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UTILIZATION OF AGRICULTURAL WASTE AS A MEDIUM FOR ART CREATION

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ABSTRACT

Rice straw, as an agricultural waste, is usually processed into fodder and openly burnt for faster land preparation for the next growing season. While burning rice straw may be practiced in certain regions to control pests and plant diseases, this perspective disregards the potential drawbacks, such as nutrient loss and CO_2 emissions leading to air pollution. Additionally, the natural decomposition of rice straw emits methane gas, which has an adverse impact on the climate. Eco-friendly rice straw processing is a step to minimize its negative environmental impact. The purpose of this research was to utilize rice straw as a medium in the creation of artworks, which is expected to reduce environmental pollution by maximizing the potential of rice waste (oryza sativa) into the artworks. The research method employed in this study is arts-based research, which draws upon the principles of adapting artistic creativity to social research by utilizing an artistic practice approach, as both domains are considered holistic and dynamic. The artistic practice follows a three-stage experimental sequence: the exploration stage, the design stage, and the embodiment stage. The result of this research indicates that rice straw has a high potential as an alternative to medium variations as well as art creation techniques by processing it into pulp, handmade paper, and clay. While regular paper has coarse light brown fiber and texture, the rice straw clay has a smooth texture. This creative process delivers three elephant-themed relief collages that are environmentally friendly, affordable, and long-lasting.

Keywords: Agricultural waste; rice straw; artworks; creative process; eco-art

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1. INTRODUCTION

Rice straw (oryza sativa) is a byproduct of the post-harvest process, generated during harvesting and processing processes. This waste is usually left in paddy fields, processed or burned. However, burning rice straw contributes to air pollution (Tsai et al., 2001). Large-scale open burning releases harmful greenhouse gases into the atmosphere, posing a serious threat to global air quality and human health (Kaur et al., 2017). In addition to environmental and air pollution, the disposal of post-harvest wastes results in the squandering of valuable biomass resources. To address the environmental pollution and tackle the energy crisis, recycling and utilizing agricultural waste have emerged as promising alternative approaches (Wang et al., 2016).

Utilization of agricultural waste offers the opportunity to transform what was once considered a post-harvest waste into a valuable resource that brings economic benefits and helps to address environmental problems (Wei et al., 2020). This approach also potentially creates new products by utilizing the biomass

present in the waste (Collazo-Bigliardi et al., 2018). An exemplary use of rice straw is its incorporation into eco-friendly food packaging, as demonstrated by Jaruwan Khammuang, an entrepreneur from Thailand. Her organic food packaging innovation represents a meaningful step towards reducing plastic usage, given that plastic waste remains a pressing global concern. However, it should be noted that the processing of rice straw for food packaging requires sophisticated equipment, which Khammuang found difficulty in accessing. Consequently, the processing of food packaging had to be carried out in the India. This highlights the importance of further innovation in utilizing rice straw for environmentally friendly and cost-effective purposes, making it accessible in terms of both tools and processes (DW Indonesia, 2020).

The people of Banjarejo village, Gabus district, Grobogan regency, Central Java use rice straw as installation art that is exhibited in the routine activities of the rice straw festival. This festival serves as a platform for the community to showcase their talent and convey their ideas through rice straw-based installations. Furthermore, Sendi Agus Cahyono, an artist from Majang, East Java, has taken rice straw art to another level by creating embossed paintings using rice straw ashes as ink. This unique technique involves burning rice straw to produce ashes, which are then combined with polyvinyl acetate ($C_4H_6O_2$) and applied to sketched paper (CNN Indonesia, 2020). Based on these examples, it is evident that rice straw holds significant potential to be further utilized in the creation of various artworks. With its ability to be processed into pulp, handmade paper, and clay, artists can continue exploring the elephant theme that has gained considerable attention, especially considering the endangered status of elephants.

