



Green Building Bricks Made with Clays and Sugar Cane Bagasse Ash

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Introduction



Performances characteristics on the use of some secondary materials and waste types, as partial replacement for primary clayey soil in the manufacture of fired bricks, in order to reduce the energy and firing cost of the clay brick production process was conducted for a long period by Rahman [1], Tonnayopas and Na-Phattalung [2], Tonnayopas and Ponsa [3], Tonnayopas et al. [4,5,6,7,8], Kooptarnond and Tonnayopas [8], Weng et al. [9], and Lingling et al. [10]. Sugar cane bagasse ash (SCBA) is generated as a combustion by-product from process of sugar, alcohol and electricity factories. Composed mainly of active silica, due to this by-product often be used as a pozzollanic material in mortar and concrete. Several studies have shown that the use of S

Aim of Study

1

To enhance the physico-mechanical properties and phase composition of local clay-bricks for construction purposes

2

Keeping on actual manufacturing costs, by incorporating SCBA as the raw material without to degrade their properties of brick based upon the Thai Industrial Standard (TIS)

Experimental Procedure



CS

SCBA

XRF

XRD

DTA

SEM

200 mesh OMC mixed SCBA 0, % 10%, 20%, 30%, 40% and 50%

Hydraulic pressure 100 bars

Heat 100°C 1 -d and fired 1050°C

Chemical resistance
XRD
SEM

Test & Analysis

Linear shrinkage
Weight loss
Bulk density
Water absorption
Electrical resistance
Crushing strength

