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The Effect of Linear Low-Density Polyethylene and Palm Kernel Shell Ash Mixture on the Physical, Mechanical and Degradation Properties of Paving Blocks

Chasri Nurhayati*, Nesi Susilawati, Tri Susanto, Winda Marthalia. Aditya Krisna Nugroho & Ahmad Paisan Pane

Palembang Institute for Industrial Research and Standardization,
Ministry of Industry of The Republic of Indonesia, Jalan Perindustrian II No 12,
Palembang 30152, Indonesia
*E-mail: chasrinurhayati25@gmail.com

Highlights:

- Palm kernel shell ash (PKSA) is an alternative filler for paving blocks.
- Composite of recycled LLDPE and PKSA is suitable to produce durable paving blocks.
- Best composition for LLDPE-PKSA paving blocks with high resistance to biodegradation in a natural environment.

Abstract: The aim of this research was to evaluate the physical-mechanical parameters of paving stones obtained on the basis of the mixture of linear low-density polyethylene (LLDPE) and palm kernel shell ash (PKSA) waste. The ratio of LLDPE to PKSA waste (% weight) was varied in five treatments: A_0 (100:0), A_1 (97.5:2.5), A_2 (95:5), A_3 (92.5:7.5), A_4 (90:10) and A_5 (87.5:12.5). The physical appearance, thickness, compressive strength, water absorption, and morphological characteristics of the paving blocks were observed. The blocks were observed at ambient temperature, exposed to sunlight, and placed on the ground surface on day 0 and day 365. The results showed that addition of PKSA waste decreased the compressive strength but increased the water absorption capacity without a significant effect on the thickness of the paving blocks. Observation after 365 days showed insignificant decreases of compressive strength and thickness, whereas the water absorption capacity increased slightly. Small cracks and more voids in the surface, and more brittleness were observed. To summarize, composites of LLDPE and PSKA as filler have physical-mechanical properties that can be used for road pavement blocks.

Keywords: *linear low-density polyethylene*; *palm kernel shell ash; paving block; physical-mechanical properties; recycled LLDPE.*

1 Introduction

About 140 million tons of synthetic polymers are produced every year, while the utilization of polyethylene annually increases by about 12% [1]. The amount of synthetic plastic waste produced globally in 2015 almost reached 6300 metric

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tons. Only 9% of plastic waste is recycled, 12% burned, and 79% is left in nature as solid waste. The waste contributes to global greenhouse gas (GHG) emissions at about 3 to 5% weight [2]. The polyethylene polymers in plastic waste and micro plastics need a very long time to degrade, so they are accumulated as pollution in water and soil [1]. For instance, the developing country Ghana produces 22.000 tons plastic every year of which only 2% is recycled [3]. In Malaysia, plastics constitute 13.2% of municipal solid waste [4]. Meanwhile, Indonesia ranks at the second worst position in the world (after China), producing 187.2 million tons of plastic waste in water and 10.95 million plastic bags as waste per year [5]. It can be stated that in Indonesia plastic waste is a huge problem that is not well managed.

Plastic waste and organic waste come from households, social facilities, markets, roads, shops, offices, and other business places [6]. The consumption of plastics has proliferated due to several advantageous properties such as good corrosion resistance, durability, and good insulation. They are also cheap and easy to make [7]. Plastic waste occurs in the form of 46% polyethylene (LDPE and HDPE), 16% polystyrene (PS), 16% polypropylene (PP), 7% polyvinyl chloride (PVC), 5% acrylonitrile-butadiene-styrene (ABS), 5% polyethylene terephthalate (PET) and 5% other polymers [8]. As with other types of plastic, LDPE and HDPE cause environmental pollution due to the very long time it takes to degrade the polymers [1].

LDPE is a polymer made of the long-chain monomer ethylene [9]. Global LDPE production increases at 12% per year, and about 140 million tons of synthetic polymers are produced annually. One type of LDPE has excellent durability and elasticity, which makes it useful for packaging [10, i.e., LLDPE, which is used to produce plastic bags, notably bags that are affordable and durable. LLDPE, with 0.90-0.94 g/cm^3 density, is a resin consisting of molecules with a linear polyethylene backbone attached randomly by short alkyl groups [11]. LLDPE products have a clear and shiny appearance.

A huge amount of plastic waste has to be recycled or reused to reduce the environmental impact and minimize pollution. Landfilling is not an effective way to manage plastic waste since it results in pollution in the form of micro plastics and burning can cause air pollution [12]. Bearing in mind some physical properties of LLDPE, making paving blocks from LLDPE composites may be a good way to recycle this type of plastic waste. Paving blocks are a building material used as the top layer of road structures instead of asphalt or concrete. In general, paving blocks are used for urban roads because paving blocks are environmentally friendly and can absorb rainwater so that surface run-off is reduced. Data shows that 50% of sidewalks with a width of 2 meters in cities are built using paving blocks [13].

