavement with Recycled Plastic Mixture

In hot asphalt concrete (AC-WC) mixtures, the addition of PVC plastic waste ranging from 2% to 6% enhances the stability of the mixture. However, plastic content above 6% results in a decrease in stability. Furthermore, the mixture of penetration-grade asphalt 60/70 with the addition of 0.5% to 2% plastic increases the material's resistance to extreme environmental conditions (Fitri *et al.*, 2018). This indicates that incorporating plastic waste in asphalt mixtures can improve the quality of paving materials while addressing environmental issues.

5. Plastic Waste Mixture for Bricks

Using a simple method such as the Lego method, plastic waste-based bricks were tested with varying material compositions. The results showed that samples with a lower proportion of plastic exhibited the best compressive strength (up to 11.5 kg) and lighter weight (Nasihah *et al.*, 2020). This application not only reduces plastic waste but also creates environmentally friendly construction materials suitable for village infrastructure.

6. PET Plastic Waste Mixture for Bricks

The study shows that the utilization of recycled PET (Polyethylene Terephthalate) plastic as a mixture for brick production, with a composition of 50% PET and 50% clay brick waste, results in a compressive strength of 17.049 MPa, surpassing the SNI standards. The P90/B10 mixture exhibits the lowest water absorption rate, at 0.686 gr/dm²/minute (Anis & Arnandha, 2018). These findings demonstrate the significant potential of recycled plastic in enhancing the efficiency of construction materials, although sustainability challenges, such as the need for stable temperatures and the impact of emissions, must still be addressed.

7. PET Plastic Waste Mixture to Enhance the Mechanical Properties of Soft Clay Soil

The use of PET plastic can also be applied to improve the mechanical properties of soft clay soil, as in Banjarmasin, enhancing the soil's load-bearing capacity for road construction. The

addition of 3% PET fragments to the clay soil increases the unconfined compressive strength from 0.976 kg/cm² to 1.366 kg/cm². Larger PET fragment sizes further enhance the soil's load-bearing capacity. This application provides a sustainable solution for infrastructure development and helps reduce plastic waste pollution (Muzaidi *et al.*, 2022).

Tabel 4. SWOT analysis of the use of plastic waste for infrastructure

Factors	Descriptions
Strengths	• Reducing the volume of plastic waste significantly. • Saving raw materials and reducing construction costs. • Supporting environmental policies and sustainable development.
Weaknesses	• There is still a lack of standards and regulations governing the quality of plastic waste-based materials. • Complex processing technologies and supporting infrastructure are required. • Challenges in ensuring the stability and quality of recycled materials. • Resistance from the industry to changes in materials and new technologies.
Opportunities	• Potential for new research and innovation to maximize the use of plastic waste. • Opportunities to create new industries for processing plastic waste for construction. • Potential for collaboration with the government sector in plastic waste management programs to support the use of environmentally friendly materials.
Threats	• Competition from conventional materials that are more widely accepted by the industry. • Potential policy changes that could hinder adoption. • Barriers in technical standards and certification affecting market confidence in recycled materials. • Global economic uncertainty that may impact investment in plastic-based construction material innovations.

The utilization of recycled plastic in the construction sector not only offers an innovative solution to reduce plastic waste that pollutes the environment, but also opens up significant opportunities to support sustainable infrastructure development. This study demonstrates that plastic waste can be processed into construction materials such as paving blocks, concrete, bricks, and others, with quality that meets certain standards. However, the successful implementation of this requires adequate regulatory support, the development of more efficient processing technologies, and cross-sector collaboration between the government, industry, and society. The author believes that with strategic approaches and continuous innovation, recycled plastic has the potential to become a key solution in addressing global environmental issues while driving the transformation toward a more environmentally friendly construction industry.

CONCLUSION

The growing issue of plastic waste drives the exploration of innovations to find more environmentally friendly solutions. This research demonstrates that recycled plastic can be used as a substitute for conventional materials such as cement and aggregates in construction products, including paving blocks, concrete, bricks, road pavements, and others. This solution can help reduce plastic waste and provide long-term economic benefits due to its cost-effectiveness. However, challenges remain, such as material quality consistency, the lack of supporting regulations, and resistance from the industry to adopt these innovations.

Looking forward, researchers must focus on improving the quality and durability of recycled plastic-based materials to better meet the needs of construction. Additionally, it is important to consider the future impact on the development of more affordable and easily applicable technologies. With support from various stakeholders such as the government, society, and industry, recycled plastic has a great potential to help create more environmentally friendly infrastructure while reducing pollution. The author believes that this innovation will bring about significant change in addressing plastic waste issues while supporting more sustainable development.

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This research does, of course, have limitations. Therefore, the authors are open to suggestions and constructive criticism for the improvement of future research. It is hoped that this research can provide benefits to various parties.