Sumatran elephants (*Elephas maximus sumatranus*) are one of the animals that hold an important role in maintaining forest ecosystems. They contribute to forest regeneration by dispersing plant seeds through their dung (Qomariah et al., 2019). Elephants play an important role as 'keystone' and 'umbrella' species, maintaining biodiversity of the ecosystems they inhabit (Perera, 2009). However, the life of elephants is not free from threats. The hunting and killing of elephants remains prevalent, and human-elephants conflicts are common, particularly in regions where humans and elephants coexist, such as Sumatra in Indonesia (Sitompul, 2011). Humans are responsible to ensure the survival of elephants in order to prevent elephant extinction (Su et al., 2020). The Asian Elephant is currently listed as Endangered (EN) due to a significant population reduction estimated to be at least 50% over the last three generations (Williams et al., 2020). Elephants offer interesting themes in creating artworks. Elephants and agricultural waste have a close relationship with the environment and nature. Both require human attention so that nature is preserved and the creatures can continue to exist.

Many artworks with elephant themes have been created by previous artists, such as Salvador Dali's *Swan Reflection Elephant*, a surrealism work executed using oil paint on canvas. Similarly, David Shepherd, using realism style, has created oil paintings centered around elephants, including *The Ivory is Theirs* and *Wise Old Elephant*. A ceramic artist, F. Widayanto, has created artworks using clay; his artwork is known as *Ganesha-Ganeshi* (Widayanto, 1993). The purpose of this research was to utilize rice straw as a medium in creating artworks, with the aim of contributing to a reduction in environmental pollution by harnessing the potential of rice waste (oryza sativa) for artistic expression. The artworks created in this study differ from existing works due to the innovative use of rice straw, a material has rarely been employed in fine art, to create visuals of elephants.

2. METHODS

This art-based research integrated artistic creativity into social research through an artistic practice approach. This methodology was chosen due to its holistic and dynamic nature (Leavy, 2017). The artistic practice involved a three-stage experimental sequence, consisting of the exploration stage, the design stage, and the embodiment stage (Gustami, 2007).

The exploration stage involved observing the surrounding environment, especially rice fields with piles of hay, to obtain ideas. This stage also explored the processing of rice straw into pulp, handmade paper and clay, with the results serving as the foundation for the subsequent design stage.

In the design stage, the results of the exploration were visualized in various alternative designs (sketches) that were to be used as a reference in the process of realizing the artwork. This stage also involved selecting and determining the materials resulting from the exploration to be used in creating the artworks. The materials needed to make the pulp and paper were five liters of water, 200 g of straw cuttings, 100 g of aluminum sulfate, 10 g of polyvinyl acetate, 200 g of sodium hydroxide (NaOH), and 100 g of aluminum sulfate ($Al_2(SO_4)_3$). Meanwhile, the ingredients for making straw clay included 1 kg of pulp, 2 kg of wheat flour, 1 kg of gypsum, and 1 kg of polyvinyl acetate. Materials for the embodiment of the work included straw paper, straw clay, polyvinyl acetate, pigments, elephant-shaped tips, and varnish.

In the embodiment stage, the selected design was transformed into a model or prototype, adhering to the design's specifications, and perfecting them until the artworks were ready for exhibition. This creative

process was carried out by using the experimental approach to collect data on the exploration of rice straw, as it is formed into three-dimensional structures, visualizing various themes, and continually updating the form and content. The following section describes the process of embodiment, from making the pulp to completion of the works.

The pulping process was divided into several stages, starting with rice straw drying, followed by soaking to soften and smooth the rice straw, resulting in rice straw pulp. The pulp was then filtered, printed and dried to produce paper. The production of rice straw clay required some additional ingredients to form the dough.

In the first stage, the rice straw was sun-dried twice. It was exposed to sunlight from 08:00 to 17:00 in hot weather or by adjusting the condition of the rice straw until it became dry. This step aimed to remove the sap from the rice straw stalks and eliminate its lignin content. The absence of lignin or minimal lignin content is desired in high-quality paper production. Following drying, the rice straw was cut into a size of ± 2 mm using scissors (Figure 1).

