

Utilization of Waste Materials

in the Manufacture of Thai Home Decorations

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Abstract

This research is on the utilization of unwanted city waste materials in the creation of Thai decorative home products so that they maintain the durability and quality similar to traditional battered mortar. The researcher has investigated, interviewed and compiled information from nine specialists and national artists residing in Petchaburi, Sukhothai and Bangkok. Two were traditional battered mortar specialists, six were stucco artists and one a material specialist. From the interviews, the researcher selected 6 formulas of traditional battered mortar that were appropriate for the objectives of the research and adapted the proportions to determine the percentage of waste materials acceptable by these specialists. The resulting formula consisted of 35% lime, 25% fine sand, 20% recycled paper, 15% cultivated banana (Nam Wa) and 5% latex glue. The material was molded using five different methods for evaluating their suitability. The study found that Re-Material Paper Stucco could be molded in the same manner as the traditional mortar in terms of bonding, flexibility for pressing and creating patterns, as well as color stability. All specialists unanimously agreed that recycled paper was suitable as component in the production of “green production” of Thai home decorations.

Keywords: *Utilization of Waste from Thai Cities, Re-Material Paper Stucco, Thai Home Decorative Products.*

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Introduction

Thailand's valuable arts include several fields such as painting, gilded black lacquer, foundry, nielloware and mother of pearl inlaying. Stucco work is one craft that is highly valued and can be found in every region of the country. It truly shows a national unique culture living in a fertile environment. Stucco is made from durable materials and has the lifespan similar to other materials such as soil, wood, laterite and metal. Stucco work can be found as decorative items in archeological sites in Thailand from the Sukhothai Era until today.

The mortar that artists use for stucco work is named differently from one area to another. For example, in Petchaburi, where artists gather as a group and produce the most prominent works, the mortar is called differently by local artists in the northern region. This depends on the artists understanding and methods of production. The details are as follows:

Fermented mortar	→	The name is coined after the first step of preparing.
Battered mortar	→	The name is coined after mixing the maner of the mortar.
Sculpting mortar	→	The name is coined after the manner of sculpting.
Fresh mortar	→	The name is coined after freshness of the mortar and spontaneous thinking and creating.
Traditional mortar	→	This is named after the long-inherited formula.
Sugarcane juice or oil mortar	→	This is named after the components in the mortar.
Diamond or Petch mortar	→	The name is coined due to durability or may be named after its origin in Petchaburi.

Battered Mortar in Thailand

The country currently known as Thailand is home to many different ethnic groups and their cultures. The stucco works therefore, vary from period to period and concepts of its creators from each region and period.

The stucco works employed as decorative items at religious sites in Thailand such as stupas, ordination halls, Buddha image halls, pavilions and belfries etc. are different in their style & patterns. The popular ones include gods, angels, Buddha images and mythical animals and are based on the preference of each guild of artisans that is unique to each period. At present, stucco work can be found in several regions in the country. The work found in northern provinces is called Lanna Stucco. There is also stucco work found in central area i.e. in Petchaburi, having its own style that has been observed since the end of the Ayutthaya Era. These works have been inherited and developed until the present.



Figure 1. Wat Nang Phaya Sukhothai Period.

Battered Mortar in Thai Cities

Petchaburi is renowned for its historical, cultural and archeological traditions. There are several historical objects and sites such as buildings and religious places in the province that have been prosperous for hundred of years having artisans in different fields. Stucco work is one of the finest arts that has been inherited from the Ratanakosin Era until present.



Figure 2. Petchaburi's traditional stucco work.

The researcher has studied and gathered information from historical documents and interviewed specialists in stucco work in Petchaburi, Sukhothai, Kampaeng-

phet and traditional stucco work conservation institutions as Men's College in the Court and Poh Chang College of Arts & Crafts in order to compile ideas, theories and formulas of traditional mortar.



Figure 3. Teacher and students of Men's College in the court.

Information and ideas from the specialists were:

- Stucco work is a method to create a work of art since ancient time with the use of mortar made from burnt mollusk shells.
- Battered mortar is a kind of mortar after being battered or crushed.