Indonesia has a large number of palm oil plantations, which produce kernel palm oil waste. Generally, the kernel is used as charcoal in the boiler system. The ashes of the kernel are used as landfill and fertilizer filler. Limited research has been done on the usage of palm kernel shell ashes (PKSA) after being composited into a polymer matrix as filler. Previous research has reported that rice husk ash was successfully composited with recycled polyethylene to improve its physical-mechanical properties [14]. Burhanuddin, *et al.* [15] used mineral bottles, plastic bags and bottle caps among others, for making plastic paving blocks, which resulted in a compressive strength of approximately 4.66-9.43 MPa. Paving blocks made from PET plastic waste composited with 0, 25 and 50 %-weight sand resulted in a compressive strength of 15.623 MPa according to Zulkarnain [16]. Krasna, *et al.* [17] used PET waste, cement and fine aggregates to make class C paving blocks, with a cement:fine aggregate:coarse aggregate (PET) ratio of 1:6:4, which resulted in a compressive strength of 144.5 kg/cm^2 for the specimen with code PB2 (25% PET).

Agyeman, *et al.* [3] made low plastic composite paving blocks (with a mixture ratio of 1:1:2) and high plastic composite paving blocks (with a mixture ratio of 1:0.5:1). After 21 days they had a compressive strength of 8.53 N/mm^2 (water absorption = 0.5%) and 7.31 N/mm^2 (water absorption = 2.7%), respectively, higher than the control value of 6.07 N/mm^2 (water absorption = 4.9%) of concrete paving blocks (cement:mine dust:sand = 1:1:2). Alaloul, *et al.* [4] made interlocking bricks from shredded and grinded plastic bottles mixed with polyurethane (PU) and polymer, resulting in a good compressive strength for use in masonry walls without load of 5.3 MPa for the sample with PET:PU at a ratio of 60:40.

Bearing in mind the potential of using LLDPE and PKSA composites in order to reduce plastic waste, the literature on the effect of using LLDPE and PKSA composites in paving blocks is limited. Therefore, the present research investigated the physical-mechanical properties and biodegradation characteristics of pavement blocks made of LLDPE and PKSA. The results may be practically useful for recycled plastic waste industries.

2 Experimental Method

2.1 Material

The materials used in this research were LLDPE plastic from household waste and PKSA from boiler burning of a crumb rubber factory, PT. Hevea MK 1 Palembang, South Sumatra, Indonesia. The content of moisture and SiO_2 of the PKSA were determined before use.

2.2 Method

The plastic waste used was restricted to LLDPE plastic. LLDPE in the form of sheets was washed with water to remove dirt and then dried. The dried sheets were placed in a furnace. The PKSA waste was burned at a temperature of 150 °C [18], and then sieved using a 150-mesh size screen. The LDPE sheets and PKSA were mixed together and stirred with compositions according to the research design. The research composition of LLDPE and PKSA was varied by percentage weight/weight (LLDPE:PKSA), i.e., A_0 (100:0); A_1 (97.5:2.5); A_2 (95:5); A_3 (92.5:7.5); A_4 (90:10); and A_5 (87.5: 12.5). After it was made into chunks, the mixture of LLDPE plastic waste and PKSA was processed using a reactor furnace at a temperature of 150 °C for 15 minutes, with a total weight of 2000 g [12,6]. After mixing and pouring into a metal hexagonal mold of about 10 x 20 x 6 cm (length x width x thickness), the mixture was pressed by using a hydraulic machine at 200 kg/cm^2 for 5 minutes. Before testing, the paving block product was soaked in water for 8 minutes. The physical appearance of the paving blocks was observed on day 0 and day 365. Visually, using a magnifying glass; the thickness was measured by using digital caliper equipment; the compressive strength was measured using a Universal Tensile Machine (Tensilon); the absorbance was measured according to ASTM D570-95; and a surface morphological characteristics test was done using SEM (JEOL 330) and XRD (Shimadzu model X-RD 6000). The paving blocks were left on the ground surface for 365 days, after which the products were observed.

3 Results and Discussion

3.1 Properties of the Raw Material

The test results of the PKSA raw material were: moisture 20.70% and SiO_2 34.37%. Awal and Hussin [19] found that PKSA contains silicon dioxide (SiO_2) 43.60%, aluminum oxide (Al_20_3) 11.40%, ferric oxide (Fe_2O_3) 4.70%, calcium oxide (CaO) 8.40%, magnesium oxide (MgO) 4.80%, and sulfur trioxide (SO_3) 2.80%. The SiO_2 content of the PKSA raw material used was not much different from the SiO_2 content from the tests conducted by Awal and Hussin. With this SiO_2 content, PKSA can strengthen paving blocks.

3.2 Paving Blocks

3.2.1 Physical Appearance

The physical appearance of the paving blocks on day 0 and day 365 is shown in Figures 1 and 2.

Figure 1 Plastic paving blocks on day 0.

Figure 2 Plastic paving blocks on day 365.

The LLDPE and PKSA paving blocks had a smooth surface and were not brittle on day 0. Table 1 shows the physical surface appearance of the mixtures with different compositions of LLDPE and PKSA as filler. After 365 days, the surface had become rough with more voids, more cracks and more brittleness. The LLDPE had higher elasticity with addition of PKSA filler, and its physical performance improved. After 365 days the paving blocks were rougher, had cavities and more cracks on the surface, and were more fragile because of the degradation by bacteria/microorganisms and air/ozone exposure [20,21].

