SINERGI Vol. 23, No. 1, February 2019: 41-46
http://mercubuana.ac.id/index.php/sinergi
http://doi.org/10.22441/sinergi.2019.1.006 .

KALANDUE *ANADARA GRANDIS* SEA SHELLS AS ECO-FRIENDLY FLOOR FINISH MATERIALS

Muhammad Zakaria Umar, Asri Andrias Herman Balo, Hudi Sonta, Nurdin Takdir
Department of Architecture, Vocational Education Program, Halu Oleo University
H. E. A. Mokodompit Stereet, Andounouhou, Kendari, Southeast Sulawesi 93232
Email: muzakum.uho@gmail.com

Abstract -- *A high low energy in buildings is determined in the potential use of materials. Tile material is potentially made by architects as a sustainable building material. The use of tiles was marginalized by ceramic flooring products produced by large industries. The result of studies on the issue of global warming note that the embodied CO2 from the tile floor is almost seven times more than the embodies CO2 tiles. This result shows that tile products are environmentally sound and sustainable compared to tile floors. In another side, Kendari City is a Coastal City, and there are Kampung KB (Family Planning) that much mothers in this village busy every day with searching metti-metti/kalandue (Anadara grandis). During this time, shell kalandue fisherman catches only utilized meat/adductor muscle, while the shell is removed and uses as waste. In order for the tile to be competitive and interesting to be used as the floor of the house, it is necessary to study to create a tandem-based kalandue. This research is intended to create a tandem-based kalandue that used exploration method. The process of analysis is done qualitatively, so it gets the form of a tile. The shape of the tiles is transformed from the parameters to the resulting tandem-based kalandue shell. This study concluded that kalandue sea shells as eco-friendly floor finish material made, as follows: the working tools used were simple and sufficient. The working materials used are quite available and economical. The making process is done quickly and easily.*

Keywords: *Tiles; Kalandue shells; Way of making*

Received: May 24, 2018 *Revised: July 30, 2018* *Accepted: Augus 24, 2018*

INTRODUCTION

The climate changes over time. Climate change that occurs cannot be separated from what humans have done in treating the environment, so the environmental crisis including the design crisis. In this condition, environmentally sustainable architecture is one approach that must be done. The built environment is supposed to respond and appreciate the nature in which it exists through a design approach that respects nature and the environment, and the use of renewable energy.

This approach will bring harmonious and harmonious relationships between the built environment and nature as its context. Building since the design stage, implementation, use to the end of life of the building, must consider the concept of sustainability. This process can reduce the impact a building has on its environment. If the entire building has become a sustainable building, then on a large scale will manifest a sustainable environment (Manurung, 2014).

Sustainable buildings are still used by the architects of homework, as follows: 1) Traditional buildings that contain local wisdom values such as harmonious, sustainable and harmonious to the environment tend to fade (Titisari, et al., 2012); 2) The influence of the local climate in designing the dwelling tends to not be considered by the architects, so that additional energy is presented (Prianto, 2007) and 3) Soul and lazy tend to still be owned by our architects in designing sustainable buildings in terms of construction and material use (Harysakti & Sholehah, 2014). High low energy in buildings is determined in the potential use of materials (Budihardjo, 2009).

Tile material is potentially made by architects as a sustainable building material. Since the 1980s, the use of tiles was marginalized by ceramic flooring products produced by large industries. The results of studies on the issue of global warming note that the embodied CO_2 from the tile floor is almost 7 times more than the embodied CO_2 Tiles. This shows that tile products are environmentally sound and sustainable compared to tile floors (Hardjasaputra, 2016).

Natural sand as a result of natural disintegration of rocks or sand produced by the stone breaking industry and having the largest size of 4.8 mm is called fine aggregate (Haryanti, 2015). Aggregates that pass 4 or 4.75 mm sieve are called fine aggregates (Dumyati & Manalu, 2015). The quality of concrete and strength of concrete is influenced by fine aggregates. Aggregates that all grains penetrate a 4.8 mm or 4.75 mm or 5.0 mm mesh are called fine aggregates. Characteristic quality of concrete is influenced in fine aggregate quality. The fine aggregates in the concrete functioned as a mixture bound by cement and water into a solid mass that solidified and filled most of the volume of concrete (Suprapto, 2008). Fine Grain Modulus (MHB) of about 1.50-3.8 is present in fine aggregate. The results showed that the value of 2.5 <MHB <3.0 produced high-quality concrete with low Cement Water Factor (FAS), had a compressive strength, and optimum crunch. The quality of the concrete is affected by the maximum aggregate grain size. High-quality concrete in maximum granules made should not be more than 15 mm. Aggregate granules up to 25 mm are still possible to be high-quality concrete (Achmadi, 2009).