Conclusion

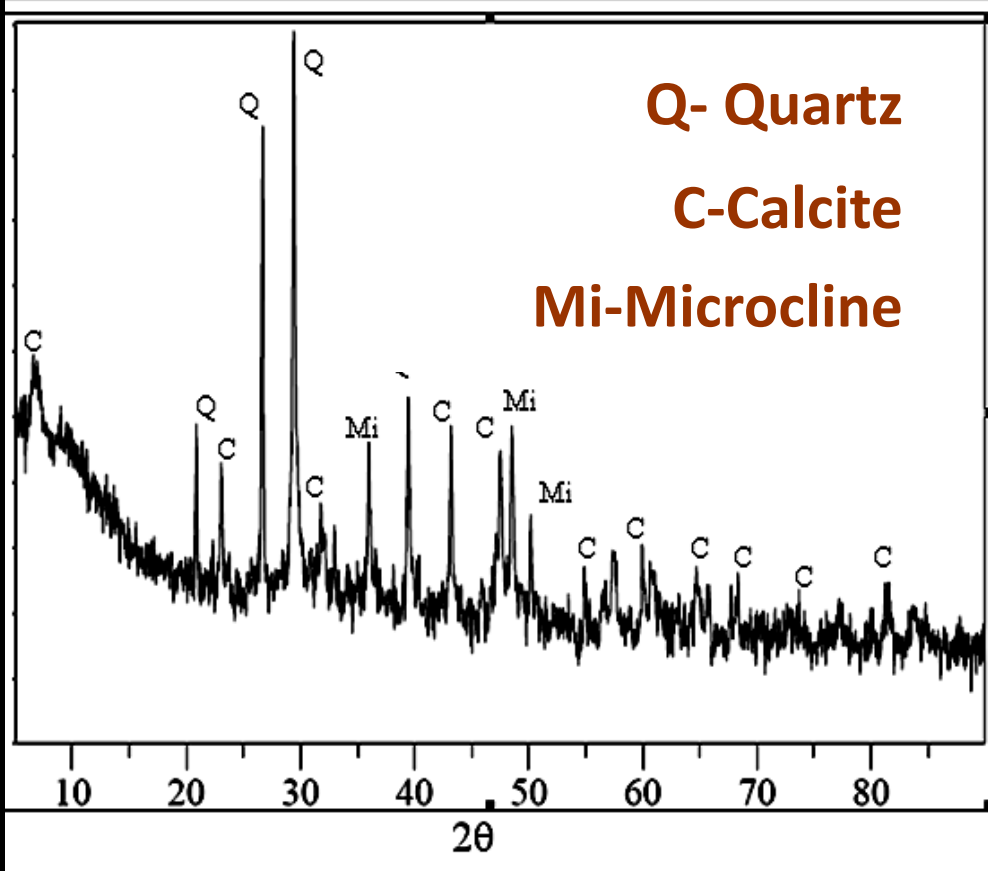


Elaborated raw materials mixtures and moisture

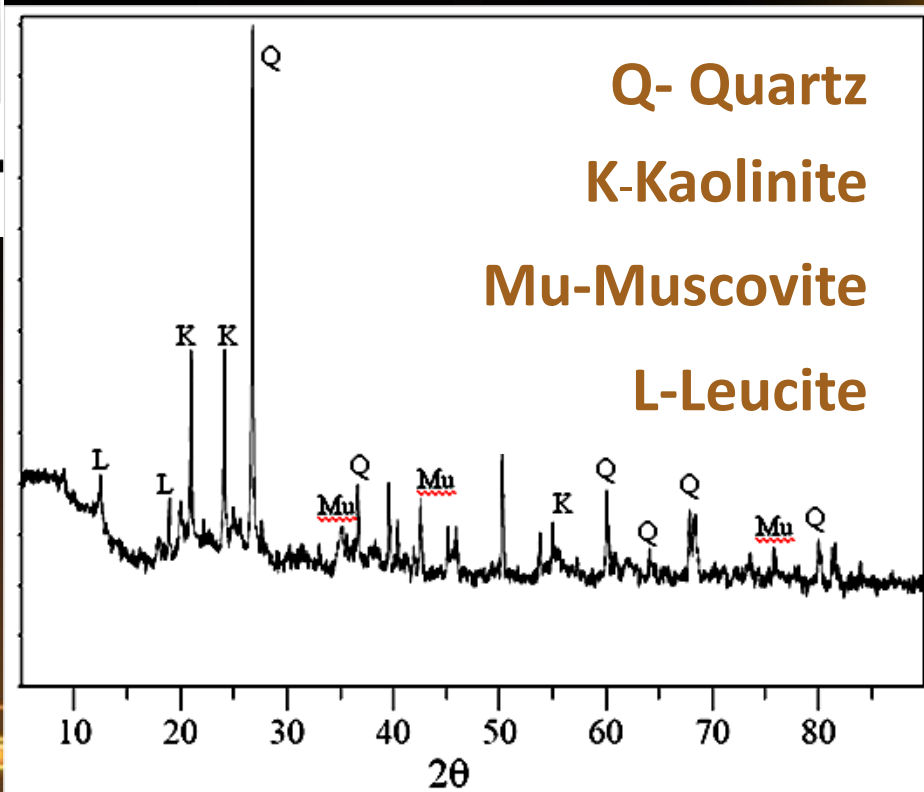
| Mixture Items | Raw materials (wt.%) | | OMC (%) |
|---------------|----------------------|------|---------|
| | CS | SCBA | |
| CS or SCBA0 | 100 | 0 | 20.81 |
| SCBA10 | 90 | 10 | 21.21 |
| SCBA20 | 80 | 20 | 21.98 |
| SCBA30 | 70 | 30 | 21.23 |
| SCBA40 | 60 | 40 | 22.15 |
| SCBA50 | 50 | 50 | 21.30 |

Chemical composition of materials (in mass)

| Chemical composition | CS (%) | SCBA (%) |
|---------------------------------|--------|----------|
| SiO ₂ | 58.11 | 38.31 |
| Al ₂ O ₃ | 17.88 | 2.84 |
| CaO | 0.13 | 10.76 |
| Fe ₂ O ₃ | 8.58 | 3.36 |
| K ₂ O | 5.98 | 1.77 |
| TiO ₂ | 1.86 | 0.21 |
| MgO | 1.22 | 0.94 |
| P ₂ O ₅ | - | 0.90 |
| SO ₃ | - | 0.45 |
| MnO ₂ | 0.30 | 0.23 |
| LOI | 0.28 | 40.21 |
| Surface area, m ² /g | - | 2.214 |