The oxidation process caused surface cracking and brittleness in Refs. [22,6]. This was confirmed by the result of the present research. When the surface of the plastic paving block oxidizes, it causes cracking and brittleness due to the lack of antioxidants in the composite [23,22]. In addition, the process and dispersion capability of the filler within the LLDPE matrix may not be very good, so that surface attacks cannot be impeded. This result is supported by Suharty [21], who studied paving blocks with a composition of polypropylene waste:acrylic acid:rice husk powder (7:0:3), which were stored for 4 months in the ground at normal air temperature. This treatment reduced the weight of the paving blocks by 12%.

Table 1 Physical surface appearance of composites of LLDPE/PKSA.

LLDPE:PKSA (w/w) %	0 Days Degradation	365 Days Degradation
A_0 (100:0)	Smooth surface, no cracks	Slightly rough surface with a few voids and brittle
A_1 (97.5:2.5)	Smooth surface, no cracks	Rough surface with voids, more cracks and more brittleness
A_2 (95:5)	Smooth surface, no cracks	Rough surface with voids, more cracks and more brittleness
A_3 (92.5:7.5)	Smooth surface, no cracks	Rough surface with voids, more cracks and more brittleness
A_4 (90:10)	Smooth surface, no cracks	Rough surface with voids, more cracks and more brittleness
A_5 (87.5:12.5)	Smooth surface, no cracks	Rough surface with voids, more cracks and more brittleness

According to SNI 03-0691-1996 'Paving Block' [24], the corners of quality A-D road paving blocks, should not be easily crumbled off with the strength of the fingers, the shape must be perfect, i.e., not cracked or deformed. The results of treatments A_0, A_1, A_2, A_3, A_4, and A_5 at 0 day met the SNI standard (Table 1), but the results after treatments A_0, A_1, A_2, A_3, A_4, and A_5 for 365 days showed a decrease in quality in the form of voids and cracks on the surface.

3.2.2 Thickness

The graph of thickness degradation of the LLDPE:PKSA composite from 0 day to day 365 is shown in Figure 3.

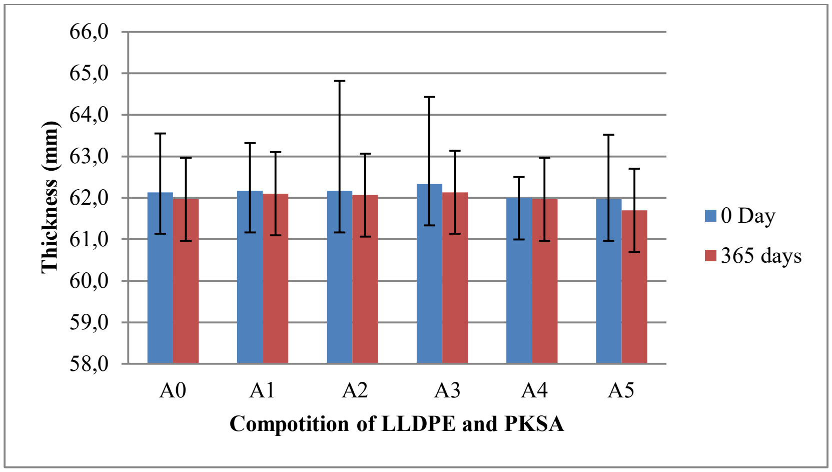

Figure 3 Thickness degradation of LLDPE:PKSA composites from day 0 to day 365 .

Based on the graph above, it can be determined that the product's thickness did not change significantly among all combinations. This result is consistent with Ref. [14], which states that the thickness of the paving blocks was not significantly altered after treatment. The paving block product was replaced with a metal mold of about 10 x 20 x 6 cm (length x width x thickness), a hexagonal shape (with an additional hexagonal engraving in the middle) and pressed at 200 kg/cm^2 with a hydraulic press for about 5 minutes, after which the product was soaked in water for 8 minutes before testing.

The test results for the thickness of the paving block ranged from 62.1 mm to 62.0 mm on day 0 and 62.0 mm to 61.7 mm on day 365. This means it did not change significantly despite undergoing degradation. PKSA as an additional material reduced the thickness of the composites, as can be seen in the results for treatments A_4 (90:10) and A_5 (87.5:12.5). It is known that the longer the degradation period, the greater the thickness reduction, especially for composites with higher PKSA content. The maximum thickness reduction was 0.48% (Figure 3). According to SNI 03-0691-1996 [24], the minimum thickness of concrete road paving blocks is 60 mm with a tolerance of 8%. Therefore, the results showed that the final thickness still met the SNI standard. Zusfahair *et al.* [26] used polyethylene thin plastic film made by dissolving ± 0.5 g of polyethylene in 15 ml of xylene solvent. They found that there was a reduction in yield strength after storage, which means that the weight of the plastic films was reduced by 2.33% over 30 days [26].