REFERENCES

- Agusigit. (2024). *Batako Lego Kreasi Warga Bumijo Solusi Mengurangi Sampah Plastik*. Wwww.Krjogja.Com. <https://www.krjogja.com/brivolution/1244590538/batako-lego-kreasi-warga-bumijo-solusi-mengurangi-sampah-plastik>
- Arbintarso, E. S., & Nurnawati, E. K. (2022). Peranan Keluarga dalam Upaya Meningkatkan Kualitas Lingkungan melalui Daur Ulang Limbah Plastik Rumah Tangga. *Jurnal Berdaya Mandiri*, 4(3), 300–318. <https://www.google.com/maps/place/Trukan,+Piyono,+Ngombol,+Purworejo>
- Awoyera, P. O., & Adesina, A. (2020). Plastic wastes to construction products: Status, limitations and future perspective. *Case Studies in Construction Materials*, 12, e00330. <https://doi.org/10.1016/j.cscm.2020.e00330>
- Decy Arwini, N. P. (2022). Sampah Plastik Dan Upaya Pengurangan Timbulan Sampah Plastik. *Jurnal Ilmiah Vastuwidya*, 5(1), 72–82. <https://doi.org/10.47532/jiv.v5i1.412>

- Dian W. Kurniawidi, Teguh Ardianto, Syamsuddin, Siti Alaa', Amrul Ikhsan, & Susi Rahayu. (2021). Pemilahan Sampah Plastik Untuk Mendukung Program Zero Waste Pada Pusat Daur Ulang Sampah Bajang Peripih Doro, Pringgarata, Lombok Tengah Tahun 2021. *Jurnal Pengabdian Magister Pendidikan IPA*, 4(4), 402–409. <https://doi.org/10.29303/jpmipi.v4i4.1159>
- Fitri, S., Saleh, S. M., & Isya, M. (2018). Pengaruh Penambahan Limbah Plastik Kresek Sebagai Substitusi Aspal Pen 60/70 Terhadap Karakteristik Campuran Laston Ac – Bc. *Jurnal Teknik Sipil*, 1(3), 737–748. <https://doi.org/10.24815/jts.v1i3.10034>
- Galuh, L. (2022). *Olah Sampah Plastik Menjadi Paving Block di Bandung*. Dw.Com. <https://www.dw.com/id/olah-sampah-plastik-menjadi-paving-block-demi-lingkungan/a-62399104>
- Hakim, M. Z. (2019). Pengelolaan dan Pengendalian Sampah Plastik Berwawasan Lingkungan. *Amanna Gappa*, 27(2), 111–121.
- Harun Mahbub. (2016). *Daur Ulang Botol Bekas di Tepi Cisadane*. Wwww.Liputan6.Com. <https://www.liputan6.com/regional/read/2441829/daur-ulang-botol-bekas-di-tepi-cisadane>
- Hidayat, M. R. (2024). *Pabrik daur ulang Polyethylene Terephthalate di Samarinda*. <https://www.antarafoto.com/id/view/2379373/pabrik-daur-ulang-polyethylene-terephthalate-di-samarinda>
- Kumparansains. (2019). *Infrastruktur dari Plastik Kini Bukan Wacana Semata*. Kumparan.Com. <https://kumparan.com/kumparansains/infrastruktur-dari-plastik-kini-bukan-wacana-semata-1s8rdH9N1sw/3>
- Muzaidi, I., Anggarini, E., & Pradhitya Hardiani, D. (2022). Solidifikasi Struktur Tanah Lempung Lunak Banjarmasin Dengan Limbah Plastik Pet (Polyethylene Terephthalate). *Extrapolasi*, 19(01), 1–8. <https://doi.org/10.30996/ep.v19i01.5520>
- Nirmalasari, R., Ari Khomsani, A., Nur'aini Rahayu, D., Lidia, L., Rahayu, M., Anwar, M. R., Syahrudin, M., Jennah, R., Syafiyah, S., Suriadi, S., & Setiawan, Y. (2021). Pemanfaatan Limbah Sampah Plastik Menggunakan Metode Ecobrick Di Desa Luwuk Kanan. *Jurnal Solma*, 10(3), 469–477. <https://doi.org/10.22236/Solma.V10i3.7905>
- Padang Et al., 2024. (2024). *Pemanfaatan Limbah Plastik Hdpe Sebagai Substitusi Parsial Agregat Halus Terhadap Sifat Mekanis Campuran Batako*.
- Prakoso, P., & Udjiana, S. S. (2023). Pembuatan Dan Karakterisasi Material Kontruksi Dari Limbah Plastik Ldpe (Low Density Polyethylene) Dan Pp (Polypropylene) Dengan Penambahan Kalsium Karbonat (Caco3). *Distilat: Jurnal Teknologi Separasi*, 6(2), 439–444. <https://doi.org/10.33795/Distilat.V6i2.152>
- Rahmadiny Et al. (2019). Penggunaan Material Limbah High Density Polyethylene (Hdpe) Sebagai Bahan Pengganti Agregat Kasar Pada Campuran Beton. *Widyakala Journal*, 6, 6. <https://doi.org/10.36262/Widyakala.V6i0.161>
- Rakhmawati Anis & Arnandha Yudhi. (2018). Studi Pembuatan Batu Bata Dari Plastik Daur Ulang Pet Dan Limbah Bata Tanah Liat. *Prosiding Satif*, 535–540.
- Varella, M., & Nasihah, M. (2020). Peningkatan Infrastruktur Desa Melalui Pemanfaatan Limbah Domestik Sebagai Campuran Batu Bata. *Jurnal Envscience*, 4(1), 40. <https://doi.org/10.30736/4ijev.v4iss1.128>