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Innovation to Protect the Smoke and Odor Pollutions in Benjarong Ceramic Production

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***Abstract*—**The improvement of a filer case utilized to purify the let-out smoke and smell in the production of Benjarong Ceramic is studied through Participatory Action Research (PAR). This research is aimed to protect smell, dirty smoke, and air pollution which are effects of incomplete combustion in the production of Benjarong ceramic. This research was conducted at Jongjint Benjarong Ceramic Factory in Plai Bang, Bang Kruai, Nonthaburi Province,Thailand, also 12 employees were interviewed for data collection. All collected data were analyzed to develop and create solution to protect smoke and smell pollution from Benjarong ceramic production.

The results revealed that the employees who have used the developed filer cases are moderately satisfied. In addition to the efficiency of developed smoke-and-smell filer cases, it was found that Overall, the respondents were satisfied moderately with efficiency of modified smoke and smell filter cases.

***Keywords*—**Benjarong Ceramic, Community Economy, OTOP Production, Production.

I. Introduction

THESE days the expansion of agricultural enterprise, agricultural industry, and manufacturing technology has increasingly caused environmental problems such as pollution as well as physical illness of industrial workers. Thus, it is challenging how to educate entrepreneurs, manufacturers, and agriculturists to understand how to use technology in their business, and to raise their awareness and social responsibility of using technology, particularly in elimination of pollutant and spoilage from agricultural plantations, factories, and cottage industries.

According to The Office of Technology Transfer and Dissemination, Department of Alternative Energy Development and Efficiency [1], the cooperation between governmental agencies and private sectors is required as one major factor to solve those environmental problems from agriculture and industry and to enhance environment substantially.

It was found that pottery becomes utility used since pre-historical age. Its shape and function, including its manufacture have revolutionized through production technology and innovation. Undoubtedly, pottery still exists nowadays, especially Benjarong ceramic, Thailand's famous ceramic products [2].

However, manufacture of pottery and earthenware, particular in procedure of biscuit and gloss firing affected environment [3]. Smoke and smell was produced as side effects of these firing steps. Smoke and smell, moreover, caused physical illness to workmen. The severity of illness depended on period and quantity of smoke and smell they breathed.

At a first stage of illness, workmen in those factories irritate their respiratory system, and they probably have a headache, unusual vision, oppression in the chest, suffocation, and unconsciousness. These indications have affects malfunction on internal organs, and may cause any cancers.

According, this study is aimed to find solutions to eliminate environmental problems and pollution caused by manufacture of Benjarong Ceramic, OTOP awarded productions from Plai Bang, Bang Kruai, Nonthaburi Province. Smoke and smell filer cases were modified and developed for effective operation and operation safety. This also aims to enrich environment, to minimize manufacturing pollution, and decrease any risk of physical illness from work for nearby community.

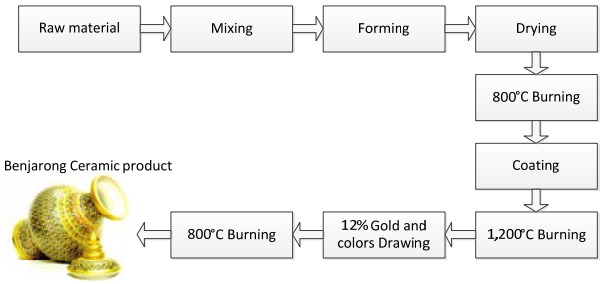

Fig. 1 Benjarong ceramic production process

Fig. 2 The benjarong ceramic products

II. Objectives

The objective is to design smoke and smell filer cases used in Benjarong production for reducing smoke and smell pollution.

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III. Methodology

In this research, the data were collected from 1) the questionnaire on satisfaction and efficiency of using developed filer cases in Benjarong ceramic production, 2) participant and non-participant observation, and 3) in-depth interview.

With the scope, the study is conducted only at Jongjint Benjarong Ceramic Factory located in Plai Bang, Bang Kruai, Nonthaburi Province. To collect data from twelve (12) employees working there, in-depth interview as well as participant and non-participant observation and questionnaire are research instruments in this study. In addition to the questionnaire, it is divided into three (3) parts as follows:

Part 1. The questionnaire was designed as a check list and open-ended questions concerning difficulties of production

Part 2. The questionnaire is designed as a check sheet which means to gain basic information of current situations, existing problems, and damages initially. The gained data is then developed to design the research questionnaire which means to measure and monitor solution, technology and work environment.