Figure 1: Pieces of Dry Rice Straw

The next stage was the rice straw soaking process. In this step, 5 l of water and 200 g of sodium hydroxide were used to soak 200 g of rice straw pieces. The first step was to add water to a container containing sodium hydroxide, and then stir until the sodium hydroxide had fully dissolved in water. Subsequently, the rice straw pieces were immersed in the solution and then stirred until they were completely wet (Figure 2). This soaking process lasted for 12 hr, from 23:00 to 11:00. Its purpose was to soften the rice straw, making it easier to grind. After the 12 hr soaking period, the rice straw was rinsed with clean water 5 times to remove the sodium hydroxide. The clean rice straw was then gradually mashed using a blender until all softened rice straw had transformed into a a slurry. Following this, the rice straw slurry was soaked in water containing 100 g of aluminum sulfate.

Figure 2: Immersion Process Using Sodium Hydroxide

The next stage was the paper-making process. Water and 10 g of polyvinyl acetate were added to the pulp. The amount of water used determined the thickness of the resulting paper; more water resulted in thinner paper, while less water led to thicker paper. The pulp was then filtered using a sieve (Figure 3), then

placed on a wooden board and left to dry in the sun until the paper was completely dry (Figure 4). After drying, the resulting sheets of handmade paper had a rough texture (Figure 5).

Figure 3: Pulp Filtering Process

Figure 4: Paper Drying Process

Figure 5: Handmade Rice Straw Paper

The process of making clay involved using materials such as pulp, wheat flour, gypsum, polyvinyl acetate in a ratio of 1:2:1:1. All the ingredients were mixed and kneaded until the dough became smooth. The kneaded dough was then shaped to form flowers and other characters (Figure 6). After that, the clay was dried in the sun until the clay was perfectly dry and ready to be applied to the artwork.

The addition of color to the clay was performed during the embodiment stage of the artwork. The dye was applied to the dry clay, before arranging and pasting it onto a hardboard surface covered with rice straw paper. Water-based color pigments were used to color both the paper and clay. The paper was colored by evenly brushing the surface with color pigments, while the clay was colored by dipping it into water mixed with color pigments in a ratio of 1:100. After dyeing, the clay was dried in the sun until it was completely dry and ready to be pasted onto the artwork. The creative exploration resulted in three artworks that could be further developed (Figures 7, 8, 9). These three works depicted different forms of elephants. The first artwork featured an elephant figure arranged to resemble flowers, bamboo shoots, and plants, covering the entire surface of the work. The second artwork presented small elephant figures made using a mold. Meanwhile, the third artwork showcased a colored elephant resembling a flower.

Figure 6: Drying of Molded Straw Clay

3. RESULTS AND DISCUSSION

Based on the exploration process, the rice straw yieled pulp, handmade paper, and clay, which were used as medium for artwork creation. The rice straw underwent a series of transformations to produce paper and clay. This sequential process continues until the final artworks were completed. All processes conducted were considered environmentally friendly. The materials used do not contain harmful toxins, ensuring that the process does not generate new waste that could potentially harm the environment.

The basic preparation of the clay involved using soft rice straw fibers as the pulp. The drying of rice straw pieces significantly influences in the refining process, as dried rice straw pieces are easier to refine compared to those not subjected to the drying process first. Rough pulp resulted in highly textured and non-flat paper. After undergoing softening and the refining process, it still retained strong characterics of rice straw. The fiber and color characteristics of rice straw remained unchanged in the pulp. The pulp created in this study exhibited excessive fibrousness, resulting in paper with a coarse texture. To achieve a smoother texture, it is suggested to soak the rice straw in sodium hydroxide for a longer duration (more than 12 hr) or perform the smoothing process twice using a blender. In this creative process, pulp is invisible in the artwork, but is only used as the material in making paper.