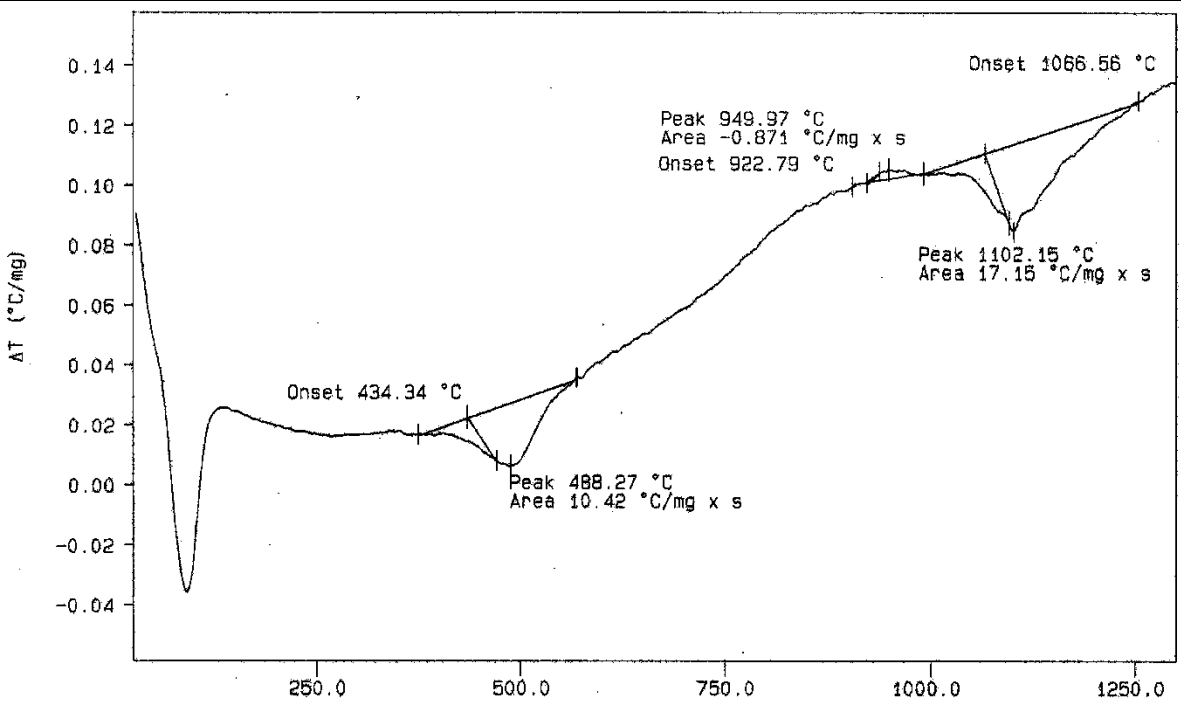
XRD pattern of raw materials



SCBA

CS

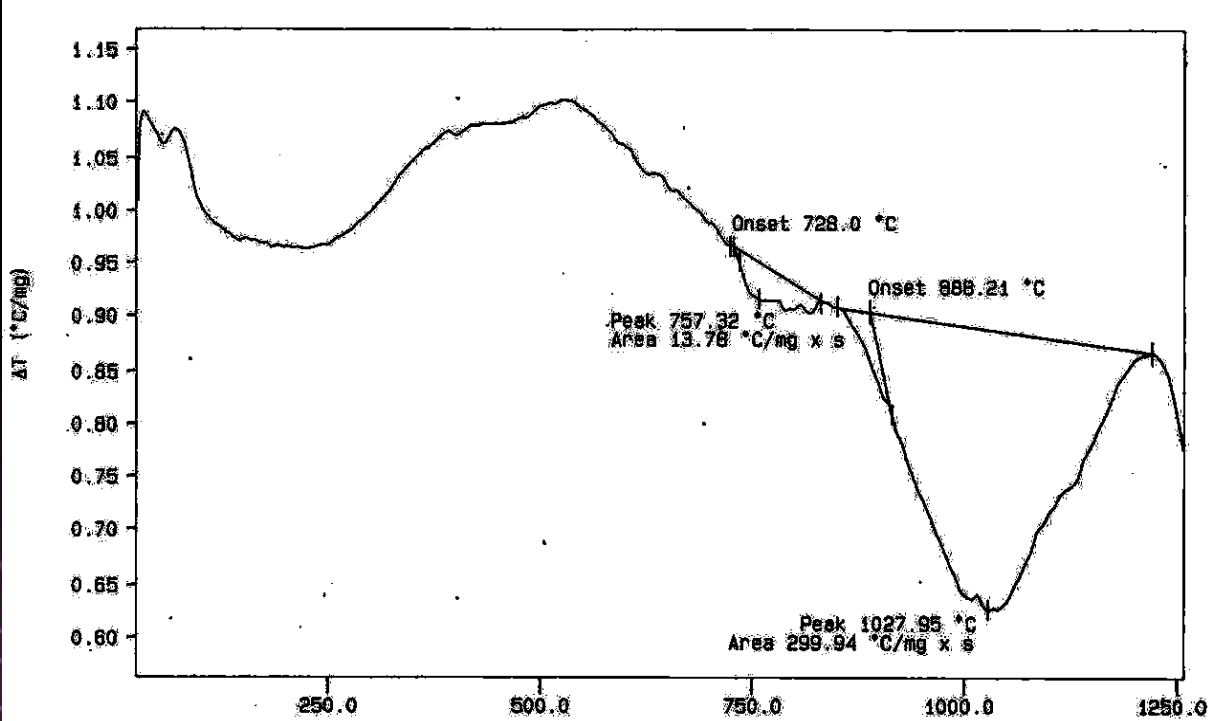
Asean++ 2013



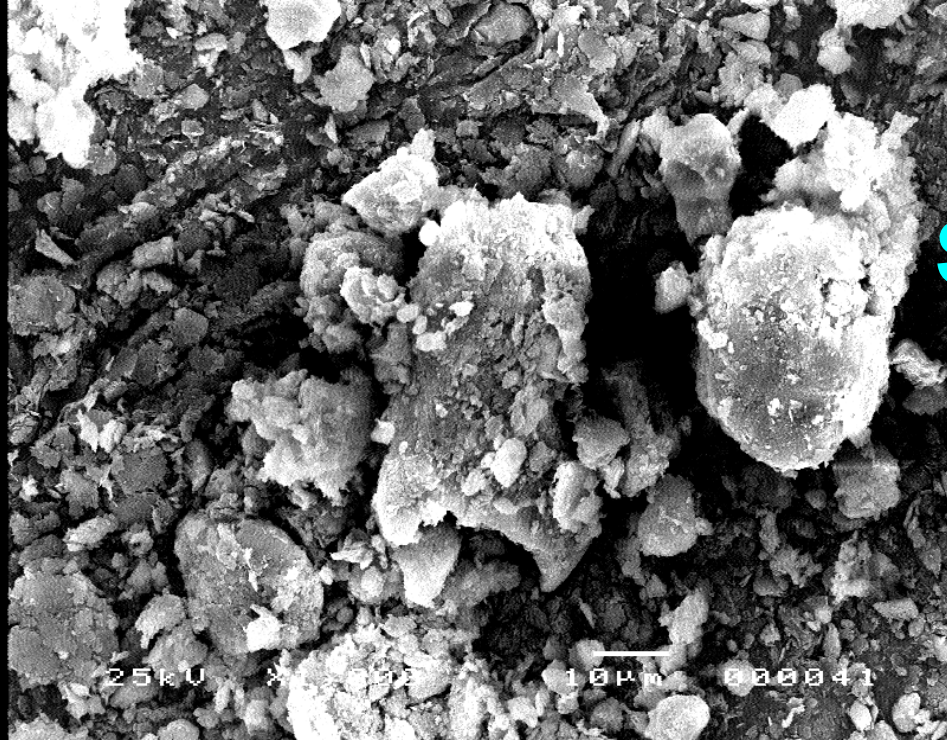
DTA pattern

CS

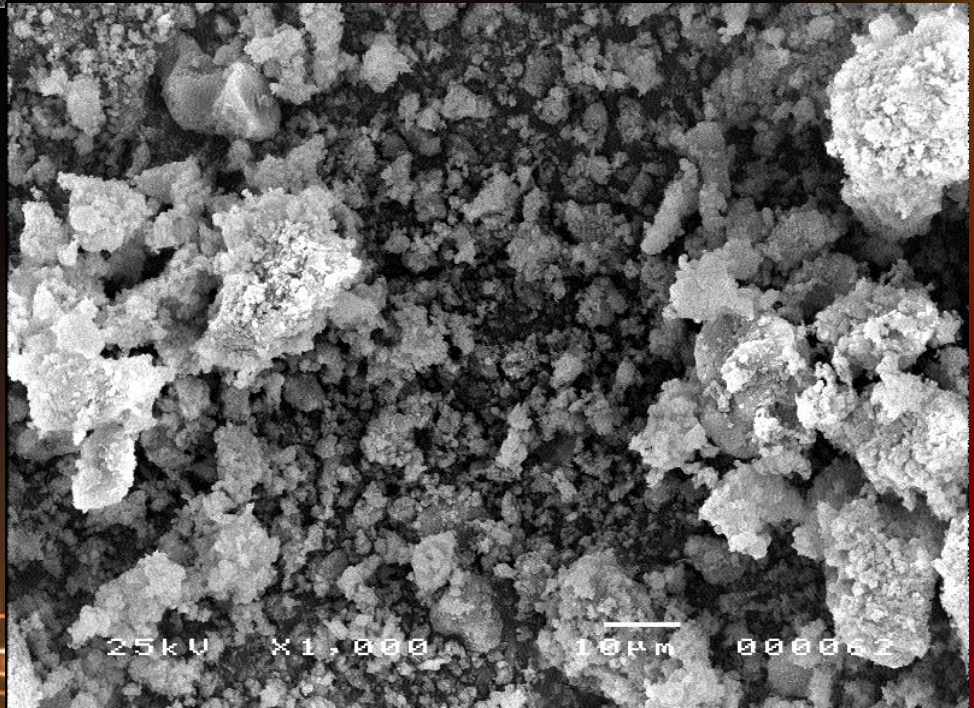
SCBA



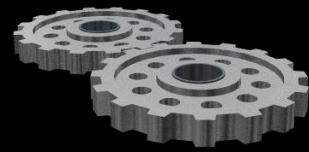
SEM photomicrograph



CS



SCBA



Preparation a of brick specimens



SiO₂-rich waste

"SiO₂+CaO"

Ball mill curing 24 h
200 mesh

A diagram showing a ball mill (a cylindrical container with small circles representing balls) and a sieve (a circular mesh) positioned above it.