The smooth aggregate in SNI S-04-1989-F is required as follows: 1) the hard and non-porous grains are present in the fine aggregate. 2) the items cannot be destroyed by weather effects. The items are tested with a sodium salt solution of a maximum crushed part of 12%. Detail if tested with a maximum magnesium sulfate salt of 18%. 3) more than 5% of mud is not contained in fine aggregates. 4) alkali-reactive substances are not contained in fine aggregates. 5) flat and long aggregate grains shall not contain more than 20% in fine aggregates. 6) fine modulus between 1.5 - 3.8 grains and grain variations adjusted to the gradation standard. 7) the maximum grain size shall not exceed 1/5 of the smallest distance between the side plates of the mold, 1/3 the thickness of the concrete plate, 3/4 of the intercellular clearance. 8) the fine aggregate of the sea may be used provided that it has been instructed by a recognized institution (Dumyati & Manalu, 2015). The fine aggregate form influences the quality of concrete quality. Minimum 33% smaller air pools are held in rounded aggregates rather than flat-shaped aggregates. Water is needed in less concrete in finely textured aggregates than coarse-grained aggregates. Fine aggregates influence the compressive strength and concrete characteristics. The test results of 4 types of fine aggregate are deduced as follows: 1) different values are each owned in fine aggregate since they are influenced by the origin of the fine aggregate source. Aggregates with good conditions result from stone age; 2) The compressive strength, air content, weight, and shrinkage of concrete are influenced by fine aggregate characteristics (Suprapto, 2008). Thus it can be concluded that fine aggregate affects the quality of concrete.

Subtraction is referred to as the process of closing an area with tiles without gaps and without overlap. Tiles used to cover the area can be a lot of wake-ups. The steps to create a tile consist of creating a design, arranging to color, and arranging blocks of tiles. Staining stages selected four different colors such as maroon, brown, milk-white, and oranges. The dyeing technique is made by coloring the tiles and made with the same number. The width of the tile arbitrary area is calculated using the determinant formula. The results of the comparison of maroon, brown, milk, and white are obtained 11: 13: 7: 6. The comparison of each color is intended to make it easier for ceramic entrepreneurs to provide the color of tiles on the pattern. The tile blocks are formed from the four basic patterned tiles, 16 tile base patterns, and various other tile arch formations. The pattern of tiles formed varies. Everyone has their own style to create patterns, so it takes creativity and high persistence in the process of making tile patterns (Lestari & Heriawati, 2014).

Floor tiles are often used in buildings. This tile is used instead of floor plates to make the floor more comfortable and look better. Tiles consist of ceramic and tile type. Floor tiles are made to be able to guarantee the strength and function of the tiles. The tiles are made to be strong enough to hold the load on it. Tiles need to be calculated to the right thickness to have high strength so that efficient materials can be used. Floor materials began to be developed and adapted to the needs of the times. Based on this, tiles can be made from tile fractions. The fractional composition of tile compared with different sand composition, the compressive strength, and flexural strength is lower than the normal tile. Floor tiles made from mortar mixture consist of cement, fine aggregate (sand), fine aggregate (tile fraction), and water. The mixture is poured in a tile mold and left, it will harden like a rock. This hardening occurs due to a chemical reaction between water and cement. Hard Mortars are considered artificial stones.