The processed pulp resulted in a paper with an intense fibrous character and rough surface. Compared to the factory-made rice straw paper, the handmade ones appear more solid with a coarser texture (Table 1). The factory-made rice straw paper had a smoother fiber and texture. The rough texture of the handmade rice straw paper was attributed to the coarse-textured pulp. While a smoother texture is preferable for drawing or writing purposes, the coarse texture of the handmade rice straw paper adds an artistic impression when used for artworks that highlight the rice straw character. Throughout the creation process of this artwork, rice straw paper was utilized as a replacement for canvas.

The handmade rice straw paper also exhibited variations in thickness, determined by the amount of rice straw pulp used during the filtering process. To ensure uniform thickness in the paper, it is recommended to use a consistent measure during the pulp filtering process. However, in the current process, no specific measure was used, leading to the production of handmade rice straw paper of different sizes and thicknesses. Another noticeable difference lies in the color of the papers. The handmade rice straw paper tended to have a light brown hue, while the factory-made ones are more yellowish and lighter in color.

Table 1: Difference Between Handmade and Factory-Made Rice Straw Paper

Paper type	Rice straw paper	Fiber	Texture	Thickness	Color
Handmade rice straw paper		Coarse	Coarse	Different thickness in each paper	Light brown
Factory made rice straw paper		Smooth	Smooth	Each paper has the same thickness	Light yellow

Rice straw paper has a relatively lower storage resistance, making it susceptible to rotting and mold growth when stored in a humid conditions. To mitigate spoilage, it is recommended to store the paper in a dry, non-damp environment. Additionally, to prevent mold formaton, several treatments can be applied to the paper such as removing the lignin content in the paper during the paper-making process or bleaching the rice straw pulp before it is processed into paper. The pulping and bleaching process will remove the lignin content found in rice straw (Li et al., 2015) and hemicellulose, a polymeric carbohydrate that naturally accompanies cellulose fiber (Espinosa et al., 2016). Rice straw consists of cellulose (33.3 ± 0.47%), pentosan (27.3 ± 0.36%), lignin (13.0 ± 0.07%), ash (12.6 ± 0.11%) and silica (11.7%) (Kaur et al., 2018). There are several factors that must be considered in the process of bleaching handmade paper, such as the choice of chemicals used and the duration of the bleaching process (Dewi et al., 2020). However, it is important to note that the bleaching process is not environmentally friendly due to the use of chemicals, such as sodium hypochlorite (NaClO), which can potentially cause respiratory problems. Mold growth can be prevented by soaking the pulp in aluminum sulfate before the paper printing process. This is carried out to neutralize the pH of the pulp, transforming it from acidic to alkaline.

The processing of rice straw results in naturally-colored smooth fibers (Figure 6). These natural fibers contribute to the artistic character of the uncolored clay. Meanwhile, in the colored work, the rice straw fibers were concealed by color pigments. Rice straw-clay needs coarse pulp to showcase its fibers. Mistakes made during the rice straw clay-making process included excessive flour usage, which covered the straw fibers and contributed to heavier clay. To produce a lighter rice straw-clay, the dough could be mixed with pulps. This approach not only resulted in a lighter clay but also enhanced its water absorption properties, allowing it to absorb humidity on the surface. However, in this study, pulp was not added to the dough.

Rice straw-clay has a smooth surface with a bone-white color. Based on the experiment, the 1mm-dried rice straw-clay was fragile and broke easily when held, whereas the rice straw-clay with a thickness of ≥ 2 mm was stronger. Therefore, it is recommended to use clay with ≥ 2 mm thickness to create more robust artwork. One of the advantages of rice straw-clay is that it does not require a burning process as it can be sun-dried to achieve complete dryness. Furthermore, the clay remained intact and showed no signs of decomposition when stored at room temperature for 1.5 years. However, its vulnerability lies in being susceptible to termite damage if left unfinished.

The utilization of rice straw resulted in three elephant-themed artworks. Each artwork presented different forms and techniques in their production. Artworks 1 and 2 showcased the natural colors of paper and clay without any coloring process, while artwork 3 incorporated coloring using color pigments.