The names of the mortar coined come from components in formula. Although, they vary, most of the mortar has the same major components namely lime, sand, gum and fiber. The difference lies only in proportion of the components which depends on research and test by each group of artisans to response to individual need.

Major Components of the Mortar

Lime

Lime is a major component being used to mix with others before creations. The lime eligible for use must be clean and pure and contain no contaminants and be of high quality.

Benefits of Lime for the Mortar

Lime plays a major role among all components. It bonds with other components such as sand, glue solution and fiber and solidifies with strong structure. After some time, calcium particles in the mortar will stick thoroughly together.

Sand

Fresh water sand used for construction is sifted and washed with clean water. Sifting is done to divide sand grain of different grades of fineness. Both coarse and fine sands are eligible for use.

Benefits of Sand for the Mortar

Sand strengthens the lime to help it retain its shape and hold its weight while the mortar is wet and solid. Moreover the mortar will be able to release moisture and heat received from environment.

Glue

Glue comes from natural sources, both plant and animals. Before battering, it must be transformed to liquid or powder to mix with other components. Each artisan prefers different types of glue depending on how to find it in local areas.

Benefits of Glue for the Mortar

Hide glue, sugar and oil are used as components. Most of them are thick liquid that bond particles of lime, sand and fiber together. The glue from plant giving sweet taste such as sugar cane and toddy palm are good agents for sticking the components particles together.

Fiber

Fiber is a necessary component. It is thorny and long. And it comes directly or is processed from plants and animals. An examples of fiber from animals is fur which can be immediately used and another example from plants is pulp of jute and arrowroot. Selection of fiber varies depending on access to resources in the area.

Benefits of Fiber for the Mortar

Fiber from any source is long and flexible with holes in its cells. When used in the mixture for the finished work that stays in normal environments, the mortar will shrink and stretch. So, the fiber will accommodate changes in size of the work by bonding the particles together.

The above mentioned materials are major components that play different roles according to their qualification.

Global warming is a crisis that affected all mankind for too long. At present, it stems from several causes, among these are deforestation, and increase in waste volume at the rate of 43 million tons and the release of 15 million tons of waste per year (statistics for Bangkok). Among these, only 22% can be recycled. Most of the waste is plastic, glass, food and paper which comes from unwanted papers, newspapers, calendars, cartons, magazine covers, notebooks and textbooks. It is found that at present, Thai people consumption of printed paper and containers is approximately 3.5 million tons or 56 kilograms per person per year.

As a result, the researcher came up with the idea to develop Re-Material Paper Soil based on recycling to reduce paper waste. The first formula is developed from the traditional mortar as shown in the table below.

Traditional mortar formulas and components		
Lime	3	Kilograms
Sand	1.5	Kilograms
Glue (Ancient Glue Solution)	150	Grams
Fiber (Paper Fiber)	100	Grams
Clean Water	300 – 900	Grams (Gradually add)

Figure 4. Traditional mortar components.

Battering Tools

- Battering mortar
- Paddy pestles. In case of normal paddy pestle, it must be made of wood with two heads and a handle in the middle.
- Fine sieve to sift sand and lime.
- Bowl for containing lime or sand to weigh and wait for mixing.
- Plastic pail for water and other materials.
- Plastic bags & rubber bands to protect the mixed mortar from drying out.

The researcher tested the three traditional formulas to develop the Re-Material Paper Soil using recycled materials. A4 paper from general office use that has been used on both sides has been used to replace fiber and latex glue that is easy to find instead of hide glue (that is difficult to find and more expensive.) Natural bonders as cultivated banana (Nam Wa), cassava and steamed sticky rice have been used to create six samples with details in the table below.

Formula Enhancing Main Materials	Steamed Sticky Rice (A)		Cassava (B)		Nam Wa Banana (Musa sapientum L.) (C)	
	Latex Glue (1)	Hide Glue (2)	Latex Glue (1)	Hide Glue (2)	Latex Glue (1)	Hide Glue (2)
Lime	3 portions	3 portions	3 portion	3 portion	3 portions	3 portions
Fine Sand	1 portion	1 portion	1 portion	1 portion	1 portion	1 portion
A4 Paper	1 portion	1 portion	1 portion	1 portion	1 portion	1 portion
Glue	½ portion	½ portion	½ portion	½ portion	½ portion	½ portion
Waste Materials	2 portion of steamed sticky rice	2 portion of steamed sticky rice	2 portions of tapioca	2 portions of tapioca	2 portions of banana	2 portions of banana

Figure 5. Formulas of mortar for the Re-Material Paper Soil to find the most appropriate formula.



