The Effect of using Wax and Wood as a Watermark Material on the Pottery

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Abtract. Counterfeiting products in the marketing process often occurs, not only for imported goods, but also for local goods produced by small craftsmen. Watermark will be one way to show the authenticity of a product. Watermark will be one way to show the authenticity of a product. The method used to analyze watermarks is non-destructive testing. This non-destructive test utilizes digital radiography with x-ray exposure. The images obtained from the radiography are then analyzed using ImageJ. The method of analysis carried out is the method of visual analysis and physical analysis methods. The visual method in this study only identified the obtained watermark image. The identification of x-ray distribution in dry and burnt pottery was used as a method of physical analysis. The value of x-ray intensity on exposed pottery is then compared. The watermark material used is wax and wood. The Paraffin content in the candle will turn into gas if it is burned. The carbon content in wood can cause wood to gray to ash if burning is more than ± 6000C. In the process of making wet pottery, wax materials for craftsmen have difficulty printing, this can cause changes in the quality of the earthenware which is not good enough. On earthenware wood materials can be formed properly without changing quality. The watermark produced on wood burning material is not very clear. Material that can be formed in the printing process, does not change during drying, and does not change the quality of wood in the combustion process is wood material material.

1. Intruduction

First, the watermark is hidden from view during normal use, only becoming visible as a result of a special viewing process (in this case, holding the bill up to the light). Second, the watermark carries information about the object in which it is hidden (in this case, the watermark indicates the authenticity of the bill). In addition to paper, watermarking can be applied to other physical objects and to electronic signals. Fabrics, garment labels, and product packaging are examples of physical objects that can be watermarked using special invisible dyes and inks. Electronic representations of music, photographs, and video are common types of signals that can be watermarked [5].

Competition for earthenware craftsmen often occurs by duplicating the designs of other craftsmen's pottery that are more marketable. Labeling has been done by making an image as a watermark outside the pottery. Drawing as a labeling step is certainly not enough to secure merchandise, it can be replicated. Watermarking methode that cannot be imitated is to hide the watermark inside the pottery.

Watermarks in pottery can be seen using the Non-Destructive Testing method. Digital radiography is one method used in Non-Destructive Testing method. Watermark information on pottery can be seen

without damaging the pottery itself. Images obtained from radiography can then be used to view watermarks on pottery.

Radiography utilizes x-ray radiation. Radiation from the process of taking digital images will result in weakening or loss of energy. The event is absorption which the intensity value can be obtained according to the Beer-Lambert law:

$$I_x = I_{(x)} = I_0 e^{-\mu x} \quad (1)$$

2. Methods

2.1. Materials

The clay used as a base for pottery is a type of red non-mess earthenware. The land was obtained from Bangunjiwo, Bantul, Yogyakarta as shown in Figure 1. The watermark material used was wax and wood.

Figure 1. *Earthenware* non mess

3. Research procedure

The process of making pottery begins with making molds. The mold used is a square mold made of acrylic. In the process of printing pottery, the watermark material that will be used is then inserted into the pottery that is still wet. Pottery is printed with a thickness of ± 1 cm and ± 1.5 cm.

Drying of earthenware is done in stages. The wet pottery is dried in a cool place until it is half dry, then dried in the direct sun. The combustion process is carried out after the pottery is completely dry. Radiographic imagery is carried out after the pottery is dry. Dry earthenware images are then compared with pottery that has been burned.

Image analysis is done in two stages. The first stage is visual analysis, carried out to determine whether the watermark made can be obtained without damaging the pottery both in the drying and combustion process. The second stage is physical analysis to see the response of soil and watermark material to X-ray radiation. Visual analysis of radiograph images was carried out by comparing pottery thickness ± 1 cm and ± 1.5 cm.

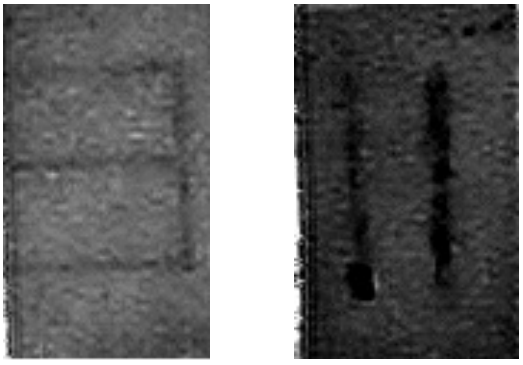
* .Bmp format images are converted to 8-bit graylevel images. Determining the graylevel value of the pixel pixel position value is done using ImageJ software. Analysis values are stored in * .txt form, then read using excel.

8-bit images are selected in the ROI (region of interest). The area without watermark or background area as I0 and watermark as It is expressed by numbers 0-255. The gray level value for pixel position on ROI is obtained by using ImageJ software. The analysis results obtained are stored in the format * .txt. Determining the ROI area by cropping the area where the watermark appears. Absorption coefficient based on Lambert-Beer law.

4. Result

4.1. Visual Analysis

Digital radiographic images obtained from exposure to x-ray digital radiographs with a voltage of 100 mA, 80 kV, and a exposure time of 0.5 seconds. Visual radiography of dry earthenware with watermark from wood and wax, as in Figure 2.