Artwork 1, titled *Bayi Gajah*, was created in 2021 using rice straw paper and rice straw clay, measuring 40 x 60 cm, in the form of a left-facing elephant relief (Figure 7). This bone-white artwork was made entirely from clay without any additional coloring process, highlighting the natural color of the clay. The composition of the work consists of various flower shapes, some resembling coral, bamboo shoots and other plant forms. The surface of the artwork exhibits a genuine texture produced from clay, arranged closely to form a unified and intact appearance. When touched, the artwork feels sharp due to the varying height and some pointed parts of the clay. The use of collage technique imparts a strong character to the artwork. This artwork portrays the imagination of a joyful elephant calf depicted without tusks, in a sitting position with its trunk raised high in the air. Flowers and plants on the surface of the artwork illustrate the beauty of the forest as the elephant's habitat. The artwork seeks to illustrate the interdependence of elephants and forests, as forests provide essential life and food sources for elephants, while elephants play a crucial role in maintaining and regenerating the forest ecosystem. Elephants produce dung containing plant seeds that contribute to forest regeneration. The artwork reflects the idea that elephants thrive in their natural environment, the forest, where they can live freely and happily.

This artwork presents an elephant visualized using processed rice straw, resulting in a balanced representation where the rice straw character is not overly pronounced, allowing the clay shapes to dominate and form a cohesive unit in the artwork. However, the natural colors present in the artwork could be enhanced visually through the use of coloring. It is worth noting that there are some areas in the artwork where the size of the flower and plant characters appear disproportionate when compared to the overall size of the artwork. In certain instances, certain parts of the flower characters may appear excessively large and stand out prominently.

The second artwork measures 120 x 80 cm and is titled *Sewu Gajah* (Figure 8). It takes the form of an elephant relief adorned with small elephants arranged on its surface. The little elephants were made of rice straw clay with a size of ± 6 cm. The background of the artwork features rice straw paper that covers the entire front and back surface, showcasing the natural brownish-yellow color of the rice straw paper. Similar to the previous artwork, this artwork does not use dyes, relying solely on the natural colors produced by the rice straw paper and clay. This artwork incorporates elements of art, specifically repetition and texture. Small

elephants are arranged to fill the surface of the artwork, following the shape of the elephant's body, including the curves on the legs, stomach, tusks and tail. The tusks and tail, unlike other parts, do not portray the typical elephant shape but are instead composed of flowers that shape the tusks and tail. The artwork boasts a smooth texture, with the surface filled with organic fields meticulously forming the elephant character. The arrangement is detailed and orderly, giving the impression of forming lines and rows.

This artwork exhibits a sense of complete unity, and the size of the small elephants is proportionate when considering the larger elephant in the background, creating a balanced composition. The title "Sewu Gajah", which translates to a thousand elephants, conveys the idea of elephants living in groups as the guardian of the forest. Elephants are social creatures that spend their lives in the forest with other elephants, often traversing around 20 km through the forest every day to find food as a group. The lowered trunk symbolizes that it is not a wild animal that cause disturbance. Like humans, elephants have a spirit of love and care for others, and they can be sad when members of their group are injured. Generally, they do not disturb others unless they are provoked.

In this artwork, the rice straw character is prominently displayed in the background of the artwork, adding the visual artistic value. The rice straw character is evident through the fine fibers visible on the surface of the paper. The artwork effectively showcases the authentic color of both rice straw and clay, harmoniously blending them into a cohesive whole. However, it is worth noting that in certain parts of the artwork, there may appear to be some elements missing, giving the impression of incompleteness.