The strength, durability, and mortar properties are based on the properties of the base material, the value of the material comparison, the stirring, the way of execution, the mode of compaction, and the way of treatment. The results of the test were strongly urged that the specimen with 4.5 cm thickness had a strong pressure equivalent to an ordinary tile with 2.5 cm thick. The result of bending strength test was found that the test specimen with 3 cm thick had strong pressure equivalent with ordinary tile with 2.5 cm thick. The result of shear tensile strength test was found that the specimen with 3 cm thick has strong pressure equal to ordinary tile with 2.5 cm thick. The above test results show that the optimum thickness of the tiles with the tile aggregate is about 3 cm in order to have the same strength as the usual tiles (Baskara & Rochman, 2016). A mixture in the manufacture of tiles is important to note the composition of the working materials. Tile-making materials are prepared, weighed, and stirred using a dry mix mixer. Sand 1539.7 kg/m^3, 512.5 kg/m^3 of cement, 205 kg/m^3 of water, silica fume 20.5 kg/m^3, and white cement 2.3 kg/m^3 are the working materials used to make tiles (Hardjasaputra, 2016). Thus it can be concluded that if you want to make a tile need to understand the fine physical characteristics of aggregate.

Seashells *(anadara grandis)* are found in Indonesian waters (Kadir et al., 2018). These shellfish are consumed by many people because they contain lots of protein. During this time, shells tend to be less utilized optimally. Clamshell wastes can be utilized as creative and innovative products such as ecosystems, floors, walls, ornaments, accessories, and starch materials. Portland cement is the greatest structural component material required in construction. Currently, Portland cement used as a sustainable material is an important goal. Alternative raw materials that can be used as a replacement of waste-based and environmentally-friendly limestone are shell wastes. The shellfish ash used in the cement making process has the potential to be a lime replacement called eco-cement. Eco-cement can be used in light construction work (Syafpoetri et al., 2013). Waste shells that are used as aesthetic elements of the building are one way to raise the locality of the marine archipelago. Shellfish can be utilized in building elements especially floor and wall. New material-forming materials are affected by the diversity of shapes and texture colors. The aesthetic flooring of the clamshell is tailored to the shapes, motifs, and textures of the shells (Armando, 2013).

Ornaments and accessories made as a business opportunity have a market share. It is based that many people are enthusiastic if buying decoration items and accessories. Ornaments and accessories can be made more unique and look beautiful when created creatively and innovatively (Sari et al., 2013). In connection with the provisions of CCRF (Code of Conduct for Responsible Fisheries), the business of fishery products must be processed more optimally and environmentally friendly. The amount of solid waste shell shells produced requires serious efforts to be addressed. Calcium content in shellfish can be used in cookies. Shellfish flour shell flour with 2N HCl produces the highest levels of calcium. Shellfish shell flour used in cookies products adds nutrient content (Agustini et al., 2011). Thus it can be concluded that the shell waste can be utilized as a creative and innovative product thus increasing the income.

Figure 1. The waste of kalandue's shell is seen to be mounting and has not been utilized optimally (Source: Result of documentation, 2018)

In the other side, Kendari City is a Coastal City, and there are Kampung KB (Family Planning). Kampung KB is located in the area of coastal reclamation. Kampung KB is an ex Kampung Bajo located on Gaya Baru Street, Petoaha Sub-District, Abeli Sub-district. Mothers in this village every day busy with searching *metti-metti/kalandue (Anadara grandis)*. During this time, *kalandue* shell fisherman catches only utilized meat/adductor muscle, while the shell is removed and used as waste. The waste of the kalandue shell is seen to be mounting and has not been optimally utilized, as shown in Fig. 1. In order for the tile to be competitive and interesting to be used as the floor of the house, it is necessary to study to create a tandem-based *kalandue*. This research is intended to create a tandem-based *kalandue (Anadara grandis).*

RESEARCH METHODS

This research used the exploration method. The data begins with the selection of materials, work tools, and stages of manufacture. Information from various sources is captured and interpreted into a creative idea. The basic concept is done and developed pragmatically on the shape of the tile. The process of analysis is done qualitatively, so we get the form of a tile. The shape of the tiles is transformed from the parameters to the resulting tandem-based *kalandue* shell *(Anadara grandis).*

RESULT AND DISCUSSION

The waste of mussel shells can be made as an eco-friendly floor finishing. Work tools, work materials, and manufacturing methods, as follows:

Work Tools

Mold floor, cast bucket, lorry, cement spoon, screwdriver, used oil, kape, sponge, old newspaper, measuring cylinder, brush, dough press tool, frame mold made of plywood, rubbing paper, and spoon.

Work Materials

Pohara sand, Nambo sand, cement, *kalandue* shell, water, resin oil, and hardener.