Figure 6. Specialists in Thai traditional stucco is testing Re-Material Paper Stucco.












Formula A1		
	The mortar was coarse, dry, uneven and cracked	The mortar could not be formed
Formula A2		
	The mortar mixed well and was quite sleek	 <p>The work was white in color and strong. When it dried, the texture was not smooth</p>
Formula B1		
	The mortar mixed well but it was not smooth. Water was needed for forming.	 <p>The work was white in color that was similar to solid board and it bent.</p>
Formula B2		
	The mortar mixed well, was smooth and sleek. The color was not quite white.	 <p>The work was creamy white and quite strong.</p>
Formula C1		
	The mortar mixed well and was sleek and in red brown color.	 <p>The work was in brown color and strong</p>
Formula C2		
	The mortar mixed well and was coarse and in light brown color	 <p>The work was in yellow brown color and quite strong.</p>

Figure 7. The result of the six samples formulas.

Using the three bonders : sticky rice, cassava and cultivated banana (Nam Wa) to mix with hide glue and latex glue, there were six samples to be selected and sculpted by specialists. It was found that Formula C2 comprising lime, fine sand, A4 paper, latex glue and banana was the best one and the most likely to be developed as Contemporary Home Decorative Products that reflect Thai design. After that the researcher has developed the formula as follows:

Components

Components	Lime	Fine Sand	A4 Paper	Latex Glue	Banana
Formula					
Re-Material Paper Soil	365 g.	270 g.	190 g.	55 g.	120 g.

Figure 8. Components of re- material paper soil.





	<i>Mix all the components at the prepared amount.</i>
	<i>Batter the mixture until the pulp mixes well with the mortar.</i>
	<i>Batter the mixture for 20 minutes until everything mixes smoothly.</i>
	<i>Keep the mortar tight in plastic bags.</i>

Figure 9. Procedure for battering the mortar.

The researcher battered the mixture by a traditional process until the mixture was ready and molded by basic ceramic pottery methods namely flattening, rolling and coiling and free forming which became five items as shown below.



Figure 10. Sample products made from Re-Material Paper Soil that were accepted by the Stucco experts.

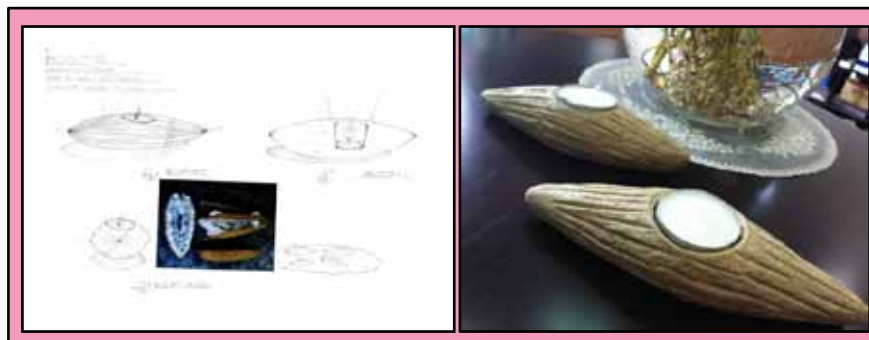


Figure 11. Example sketch design and product.

Conclusion

The new material stucco mortar formula has been developed from the Thai traditional battered mortar formula by modifying components from waste and natural materials that are easy to find in every region of Thailand. The components are “Nam Wa banana” and “used A4 paper” from offices replacing fiber. This newly developed stucco mortar in this research can be used as materials for home decorations or other designed items. The creation of this new “eco” or “green” material helps reduce production costs and can be commercially developed further as a local product (OTOP - One Tambon [district] One Product) and industrial production in other SMEs throughout Thailand, the ASEAN countries and worldwide.

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