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The Study on the Possibility of Expanding to Environmentally-Friendly Products Utilizing Clean Mud as an Environmentally-Friendly Construction Material Technologies

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Abstract: Background/Objectives*: Environmentally-friendly construction material means the production and installation of the construction materials with reduced energy use and environmental load. The area includes environmentally-friendly construction finishing materials, energy-saving material technologies, etc. They try to make a growth in connection with regional industries by way of convergence industrialization of marine resource materials, getting out of the limit of utilizing the mud resource.* **Methods/Statistical analysis***: Survey has been Step 4(Environmentally-friendly Materials, Insulation and Heat Storage Performance, Provides Comfortable Environment, Natural Deodorization Function) program.* **Findings***: Environmentally-friendly construction material markets grow continuously because the mud products may replace the role of red clay products in the construction material market, so we can expect demand for the mud products to be high in future.* **Improvements/Applications:** *Based on the awareness built up by the activation of mud festival, it is required to strengthen the competitiveness of the community industry using mud, the representative resource in Boryeong City, converting value added industry that is life care industry.*

Keywords: Clean Mud, Construction Material, Environmentally-Friendly**,** Expanding, Products Utilizing

Introduction

With the emergence of greenhouse gas lowering according to the regulation of building energy and green industry growth by the countries, it tends to choose the healthy materials for the building interiors, and increase the interest in the health by the people.

It is necessary to establish a strategy to improve the awareness of the products which are relatively not recognized well by utilizing the high awareness of[1]Boryeong Mud established by revitalization of the festival, and efforts have been made for grafting in the business areas of furniture, interior decoration, ceramic, etc.

The effect of Boryeongmud is like this. Generally, mud contains many effective components in terms of preventing skin aging and other natural minerals as shown in Table 1. It is abundant glial component of vitality and elasticity to skin and cultivate young and fresh skin. What is more, due to it contains the gluey and determined components, therefore, it is also available in the physical therapy like sand bath and sauna for Anti-bacteria, there is a very effective in the treatment of trauma.(Boryeong city mud festival homepage See more at: http://www.mudfestival.or.kr/ about Festival/story.html#sthash.X2ipnhub.dpuf)

Generally, the products with mud had been limited to the cosmetics in the past while raw material of mud is anticipated to expand the usages by the item developments such as eco-friendly construction products, mud bed with medical function, mud earthen bowl for induction, and so on.

According to the report of Korea Technology and Information Promotion Agency for SMEs in 2014, environmentally-friendly construction materials have showed constant growth of

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Table 1. Effect of mud.

Ingredient	The Function and Effect
Far-infrard radiation	Vitalizing the cell activities, expanding capillaries, vitalizing blood circulation and metabolism, helping release various wastes from inside of skin/vitalizing cells in human body
Ge(germanium)	Mystical materials that brings good effects to body, such as skin contraction and vitalizing skin elasticity
Al(alumin(i)um)	Main source material for cosmetics that help blood circulation ad metabolism, eliminate wastes, make skin transparent
Na(natrium)	Controlling osmotic pressure and balancing water in human body Mg(magnesium) - Help excrete wastes, used in collagen combination
Si(silicon)	Eliminating excessive wastes and sebum in pores
K(kalium)	Controlling osmotic pressure, balancing water and soothing effect
Ca(calcium)	Detoxification and releasing stresses
Fe(iron)	Used in collagen combination

more than 10% per year in global and domestic markets during 2012~2015, and are expected to show continuous growth in the futureas shown in Table 2.

Proposed Work

Since the mud contains lots of natural minerals and minute elements, In [2] Boryeong City succeeded in the commercialization of raw material for mud in 1994 for the first time in Korea[3]. Boryeong City representing South Choongchung Province has the geographical characteristics of coastal area and clean marine resources are its strength.

According to this, they try to make a growth in connection with regional industries by way of convergence industrialization of marine resource materials, getting out of the limit of utilizing the mud resource in the form of a festival. Environmentally-friendly construction material means the production and installation of the construction materials with reduced energy use and environmental load. The area includes environmentally-friendly construction finishing materials, energy-saving material technologies, etc. as shown in Table 3.

Unique mud's in Korea are beautiful colored yellow soil of Gosung in South Gyungsang Province, Boryeong mud, and so on, and especially[4] Boryeong mud has high level of mineral quantity which is popular with excellent quality in the world. A variety of products have been developing using mud material to expand the market of mud industry. Products using mud can be utilized as the interior items with yellow soil including tiles, bricks, and other interior pieces.

The representative examples are the red clay brick and mortar manufacturing companies in Boryeong region, however, most of them are small companies, and the types of products are not varied. Some companies produce tiles and roof tiles using red clay, but the designs and colors are monotonous as shown in Table 4.

Now the paradigm of construction material is changing, with environmental-friendliness starting to emerge as a main value from the existing values of cost, quality and construction period as seen in Table 5.

Table 2. Global and domestic market situation and prospect for environmentally-friendly construction material area (Korea technology and information promotion agency).