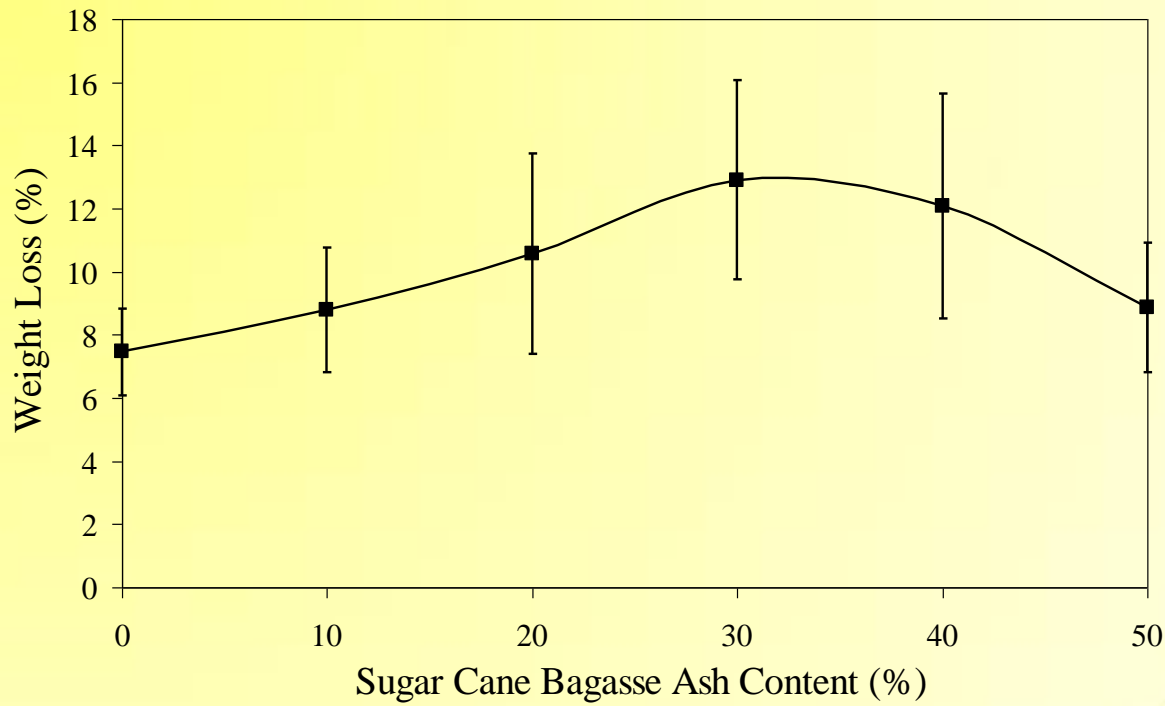
100°C
curing 24 h
Mixing

OMC and Hydraulic pressure at 100 bars

A diagram of a yellow rectangular brick.

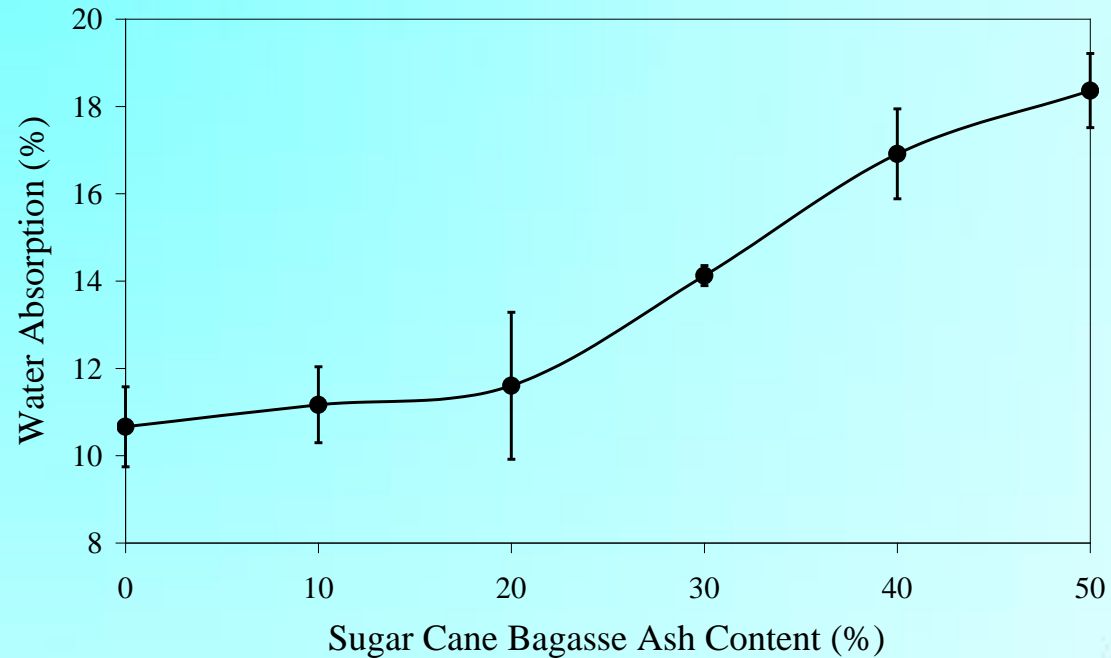
1050°C

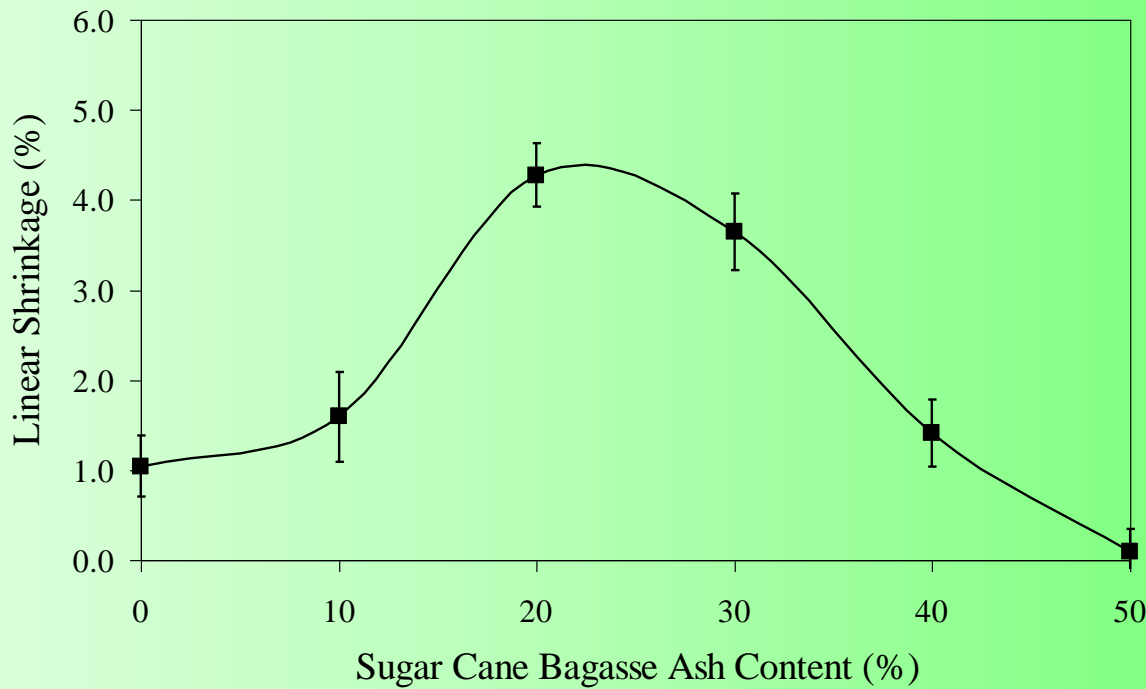
A diagram of a furnace with a brick inside. The furnace has a blue interior and a white exterior. The brick is yellow.