Part 3. A pack of questions concerning production progress and solutions is stated in this part.

All collected data was verified and analyzed through static information by using computerized programs, and then this information was summarized respectively.

TABLE I
Production Problems

Questions	Answer		
1 Sources of Materials	In the district	In Amphoe	In the province 100%
2. Need to expand production	Demand	In progress 100%	No needs
3. Demand for labor in manufacturing.	Demand	In progress	No needs 100%
4. Environmental protection in the production process.	Produce without environmental impact	The improvement of the environmental impact 100%	Corrective action impacted the environment.
5. Tools used in the manufacturing process.	Sufficient 100%	Between procurement	Inadequate
6. The tools used in the manufacturing process.	Available 100%	Poor performance	Not available
7 a place to store the raw materials used in production.	Have 100%	In progress	Don't have
8. Capacity per customer requirements.	Sufficient	Inadequate 100%	Excess demand

TABLE II
Technology and Work Environments

Questions	Answer		
	Have	Sometimes	Don't have
1. Well-lit work	100%		
2. The problem of noise in the workplace.			100%
3. And that the working temperature.			100%
4. Heating problems in the workplace.			100%
5. A dust / chemicals in the workplace.			100%
6. Problems in the work area			100%
7. Planning and fire protection in the workplace.			100%
8. The problem of water pollution			100%
9. Infrastructure problems			100%
10. There odors during operation.	100%		
11. The removal or garbage properly.	100%		
12. Controlled the risked area		100%	

TABLE III
Assessment of Satisfaction in Improving the Tank Reduces Smoke and Odor

Questions	Answer		
	Less satisfied	Moderately satisfied	Very satisfied
1. Concept to improve the tanks to reduce smoke and odor.		58.33%	41.67%
2. Planning Practice		58.33%	41.67%
3. Knowledge of tool use		58.33%	41.67%
4. Knowledge and ability to perform.			100%
5. The ability to resolve problems.			100%
6. Gestures to work after the update resulted tank reduces smoke and odor.			100%
7. The tank design reduces smoke and odor.		100%	
8. The ability to analyze performance cylinder reduces smoke and odor.	100%		
9. Research data to improve performance and reduce body odor.	58.33%	41.67%	
10. Manual And maintenance of the tank to reduce smoke and odor.			100%

TABLE IV
Performance Evaluation Restated Tank Reduces Smoke and Odor

Questions	Answer		
	Less satisfied	Moderately satisfied	Very satisfied
1. A shaped tank reduces smoke and odor.			100%
2. The sound of the tank to reduce smoke and odor.	100%		
3. The temperature of the tank to reduce smoke and odor.		66.67%	33.33%
4. Heat in the Workplace.		100%	
5. Location in the dust bin after installation reduces smoke and odor.	100%		
6. The installation of the tank to reduce smoke and odor is strong.			100%
7. Problems with performance space after adjustment tank reduces smoke and odor.	100%		
8. Designing tank reduces smoke and the smell is very safe to use.			100%
9. Able to Vent			100%
10. Smoke and odor after using tanks to reduce smoke and odor.			100%
11. Atopic symptoms decreased after the tank reduces smoke and odor.			100%
12. Lower respiratory diseases after using tanks to reduce smoke and odor.			100%
13. Diseases of the skin down the back of the tank to reduce smoke and odor.			100%
14. Ease-of-use tanks to reduce smoke and odor.			100%

IV. Results

Part 1. Evaluation on Satisfaction on Modified Smoke and Smell Filter Cases

It was found that the subjects had moderate satisfaction with the modified filter cases. To give more details, knowledge and capacity on work operation, problem-solving ability, work performance after modifying, user's guide of modified filter cases, and effective maintenance were very satisfying for these twelve respondents. In addition, they were satisfied moderately with concept of filtering modification, operation planning, and knowledge of device usage whereas work efficiency of smoke and smell filter case was slightly satisfying.