Global Market Situation and Prospect for Environmentally-friendly Construction Material Area (Million Dollar)										
Division	Main Items		2012	2013	2014	2015	2016	2017	Growth Rate(%)	Share in Construction Market(%)
Global Market	Environmentally-friendly Construction Materials	Environmentally-friendly Construction Finishing Materials	103,900	116,200	130,000	145,000	162,000	182,000	11.92	2.57
		Energy-Saving Materials	32,800	34,500	36,400	38,300	40,400	42,500	5.36	0.56
Domestic Market Situation and Prospect for Environmentally-friendly Construction Material Area (Hundred Million Won)										
Division	Main Items		2012	2013	2014	2015	2016	2017	Growth Rate(%)	
Domestic Market	Environmentally-friendly Construction Materials	Environmentally-friendly Construction Finishing Materials	19,450	21,740	24,290	29,250	34,920	41,410	11.76	
		Energy-Saving Materials	13,600	14,330	15,100	16,000	16,900	17,800	5.34	

Table 3. Mud boards manufacturing process.

		
1. Red Clay Collection	2. Raw Material Storage	3. Drying of Mud
		
4. Refining of Impurities	5. Raw Material Mixing	6. Tempering of Clay

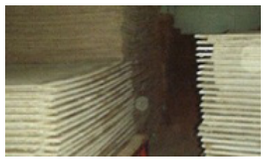
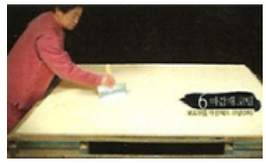
		
7. Forming Frame Paste Application	8. Fine Forming Work	9. Press Compression
		
10. 1st, 2nd Drying	11. Stacking of Original Plate	12. Pine Resin Coating

Table 4. Products utilizing Mud.

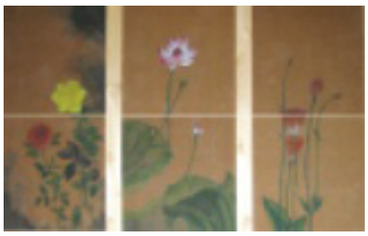
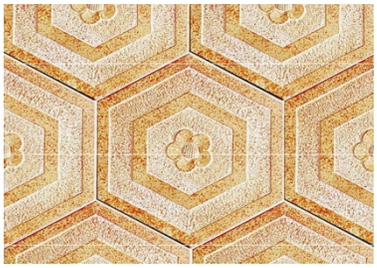
Interior Decoration Products utilizing Mud		
Red Clay Tex	Red Clay Mortar	Red Clay Brick
		
The representative examples are the red clay brick and mortar manufacturing companies in Boryeong region, however, most of them are small companies, and the types of products are not varied.		
Tile and Roof Tile Products utilizing Mud		
Red Clay Tile		Red Clay Roof Tile
		
Some companies produce tiles and roof tiles using red clay, but the designs and colors are monotonous.		

Table 5. Comparison between red clay and mud.

Division	Mud	Red Clay
Ingredient	SiO_2 Al_2O_3, Fe_2O_3 90% Abnormal	
Washing/colo(u)r fastness to perspiration	4~5 level excellent	
antibiotic action	99.9%	
far-infrared radiation	0.9	
Effect	Dyed cotton knitted fabric has excellent color fastness, high antibiotic action and far-infrared radiation so that it has blood purification action and pulmonary function reinforcement effect by thermal effect and negative ion effect when used as textile and other products	
Pb, Mn Adhesion removal rate	Mud > Red Clay	
Cd, Cu Adhesion removal rate	Mud > Red Clay	
Fe Adhesion removal rate	Red Clay > Mud	
Utilization	Mud has high adhesion rate than red clay except iron, and adhesion removal rate of harmful heavy metals is in the order of Mud>Red Clay. So mud can be possibly used for an adhesion material	

Step1: Environmentally-friendly Materials

Soil (red clay, clay, kaolin, etc.), a 100% natural material, is used as a main raw material. It is a material which causes less environmental pollution as it is made of soil and returns to soil when wasted.

Step 2: Insulation and Heat Storage Performance

A red clay brick made by baking soil is in layered structure and has excellent insulation and heat storage functions so that it reduces energy costs by more than 10% and also reduces building maintenance and repair costs.

Step 3: Provides Comfortable Environment

The far-infrared ray generated from red clay has the functions of neutralizing toxins in the body and controlling temperature and humidity so that it contributes to providing comfortable environment.

Step 4: Natural Deodorization Function

Positive ion in soil maintains substitution ability so that it absorbs and decomposes contaminated indoor air and bad smell.

Conclusion

Based on the awareness built up by the activation of mud festival, it is required to strengthen the competitiveness of the community industry using mud, the representative resource in Boryeong City, converting value added industry that is life care industry.

Environmentally-friendly construction material market grows continuously, and as we think that mud products may replace the role of red clay products in the construction material market, we expect the market potential of mud products is very bright in the construction material market in the future.

This paper is the result of <Grass-root Enterprise Development Project Plan : Interior, Construction Material, Functional Bed and Household Item Development Support Project utilizing Clean Mud(2016)> implementation in the MINISTRY OF TRADE INDUSTRY & ENERGY and Competent authorities of the Chungwoon University the Academic-Industrial Cooperation Organization.

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