Variation of weight loss of SCBA bricks

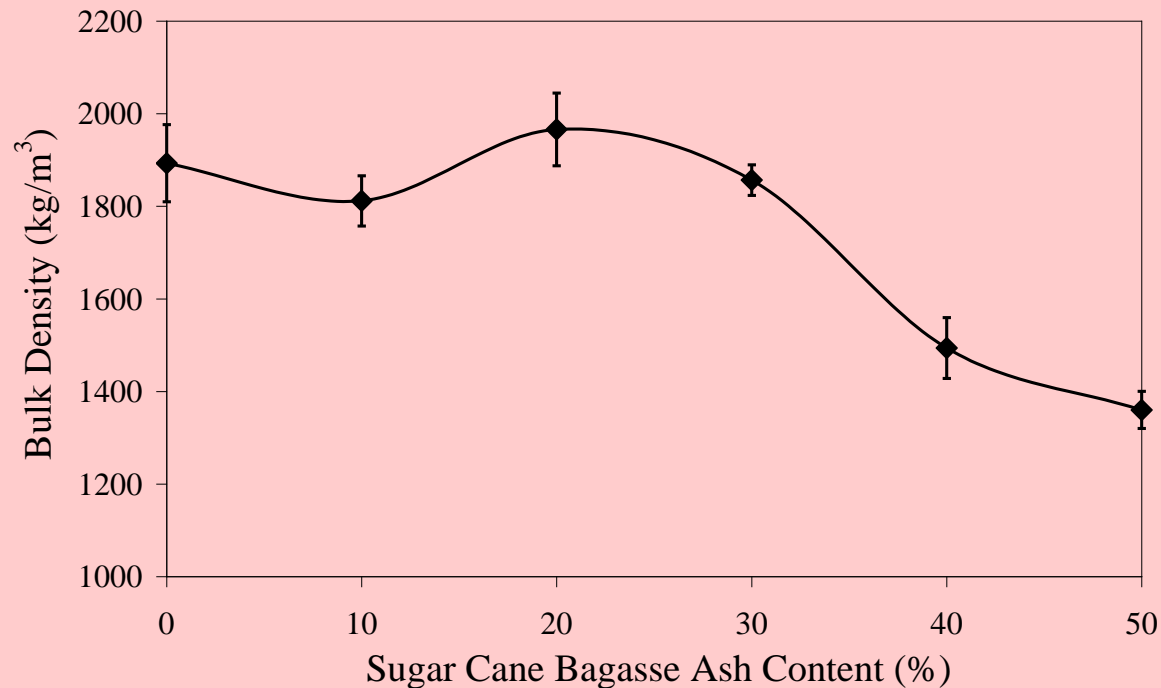
Variation of water absorption of SCBA bricks