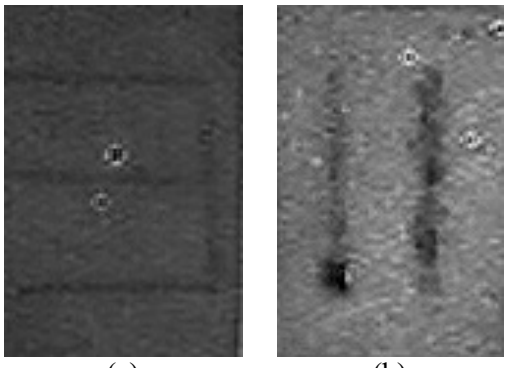
(a) (b)

Figure 2. Dry earthen radiograph images with (a) wood watermarks, (b) Candles

In Figure 2 it can be seen that the results of the watermark image of the wax material and wood can be clearly seen. In Figure 2 the wood watermark material clearly looks like a number three and two straight lines for the wax watermark material.

In the process of making pottery, wood materials are easier to use than wax materials. Solid wood is more easily formed and stable on wet soil, so it does not affect the shape of pottery too much. Wax materials that tend to change easily are similar to soil materials, making it more difficult to form in the process of making pottery. The wax material used is wax powder so that in the printing process. More watermark candles are mixed with wet soil exceeding the watermark limit to be made. The quality of dry pottery with wood watermark or wax material is not too affected. Both of these materials can be analyzed visually and pottery can dry completely.

In the combustion process, pottery made from distant wood watermarks looks less clear than wax material, as in Figure 3. The wood in the pottery changes material to ash because the combustion process is at 6000C over 3 hours of combustion. The hollow watermark of wood that turns into carbon depends largely on the amount of wood installed as a watermark before being burned. The watermark cavity will look bigger if larger wood material is installed.



(a) (b)

Figure 3. Radiographs of burnt earthenware with (a) wood watermarks, (b) Candles

4.2. Fisis Analysis

Absorption coefficients in dry watermarked pottery are in Table 1, while in burnt pottery in Table 2

Table 1. Value of Dry Pottery Absorption Coefficient

No	*Watermark*	x (cm)	(μ) . cm^{-1}
1.	Kayu	±1	0.296
2.	Lilin	±1	0.235

Table 2. Value of Burning Pottery Absorption Coefficient

No	*Watermark*	x (cm)	(μ) . cm^{-1}
1.	Kayu	±1	0.981
2.	Lilin	±1	0,741

The wood watermark material is only good until the drying process, while after burning the watermark made from wood is not very clear. This is due to the use of wood material that is too small so that the burning process of the watermark cavity is too small.

Wax watermarked areas have a more stable absorption coefficient than wood watermarks. Paraffin content in the wax which is mixing Hydrocarbons from Alkana contained in the wax. The alkane boiling point increases ± 20–30 ° C in every 1 carbon atom added. The process of burning pottery affects the paraffin content in candles in pottery, alkane compounds will change into solid, liquid, and gas. The process of burning pottery reaches ± 6000C, this can cause paraffin to turn into gas. The gas can evaporate, causing cavities in the pottery watermark area.

5. Conclusion

Radiograph images of wax and wood watermark material can be clearly identified visually. The most suitable watermark material used in pottery in this study is wax. The weakness of wax materials is the process of installing watermarks that are difficult to adapt to the shape of pottery. Better wood in the earthenware printing process, to produce a clear wooden watermark image that requires wood greater than ± 1 cm2.

6. References

[1] Suparta, G.B., Moenir, A.A., Swakarma, I.K., Nugroho, W., dan Supardiyono, B. 2005. Sistem Radiografi Digital untuk Medis.In : *Procedding 3rd Kentingan Physics Forum. Physics Departement, Sebelas Maret University*. Solo. September 2005

[2] Mahmud, M.I., Susanto, N.N., 2000. Wawasan Analisa Naskah Lontarak untuk Kepentingan Arkeologi. Jurnal Arkeologi Sulawesi Selatan. Volume 3. No.2.

[3] Ramasamy. N., Janawadkar. M., 2012. *SQUID Based Nondestructive Evaluation*. Nondestructive Testing Methods and New Applications. Chapter 2.

[4] Yuliani. S., Lubis. L.E., Nurlely., Soejoko. D.S., 2018., Kuantisasi Dan Analisis Citra Computed Radiography Pada Pemeriksaan Sinus Paranasal Pasien Pediatrik Dengan Metode Line Profile. Journal of Medical Physics and Biophysics, Vol. 5, No. 1, February 2018

[5] Cox, I. J., Miller, M. L., Bloom, J. A., Fridrich, J., & Kalker, T. (2008). Watermarking with Side Information. Digital Watermarking and Steganography, 1-13.

[6] Salin, J., Balayssac, J.-P., & Garnier, V. (2018). Introduction. Non-Destructive Testing and Evaluation of Civil Engineering Structures, 1–20.

[7] Kuhn T 1998 Density matrix theory of coherent ultrafast dynamics Theory of Transport Properties of Semiconductor Nanostructures (Electronic Materials vol 4) ed E Schöll (London: Chapman and Hall) chapter 6 pp 173–214

[8] Hartley, C., and Greene, A., 2009, *From Analog To Digital: Protocols And Program From A Systemic Digital Radiography Of Archaeological Pottery*, University of Chicago, Departement of Antropology, 2009.

[9] Harara, W., 2012, Digital Radiography of Aluminium Casting by Fluoroscopy, *Russian Journal of Nondestructive Testing, Volume 48, Issue 6, Pages 384-390.*
[10] Munir, R., 2004, *Stenografi dan Watermarking*, Departemen Teknik Informatika, Institut Teknologi Bandung, Bandung.

Acknowledgement

Thank to :
1. KEMENRISTEKDIKTI has funded this research.
2. Tasikmalaya Muhammadiyah University which has helped this research.
3. Gadjah Mada University especially Lab.Fisika Citra which has permitted this research.
4. Ceramic Arts and Crafts Industry Cooperative (KOPINKRA) Setya Bawana Bantul, Yogyakarta.