

# The Usage of Sludge from Banglen Water Treatment Plant to Produce the Bricks.



## 1. Abstract

The physical property of sludge is loamy and sandy soil. Its chemical composition consists of Silicon Dioxide (SiO<sub>2</sub>, 41.48%), Aluminium Oxide (Al<sub>2</sub>O<sub>3</sub>, 25.37%), Ferrous Oxide (Fe<sub>2</sub>O<sub>3</sub>, 7.36%), Calcium Oxide (CaO, 0.88%) and other compositions (24.91%) which are similar to the clay for the manufacturing of bricks. By this reason, the research is to use the sludge from the water treatment plant to substitute the clay with 5 different ratios between sludge and clay i.e. 1:1, 1:2, 1:3, 1:4 and 1:5 by weight and one set of controller made of 100% clay. The result of the experiment shows that the most suitable ratio is 1:5, in which, its property is close to regular bricks. It has compressive strength of 3.5 Mpa and water absorption value below 24% complying with the Thai Industrial Standards TIS 153-2540. Therefore, the sludge from the water treatment plant should be mixed not exceeding 20% by weight to maintain the compressive strength and water absorption to be in line with the construction standard. The brick made of sludge is classified as "Kor" class of quality, which means it is suitable for regular walls and interior works rather than being the support of heavy structures. The sludge-and-clay brick can reduce the manufacturing cost by 0.03 baht per block.

## 2. Introduction

The process to treat the natural raw water always creates the sludge which is from the sedimentation process due to the chemical reaction with liquid alum and polymers. This process is carried out by Banglen Water Treatment Plant of TTW Public Company Limited with maximum capacity of 440,000 cubic meter/day. Our water treatment plant generates the sludge around 20 ton/day causing the difficulty in transportation and landfill.

## 3. Objectives

- 3.1 To study physical property and chemical composition of the sludge.
- 3.2 To study for the optimum mixing ratio between sludge and clay for producing bricks.
- 3.3 To study the properties of bricks made of sludge and its application.

## 4. Results

4.1 The sludge texture is likely to be loamy and sandy soil. Chemical composition consists of SiO<sub>2</sub> (41.48%), Al<sub>2</sub>O<sub>3</sub> (25.37%), Fe<sub>2</sub>O<sub>3</sub> (7.36%), CaO (0.88%), and others which are close to the clay for the manufacturing of bricks.

4.2 The result of forming of bricks made of sludge from the water treatment plant shows that if the ratio of the sludge : clay is more than 1 : 2 by weight, the brick cannot be formed.

4.3 The ratio between sludge and clay of 1:5 by weight is the optimum ratio and it is close to regular bricks. And it also complies with Thai Industrial Standards TIS 153-2540 in "Kor" class of quality.

4.4 The sludge-and-clay bricks can reduce manufacturing costs by 0.03 baht per block.

## Procedure

### 1. Study of the basic properties of materials

Parameter	Methods/ Analytical Tools
<b>1. Physical properties</b>	
Soil texture	Hydrometer Method
Moisture	Hot Air Oven
<b>2. Chemical composition</b>	
Oxide compound	X - ray Fluorescence
Heavy metal; Total Cu, Cr, Zn, Mn, Pb and Cd	Digest with nitric acid and measure the concentration by Atomic Absorption

### 2. Study of the optimum ratio between the sludge and clay for brick manufacturing.

- Step 1 : Ferment the clay for 24 hours.
- Step 2 : Mix the sludge and clay by 1:1, 1:2, 1:3, 1:4 and 1:5, add 5-10% ash, and press for forming the bricks.
- Step 3 : Cut it to 4.7 x 5.7 x 15 cm.
- Step 4 : Dry bricks by sunlight for 10 days
- Step 5 : Prepare and align the bricks for burning
- Step 6 : Burn the bricks with husk fuel at 750 degrees Celsius for 7 days



### 4. Application.

Application for reducing the production cost by using the sludge as the mixing material in the bricks. The production cost comprises the following expenses; 1) tools and equipment, 2) materials and 3) labor cost.

### 3. The study of properties of bricks made of the sludge as a raw material.

Test the properties of the construction bricks made of the water treatment plant by burning test which complies with the Thai Industrial Standards TIS 153-2540, including compressive strength and water absorption to identify the classification of bricks and way to use for building materials.

## 5. Suggestions

5.1 The sludge should be randomly picked up as the monthly sampling for analysis of physical property and chemical composition before using due to the difference of water quality and chemical consumption in water treatment process.

5.2 The experiment of mixing the sludge in brick manufacturing process should pay attention to humidity control due to the fact that it affects the forming of bricks.