The Development Stages

Basic Layer Creation

The base layer is made with a mixture of pohara sand material and Nambo sand material. The color of the red sand tends to be light, the sand contains a lot of soil, pebbly sand, and the white pebbly color is owned in the features of Nambo sand. Sand Nambo sold at Rp. 200.000, - / ret up to Rp. 400,000, - / ret. The color of gray sand tends to be dark, slightly rough, and grained sand like sugar/salt is owned in the characteristics of Pohara sand. Pohara sand is sold at Rp. 600.000, - / ret. The composition of the sand material is mixed with a ratio of 3 pohara sand and 1 Nambo sand. The dry mixture consists of mixing the dry dough and stirring the damp dough. Dry dough mixing is carried out in the following manner: 1) pohara sand rests on the work floor; 2) pair Nambo poured on the sand of pohara; 3) cement is poured on Nambo sand; 4) the dough is stirred by forming a mounting at least 3 times. The dough is always thrown towards the top at the time of forming the mountains. The color of the dough has become one color (the color of cement) is the characteristic of well-mixed dry dough, and 5) the dough is recovered approximately 10 cm thick to the dough mixer. Stirring damp dough is done in the following way: 1) the dough is splashed water until moist. The moist dough is obtained in a situational way; 2) the damp dough is stirred to form a mountain at least 3 times. The dough is always thrown towards the top at the time of forming the mountains. The color of the dough has become a color (color of sand) and moist is a characteristic of well-mixed damp dough.

Printing

The dough is poured into the mold gradually. The first dough is poured with a thickness of about 0.7-0.8 mm. The dough is pressed by hand and dough pressing device. Instead, the dough is trampled by the worker to be solid. The dough is again poured into the mold until it soars. The dough is pressed with a pressure tool and trampled by the worker to solidify. The dough is flattened on the surface of the mold with a cement spoon to flatten as seen in Fig. 2.

Figure 2. The bottom layer dough is pressed with a cement spoon

Release

Fresh tiles are removed from the mold in the following manner: 1) the top mold is provided with a used newspaper; 2) mold is reversed and placed on the work floor; 3) the bolts on the mold are opened with a screwdriver; 3) the sides of the mold are pulled up. Prints are pulled up carefully.

Drying

Drying stage one fresh tin dried for one day. The drying process in a roofed area is safe.

Adhesiveness

Kalandue shell was washed with water until clean and dried. Kalanduu's shell is smoothed with scrap paper. Tiles are inserted into the frame. Frame made of wood plywood. The frame is made to a size higher than 5 mm tiles.

Figure 3. *Kalandue* shell filled with mortar

This is intended to lay the top layer of the shell kalandue. The kalandue shell is filled with mortar as depicted in Fig. 3. The composition of mortar mixture is required with a ratio of 1 cement: 1 water. The top layer of tile is given enough mortar. *Kalandue* shell is affixed to the top tile layer. *Kalandue* shells are placed on the tiles randomly. *Kalandue* shell is filled in tiles until full. The top layer of the tile is filled with mortar on the sidelines of the shell to be solid and aesthetic Drying.

The tile is dried in a place where the roof is applied for a day as shown in Fig. 4. Frame released from a tile.

Dauber

The tiles are smeared with resin oil. The resin oil is mixed with hardener. The composition between resin and hardener oil is mixed with a ratio of 150 ml: 5 ml hardener. The resin and hardener oils are stirred evenly. The resin oil is poured into the tile until smooth. The resin oil layer is flattened on the tile surface using a cape. The tile is aired for 15 minutes. Tiles are made with size 20 cm x 20 cm x 20 cm and 3 cm thick.

Figure 4. Tiles dried for one day

CONCLUSION

This study concluded that *kalandue* sea shells as eco-friendly floor finish materials made, as follows: the working tools used were simple and sufficient. The working materials used are quite available and economical. The making process is done quickly and easily. This research can proceed to investigate the flexural strength and abrasion of the tiles.

REFERENCES

Achmadi, A. (2009). Kajian Beton Mutu Tinggi Menggunakan Slag Sebagai Agregat Halus Dan Agregat Kasar dengan Aplikasi Superplasticizer Dan Silicafume. *Undergraduate Thesis,* Diponegoro Semarang, p. II-1.