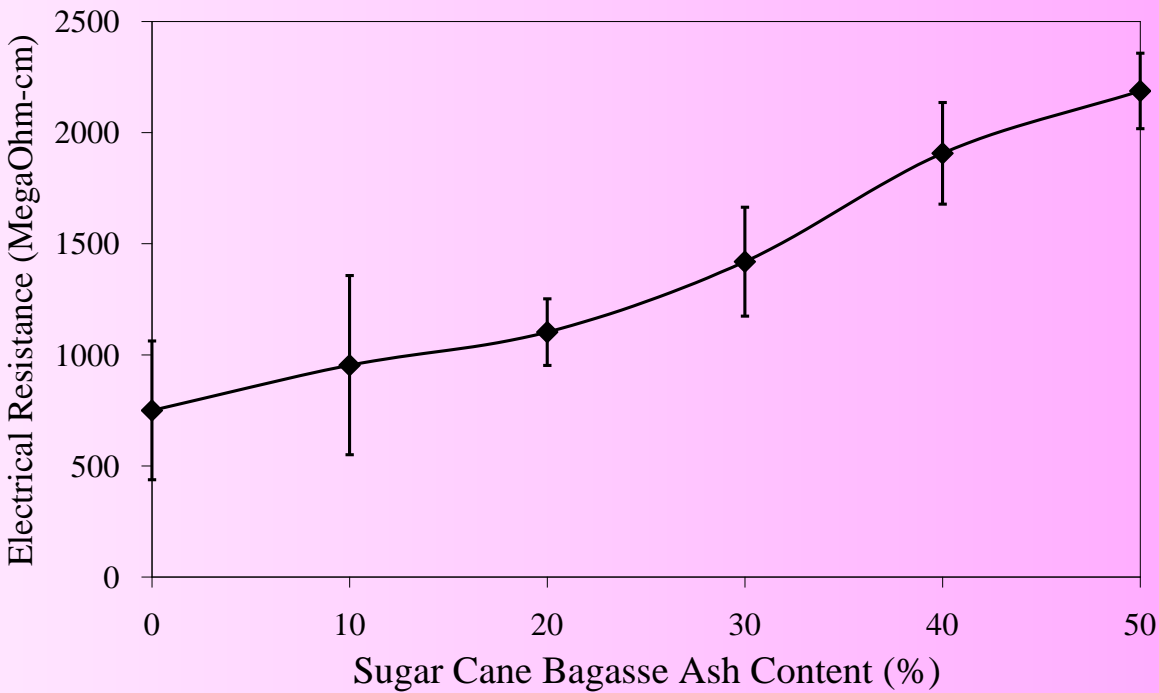




Variation of linear shrinkage of SCBA bricks

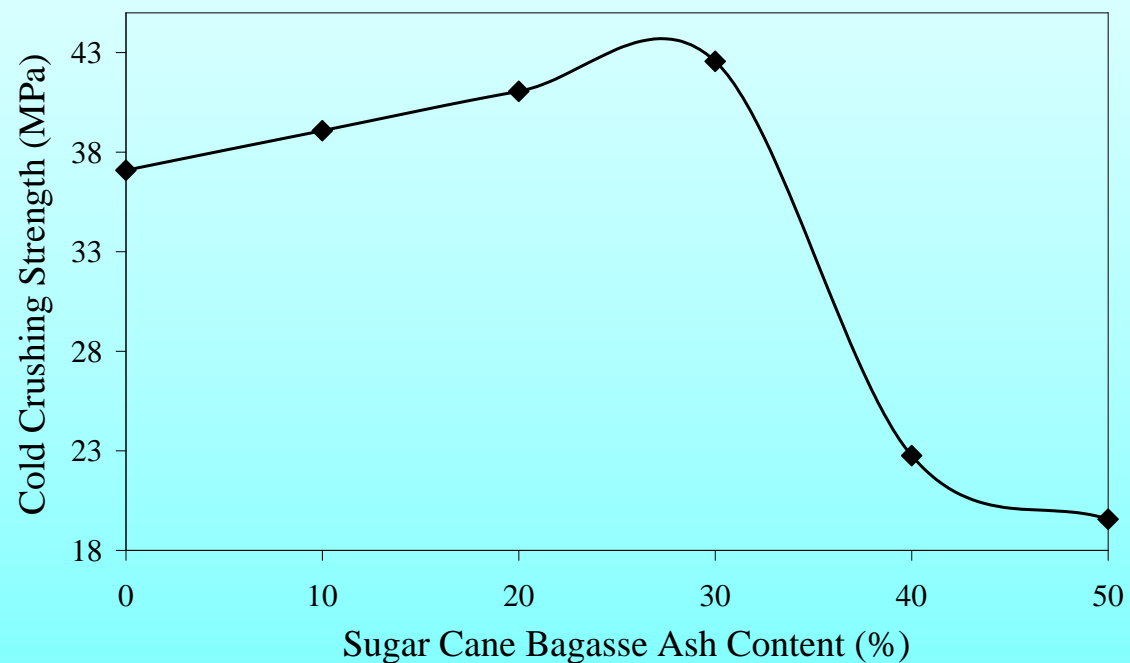
Variation of bulk density of SCBA bricks