3.2.3 Water Absorption

Water absorption testing of the specimens was done by soaking them at room temperature for ±24 hours. After draining the remaining water for ±1 minute, the surface of the product was dried in order to reduce the remaining water. After that, the weight of the paving blocks was measured and they were put in oven at 105 °C and then underwent cooling at room temperature (ASTM D570-95). A graph of water absorption of the LLDPE:PKSA composites on day 0 and day 365 is shown in Figure 4.

For ground pavement and road construction application, the water absorption capacity is one of the key properties used to determine its utilizations and functions. Figure 4 illustrates the water absorption capacity of the LLDPE/PKSA composites and its degradation profile from day 0 to day 365. It can be seen that the highest water absorption (0.84%) was obtained for A5 (87.5:12.5) on day 0 and 2.14% on day 365. Meanwhile, the composite without PKSA (0%) had very low water absorption capacity: only 0.06% on day 0, and 0.34% on day 365. The results of Suharti [21], who made paving blocks with a composition of polypropylene waste:acrylic acid:rice husk powder (7:0:3) with addition of ash showed an increase of the water absorption capacity of the paving blocks by 4%. Meanwhile, Wicaksono [27] states that paving blocks with a ratio of plastic waste LDPE:PP:sand of 70:0:30 with the addition of 30% sand increased the water absorption by 0.033%.

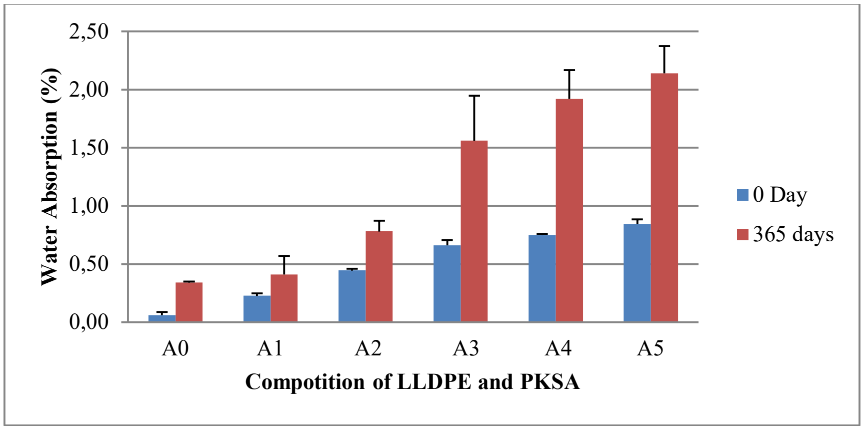

Figure 4 Water absorption of LLDPE and PKSA paving blocks.

LLDPE is waterproof and it does not dissolve in water at ambient temperature, so that LLDPE without filler is not suitable for building roads or pavements. However, LLDPE has high crystallinity and strong intermolecular attraction so that its mechanical strength is excellent [21,22,28]. In [24], the presence of LLDPE crystallinity influenced the treatment results so they could not meet the requirements of SNI 03-0691-1996 of at least 3% air absorption for quality A and 10% for quality D concrete bricks. However, the addition of PKSA increases air absorption. Hence, treatment A_5 (87.5:12.5) at 12.5% PKSA was the best combination. In addition to producing a high water absorption capacity, it also reduces palm kernel shell ash waste, by using it as filler/addition for paving blocks.

3.2.4 Compressive Strength

A graph for compressive strength degradation of LLDPE and PKSA paving blocks on day 0 and day 365 is shown in Figure 5. The highest compressive strength was found for treatment A_0 (100:0) and the lowest average strength was found for treatment A_5 (87.5:12.5) on day 0. Meanwhile, on day 365 the highest strength found was for treatment A_0 (100:0) while the lowest strength was found for treatment A_5 (87.5:12.5) (Figure 5). The addition of PKSA as filler reduces the compressive strength of paving blocks [13]. This is in line with the result of our paving block compressive strength test, where the addition of PKSA reduced the compressive strength from day 0 to day 365 (Figure 4). This is also supported by the results from Olale [18], who made paving blocks using LLDPE, sand, and kaolin waste. The addition of 8% kaolin reduced the compressive strength by 11 kg/cm^2. Furthermore, Oyetuji [13] made paving blocks with a composition of PP plastic waste and sand at 1:1, and melting point at 200 °C, which resulted in a compressive strength of 415 kg/cm^2.