Figure 7: Artwork I, Title: *Bayi Gajah,* Year: 2021, Size: 40 x 60 cm, Medium: Rice Straw Clay

Figure 8: Artwork II, Title: *Sewu Gajah,* Year: 2021, Size: 120 x 80 cm, Medium: Rice Straw Paper and Rice Straw Clay

The third artwork, titled *Gajah Biru* (Figure 9), measures 60 x 40 cm and takes the form of an elephant facing left. The mediums used in this artwork include rice straw paper, clay, and color pigment. The rice straw paper serves as the background, while the clay is arranged on specific parts of the surface to form a relief with blue gradation elements that fill every aspect of the artwork. The artwork's focal point lies in the flower shapes with attractive color gradations on the surface of the artwork. The real texture presented in the artwork visually corresponds to the texture incorporated within it. The use of color gradations adds a sense of dynamic lighting, infusing each part of the artwork with a distinct illumination. The organic fields featured in the artwork create an aesthetically pleasing impression. The varying heights and lows of the artwork's surface contribute to a visually stimulating contrast that enhances the overall form created.

Gajah Biru portrays the free imagination of an adult male elephant symbolized by flowers and the blue color. In elephant herds, adult male elephants typically separate from the female group and either live alone or join other male elephants. The herd is led by an adult female elephant; male elephants join the herd from birth until adolescence, and eventually reach adulthood.

This artwork exudes complete unity and harmony, with the color gradation providing a distinct impression. The rice straw character in this artwork is not prominently visible due to the use of color that fills the entire surface of the artwork. The character of the blue flowers contributes to the artwork's visual appeal.

Figure 9: Artwork III, Title: *Gajah Biru,* Year: 2021, Size: 60 x 40 cm, Medium: Rice Straw Paper and Rice Straw Clay

Lastly, the making of these three artworks exhibits several novelties. The entire process was low-cost, affordable, and had a longer-lasting outcomes than previous rice straw works. However, the rice straw characters in the present works were not salient. The novelty of these works, compared to previous elephant-themed works, lies in their medium, forms, and techniques. Previously, Salvador Dali created arts using oil paint in surrealism style, David Stepart created an elephant-themed artwork using oil paint in a realistic style. F. Widayanto used clay, and Sendi Agus Cahyono made an embossed painting from rice straw, using rice straw ash as ink for his work. The Ricestraw festival in Banjarejo also exhibited an installation art purely crafted from rice straw. In contrast, artworks in this study present a novelty by utilizing agricultural waste as a medium, shaping it into relief art with a collage technique. This fresh approach marks a development in elephant-themed artworks, offering inspiration and reference for future artistic endeavors.

4. CONCLUSION

In conclusion, nature and environmental conservation remain as an ongoing endeavors. Artists, like everyone else, have a role and responsibility to safeguard and preserve the environment. Creating artwork using local waste materials constitute artists' efforts in conserving the environment. This research also serves as an invitation to all members of society to take part in preserving nature through simple actions.

From the environmental perspective, this waste utilization is one of many efforts to alleviate environmental pollution and reduce air pollution. It also decreases methane emission caused by rice straw decomposition, presenting a perspective on how agricultural waste could be transformed into be something valuable. For artists, the result of this creative process offers an alternative medium, theme, concept, and technique for artwork creation. It could also be used as a material of art appreciation.

The environmental conservation efforts through this research on waste utilization do not end at this stage. The findings of this research may serve as a foundation for the future studies exploring waste utilization as the medium of work creation. Rice straw, rice straw paper, rice straw clay still have high potential for further development in both pure art or applied art. The success of using rice straw as a medium for artwork in an environmentally friendly, accessible, and cost-effective manner marks a significant achievement in this creative process. The resulting artworks also demonstrated satisfactory durability and resistance to decomposition when stored over extended periods.

From the creative process performed, it can be concluded that the rice straw adds a natural artistic image to the clay. The coloring of rice straw paper and clay diminishes the rice straw character and fibers. Therefore, rice straw-based products are recommended to avoid colorants to maintain the fiber and character of rice straw. The results of this study and creative process culminated in the creation of three elephant-themed relief artwork using rice straw pulp, handmade paper, and clay. The use of agricultural waste in this relief work of art serves as a deliberate effort to reduce environmental pollution and maximize the potential of rice waste without generating additional waste.

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