Agustini, T., W., Fahmi, A., S., Widowati, I., dan Sarwono, A. (2011). Utilization of Asian Moon Scallop (Amusium pleuronectes) Shell Waste on Making of Calcium-Rich Cookies. *Jurnal Pengolahan Hasil Perikanan Indonesia, XIV* (1), 8-13.

Armando, A., W., (2013). The Utilization of Scallop Shells Waste as an Aesthetic Element of the Building. *Undergraduate Thesis*. Universitas Brawijaya, p. 15.

Baskara, H., & Rochman, A. 2016. Tinjauan Karakteristik Dan Kekuatan Ubin/Tegel Lantai dengan Menggunakan Agregat Halus Dari Pecahan Genteng. In *Prosiding Seminar Nasional Teknik Sipil Fakultas Teknik Universitas Muhammadiyah Surakarta*, Solo, Indonesia (pp. 425-430).

Budihardjo, E., (Ed.). (2009). *Percikan Pemikiran Para "Begawan" Arsitek Indonesia*

Menghadapi Tantangan Globalisasi Mangayubagya Purna Tugas Prof. Ir. Eko Budihardjo, M.Sc. Bandung: P.T. Alumni.

Dumyati, A., & Manalu, D., F. (2015). Analisis Penggunaan Pasir Pantai Sampur Sebagai Agregat Halus Terhadap Kuat Tekan Beton. *Jurnal Fropil, 3*(1), 1-13.

Hardjasaputra, H. (2016). Pelatihan Pembuatan Lantai Rumah (Ubin) Berbasis Semen Berserabut Kelapa Untuk Warga Kecamatan Mauk Tangerang. *Jurnal Sinergitas PKM & CSR, 1*(1), 76-87.

Haryanti, N., H. (2015). Uji Pasir Limbah Tambang Intan Cempaka. *Jurnal Fisika FLUX*, *12*(2), 109-117.

Harysakti, A., & Sholehah. (2014). Studi Potensi Material Bambu dan Re-Material Modular Untuk Desain Rumah Murah Yang Berkelanjutan Studi Kasus: Permukiman Danau Seha Kota Palangkaraya, Kalimantan Tengah. *Jurnal Perspektif Arsitektur, 9*(2), 74-83.

Kadir, I., Faslih, A, & Umar, M.Z. (2018). Creative and innovative products material floor from shellfish (Anadara grandis) waste. In *The 3rd International Tropical Renewable Energy Conference: Sustainable Development of Tropical Renewable Energy, 67*, 02002. http://doi.org/10.1051/e3sconf/20186702002

Lestari, T., V., & Heriawati, Y., P. (2014). Pola Pengubinan Parabolis. In *Prosiding Seminar Nasional Matematika,* Universitas Indonesia, Depok, Indonesia (pp. 1-10).

Manurung, P. (2014). Arsitektur Berkelanjutan, Belajar Dari Kearifan Arsitektur Nusantara. In *Simposium Nasional RAPI XIII-2014 FT UMS,* Solo, Indonesia. (pp. A-75 – A-81).

Prianto, E. (2007). Rumah Tropis Hemat Energi Bentuk Kepedulian Global Warming. *Riptek*, *1*(1), 1-10.

Sari, E.D., T., Rismana, A., D., Suseno, Tyas, C., A., & Lailassalami, U. (2013). Pemanfaatan Kerang Laut Untuk Usaha Souvenir Buatan Tangan, *Program Report*, Universitas Dian Nuswantoro, Semarang. (pp. 1-12).

Suprapto, H. (2008). Studi Sumber Agregat Halus dan Pengaruhnya Dalam Pembuatan Beton Normal. *Jurnal Desain & Konstruksi, 7*(2), 153-154.

Syafpoetri, N., A., Olivia, M., & Darmayanti, L. (2013). Pemanfaatan Abu Kulit Kerang (Anadara grandis) Untuk Pembuatan Ekosemen, *Program Report*, Universitas Riau, Pekanbaru, (pp. 1-14).

Titisari, E., Y., Triwinarto, J., & Suryasari, N. (2012). Konsep Ekologis pada Arsitektur di Desa Bendosari. *Jurnal Ruas, 10*(2), 20-31. http://doi.org/10.21776/ub.ruas.2012.010.02.3