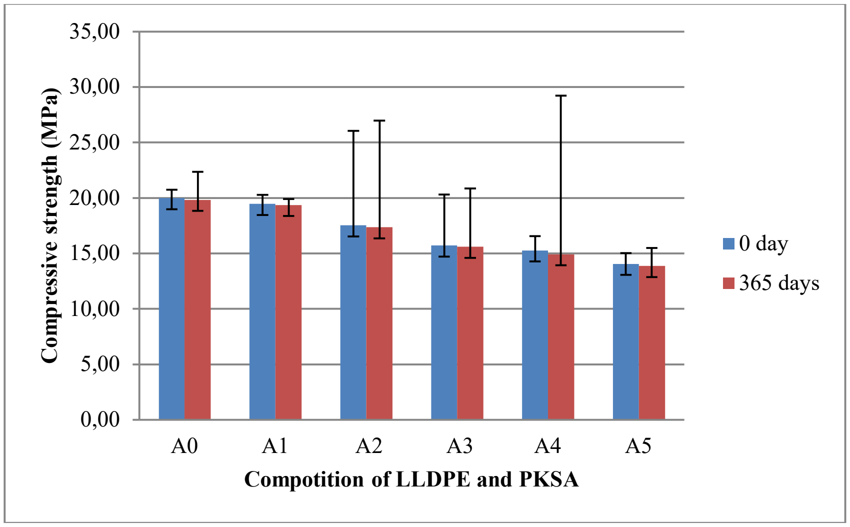

Figure 5 Compressive strengths of LLDPE and PKSA paving blocks.

LLDPE is a resin consisting of molecules with a linear polyethylene backbone attached randomly by short alkyl groups. LLDPE has a density of 0.90-0.94 g/cm^3 [11]. The addition of PKSA is not only intended to minimize environmental problems caused by excessive plastic waste but also to optimize the water absorption capacity of the paving blocks [29]. For cement or concrete applications, PKSA filler contributes not only to the compressive strength but also to its hardness. Conversely, in recycled LLDPE composites, the PKSA may not disperse within the polymer and its process capability is severely limited due to the difference in polarity, size and density between the filler and the polyethylene [1,21,22,29]. PKSA contains silicon dioxide (SiO_2), aluminum oxide (Al_20_3), ferric oxide (Fe_2O_3), calcium oxide (CaO) and magnesium oxide (MgO). The PKSA used in this study, which came from boiler combustion at PT. Hevea MK I Palembang, Sumatra, Indonesia, had low humidity at 20.70%, while SiO_2 has a humidity of 34.37% [19]. Adding SiO_2 increases the compressive strength of cement raw materials, but it will decrease the compressive strength of polyethylene.

As mentioned above, LLDPE is a resin consisting of molecules with a linear polyethylene backbone that are radical bound by short alkyl groups. LLDPE has a density of 0.90-0.94 g/cm^3 [10]. This type of plastic is generally available in the market at various sizes. The physical appearance is slightly less clear/shiny. The product will soften and melt at a temperature of 110 °C. Low-density polyethylene has few branches in the intermolecular chain, which makes it that way [11]. Figure 5 tells us that the shelf life affected the compressive strength of the product. The highest compressive strength was obtained on day 0 and the lowest on day 365. The test results showed that all treatments had compressive strengths according to the requirements of SNI 03-0691-1996, with a minimum value of 127.465 kg/cm^2 for quality A pedestrian blocks.

3.2.5 Morphological Properties

3.2.5.1 Paving Blocks at Day 0

Figures 6 and 7 show SEM images of the LLDPE/PKSA paving block porosity from treatments A_0 (100:0) and A_5 (87.5:12.5).

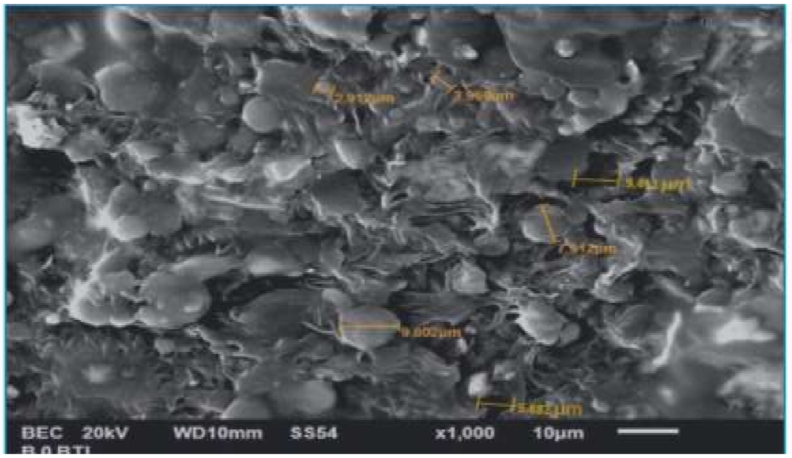

Figure 6 SEM image of LLDPE/PKSA paving block porosity with A_0 (100:0) treatment on 0 day with a magnification of 1000x.

Based on observations of the paving blocks' morphology, the sample from treatment A_0 (100:0) showed white polyethylene parts that bind quite well, resulting in good density of the composite. To determine the morphology of the paving blocks, SEM testing was carried out. The observations showed that the cavities formed were not too large, so the porosity value was not high, ranging from 2.912-9.8 mμ (Figure 6). SEM testing of the sample from treatment A_5 (87.5:12.5) showed that the white parts were LLDPE, which had spread, resulting in poor density of the composite. To determine the morphology of the paving blocks, SEM testing was carried out. It showed that cavities were formed that were so large that they produced high porosity values, ranging from 2.236 to 23.529 mμ (Figure 7).