Part 2. Efficiency of Modified Smoke and Smell Filter Cases

Overall, the respondents were satisfied moderately with efficiency of modified smoke and smell filter cases. To have detailed clarification, shape of filtering structure, installation of modified filters, work safety of filtering structure, let-out ventilation, low quantity of smoke and smell filter cases, decrease of allergy, decrease of respiratory diseases, decrease of skin diseases, convenience of using modified filter cases had high satisfaction. Furthermore, these subjects had moderate satisfaction with heat of filtering operation whereas they were satisfied slightly with noise of filtering operation, dust in filtering operation plant, and operation plant of filer-case installation.

V. Discussion

According to the finding of this study, to create solutions for reducing air and odor pollution from Benjarong ceramic production, manufacturing or industrial designers should have more concern for the safety of using smoke and smell filter cases in producing Benjarong ceramic. Filtering cases should have well-built and substantial structure. The filter cases are supposed to provide operators friendly us, and they should have effective ventilation after operation. There are main factors that filter-case creators should consider which are a place for settling filter cases - closed area, size and quality of ventilation fans, and easy maintenance.

The finding is relevant to a previous study conducted by the Faculty of Agricultural Engineering and Industry, Mae Joe University [4]. They studied on differences of charcoal burning with and without smoke filter cases. They compared and analyzed the quantity of burning smoke in order to gain initial idea or assumption for building effective smoke filter cases. The finding of this research brought the concept to enhance efficiency of charcoal burning procedure as well as to reduce pollutants from this ceramic-making industry.

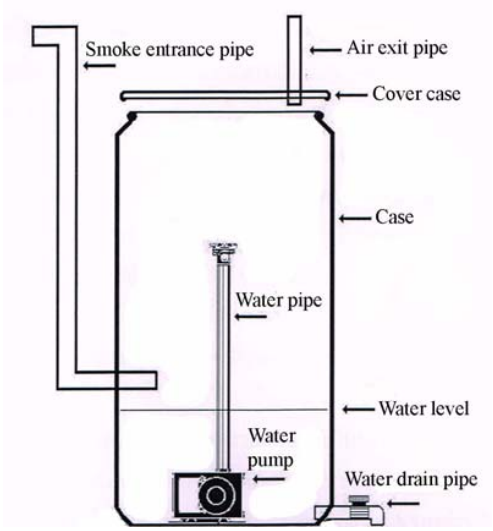

Fig. 3 A smoke and smell filter case design

Fig. 4 A smoke and smell filter case

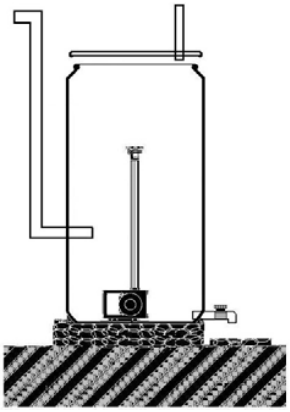

Fig. 5 Installation of a smoke and smell filter case

Besides, Vittaya [5] found that most of producers are experienced by integrating with their local knowledge, putting more work effort, having positive attitudes and having chanced to share their knowledge with students, youths,

academic officials and other people. This led to increase production to be more effective. Moreover, producers avoid raw material which probably caused pollution and harmed environment. Obviously, it is beneficial for Thai society and living habitat. People have more awareness to sustain their environment in their community. Philosophical concept of sustainable economy is linked to the governmental policy for developing the quality of OTOP products to meet international standards.

Consequently, the findings of this research can be more concerned on development of Benjarong ceramic production to more effective in the future. This also helps minimize pollutants which have become environment problems, and caused unhealthy situations to operators in production process. Moreover, this study probably inspires other manufacturers to apply innovative technology in industry under economical concept of sustainability; as a result, a high quality of production standards for OTOP producers.

VI. Suggestions

The suggestions from this research are as follows:

1. To decline smoke and smell from burning process perfectly, an area of combustion should be indoor covered neatly, and the size and numbers of ventilation fans should be proper to the size of that combustion area.
2. As the researcher conducted this study at Jongjint Benjarong Ceramic Factory, it was found that size of ventilation fans were not suitable and appropriate to size of production areas. The ventilation was too small, so some smoke was remained since those fans could not ventilate perfectly. Moreover, there were some dangers caused by malfunctional electronic wires of clay kilns. Therefore, safety should be highlighted in the future study.

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