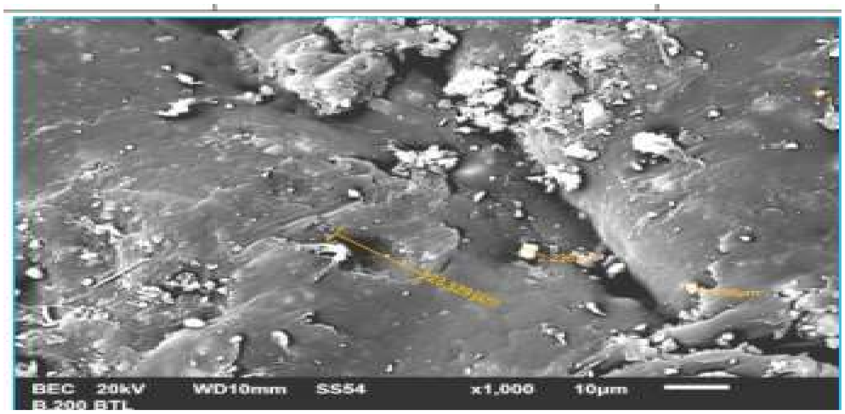

Figure 7 SEM image of LLDPE/PKSA paving block porosity with A_5 (87.5: 12.5) treatment on day 0 with a magnification of 1000x.

The SEM-EDX results for the LLDPE-PKSA paving blocks from treatments A_0 (100:0) and A_5 (87.5: 12.5) are shown in Figures 8 and 9 below.

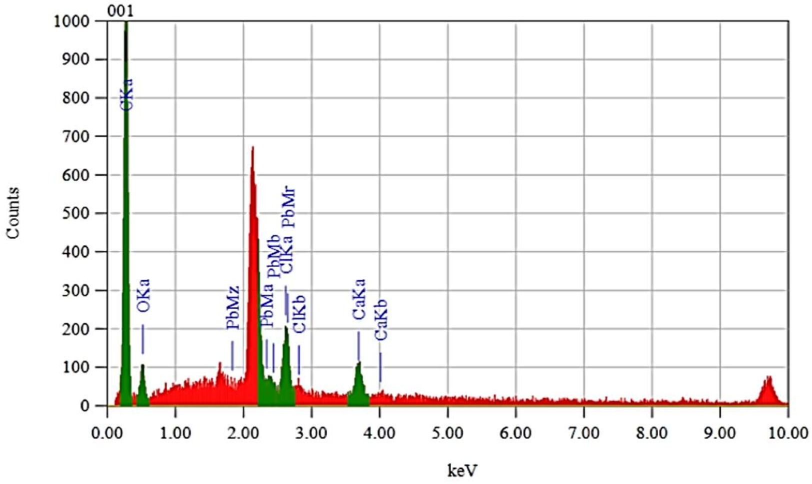

Figure 8 SEM-EDX test results for LLDPE-PKSA paving block from treatment A_0 (100:0) without coating on 0 day at 1000x magnification.

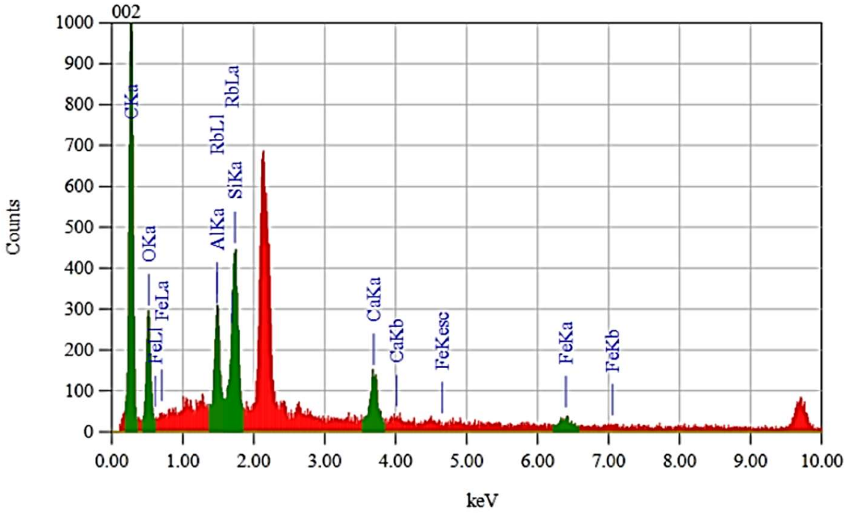

Figure 9 SEM-EDX test results for LLDPE-PKSA paving block from treatment A5 (87.5: 12.5) without coating on 0 day at 1000x magnification.

The small area of porosity in the paving block with treatment A_0 is in line with the high compressive strength value of 203.79 kg/cm^2 (Figure 5) and low water absorption of 0.06% [28] (Figure 4). From the EDX results at 1000x magnification for the paving blocks without the addition of PKSA (treatment A_0) and without coating, the elements found were Pb (8.3%), Ca (5.53%), Cl (8.40%), O (10.74%) and C (67.00%). The majority was O and C and the minor elements were Pb, Ca, and Cl (Figure 8).

The large area of porosity for treatment A_5 (Figure 9) is in line with the lowest compressive strength value of 43.26 kg/cm^2 (Figure 5) and high water absorption of 0.84%, in Figure 3 [28]. From the EDX results at 1000x for treatment A_5 (87.5:12.5) without coating, the elements found were Rb (17.47%), Fe (2.31%), Ca (5.37%), Si (5.37%), Al (4.72%), O (22.74%) and C (41.43%). The major elements were C and O, and the minor elements were Rb, Fe, Ca, Si and Al (Figure 9).

3.2.5.2 Paving Block on Day 365

The results of the SEM test of the LLDPE-PKSA paving blocks heated at a temperature of 150 °C for 15 minutes are shown in Figure 10 below. Based on the observations of the paving blocks' morphology, the paving block sample from treatment A_0 (100:0) showed white polyethylene parts that bind quite well, resulting in good density in the composite. To find out the morphology of the paving blocks, SEM testing was carried out. The result showed that the cavities formed were not very large, ranging from 2.56 to 11.764 mμ (Figure 11).

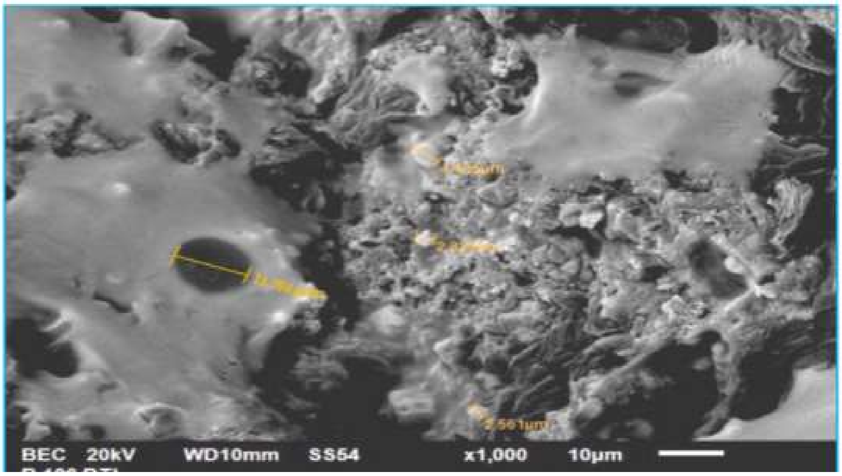

Figure 10 SEM image at 1000x magnification of LLDPE-PKSA paving block porosity for treatment A_0 (100:0) on day 365.

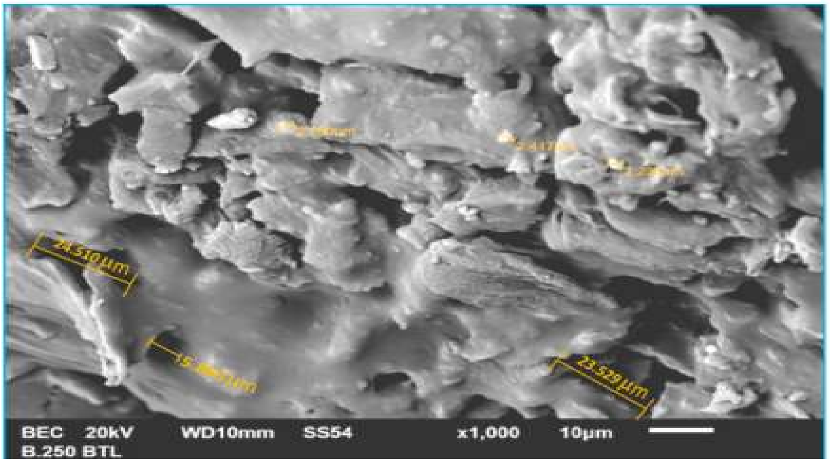

Figure 11 SEM image at 1000x magnification of LLDPE-PKSA paving block porosity for treatment A_5 (87.5: 12.5) on day 365.

SEM testing for treatment A_5 (87.5:12.5) after 365 days based on the observations of the paving block morphology showed that the white polyethylene parts in the paving block had spread, resulting in poor density of the composite. To determine the morphology of the paving blocks, SEM testing was carried out. It showed large cavities, resulting in high porosity values, ranging from 2.280 to 24.510 mμ (Figure 12).

The SEM-EDX test results at 1000x magnification of the LLDPE-PKSA paving blocks for treatments A_0 (100:0) and A_5 (87.5:12.5) without coating are shown in Figures 12 and 13 below.

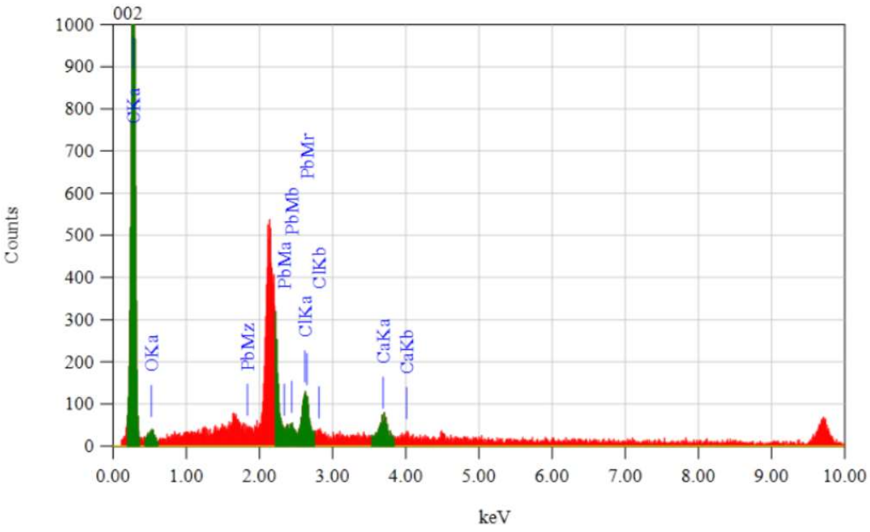

Figure 12 SEM-EDX test result at 1000x magnification for the paving block from treatment A_0 (LLDPE:PKSA ratio at 100:0) without coating after 365 days.

The small area of porosity in the paving block from treatment A_0 is in line with the high compressive strength value of 202.21 kg/cm^2 (Figure 4) and low water absorption of 0.34% (Figure 3) [28]. The EDX analysis at 1000x magnification of the paving blocks without addition of PKSA (treatment A_0) and without coating revealed the following compounds: Pb (7.04%), Ca (3.47%), Cl (5.74%), O (2.76%) and C (60.97%). The major element was O, and the minor elements were O, Pb, Ca, and Cl (Figure 12).

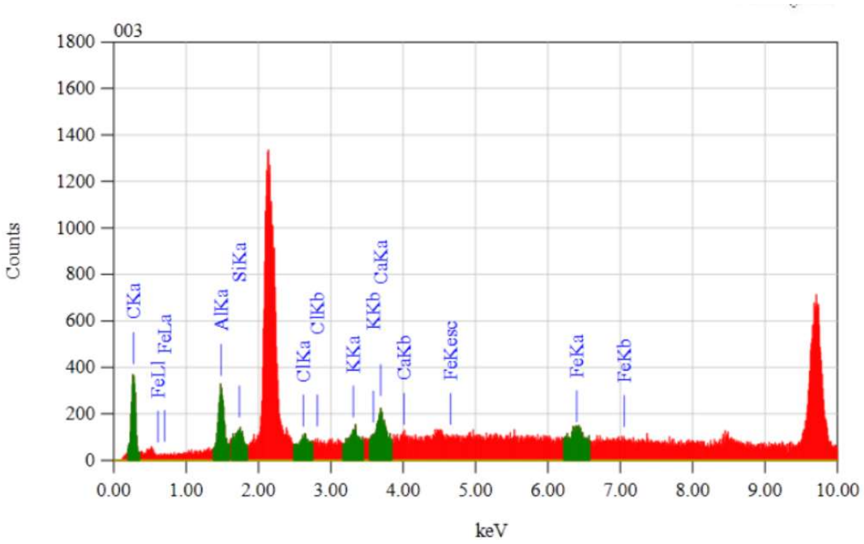

Figure 13 SEM-EDX test result at 1000x magnification for the paving block from treatment A_5 (LLDPE:PKSA ratio at 87.5:12.5) without coating after 365 days.

The large area of porosity in the paving block from treatment A_5 (Figure 11) is in line with the lowest compressive strength value of 141.23 kg/cm^2 (Figure 4) and the high water absorption of 2.14%, as can be seen in Figure 3 [28]. The EDX analysis at 1000x magnification of the paving block from treatment A_5 (87.5:12.5) and without coating, revealed the following compounds: C (37.78%), Al (13.85%), Si (3.44%), Cl (4.68%), K (7.21%), Ca (14.63%) and Fe (18.40%). The major elements were C and Fe, and the minor elements found were Al, Si, (3.44%), Cl, K (7.21%) and Ca (Figure 13).

Observations based on SEM and SEM-EDX after 365 days of storage revealed that the degradation of the paving blocks will increase the porosity and decrease the content of SiO_2 [23].

4 Conclusion

The addition of PKSA to paving blocks causes the surface of the product to become slightly rough and more brittle and it also affects their physical appearance, compressive strength, water absorption capacity, cavity structure, and elemental silica content. After 365 days of exposure to sunlight placed on the ground surface at ambient temperature, the paving blocks experienced an insignificant decrease in compressive strength. Meanwhile, the water absorption capacity and porosity of the composites slightly increased due to the addition of the PKSA, which contains silica and hydroxyl groups that may allow water absorption through hydrogen bonds. According to the biodegradation characteristics and mechanical properties, the best paving block treatment was A_5 (87.5:12.5) with 62.0 mm thickness, 143.26 kg/cm^2 compressive strength, and 0.84% water absorption. Further research will be carried out to study the optimal LLDPE:PKSA ratio to achieve the optimal balance between strength and absorption as well as types of antioxidants and plasticizers to improve the dispersion of recycled PKSA and LLDPE fillers.

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