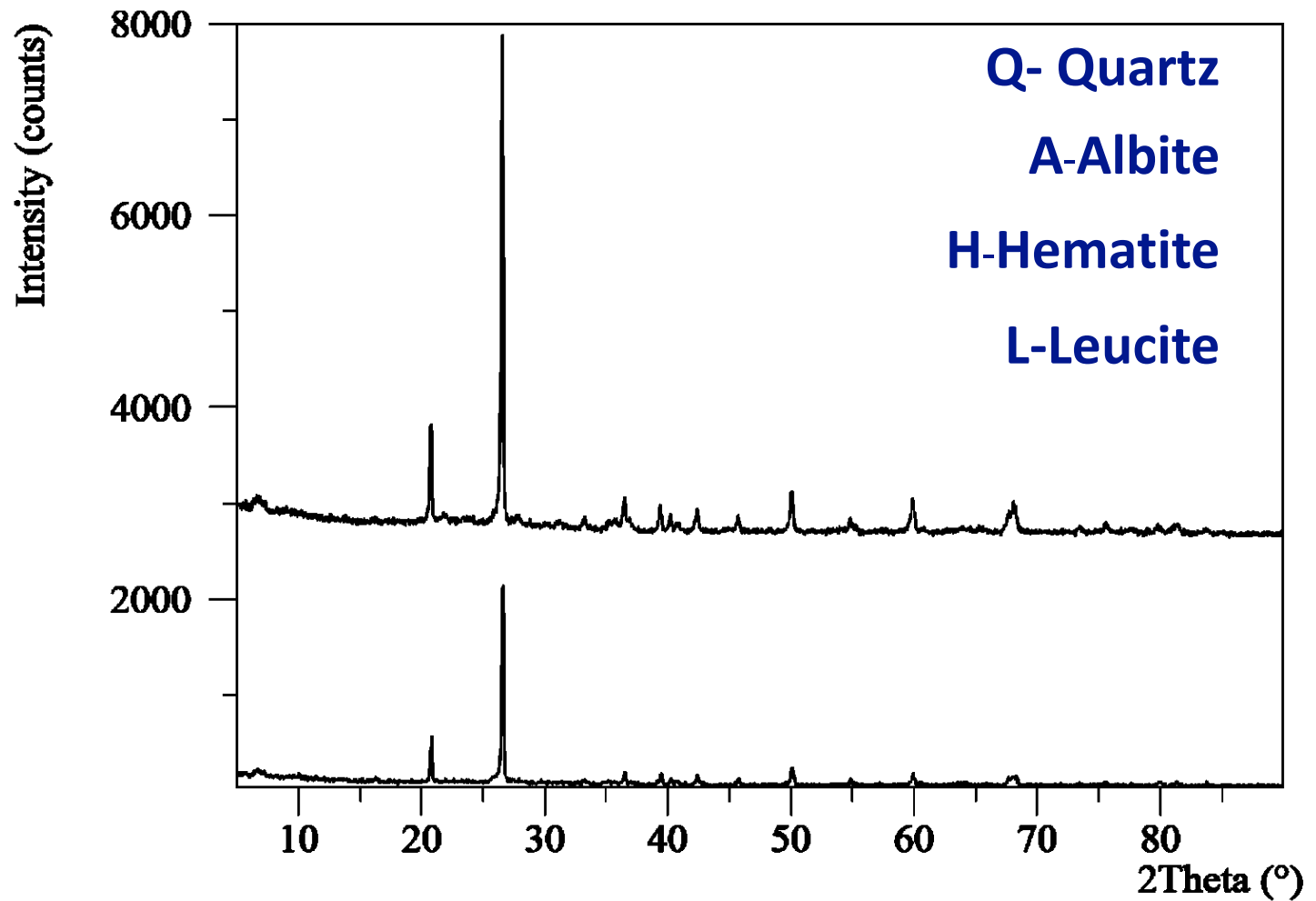


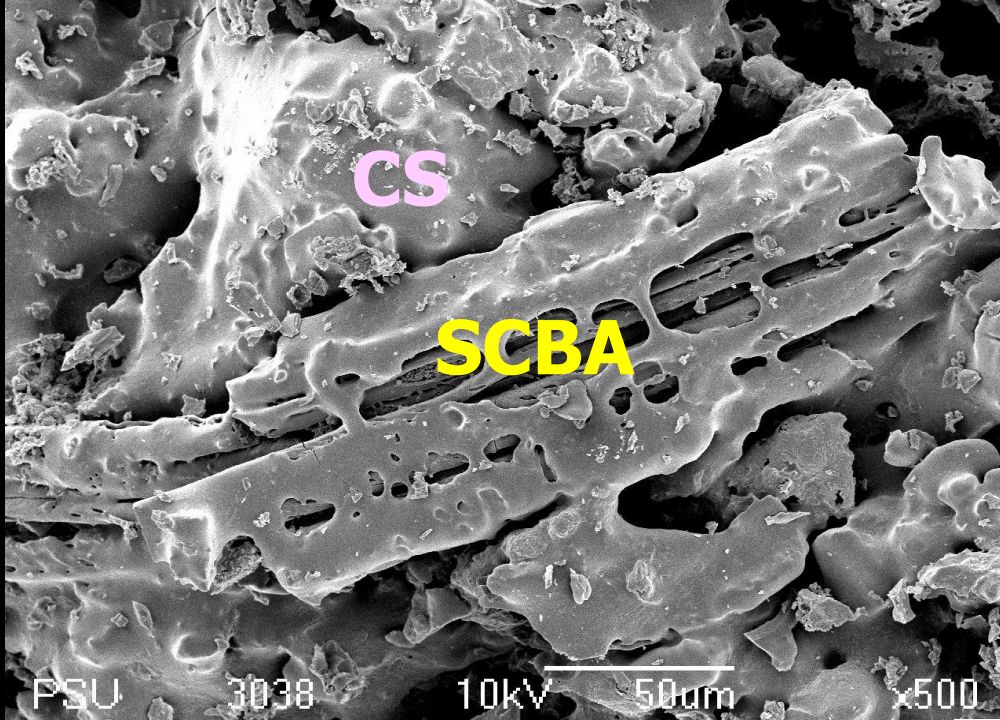
Variation of electrical resistance of SCBA bricks

Variation of cold crushing strength of SCBA bricks



X-ray diffraction patterns of brick SCBA30

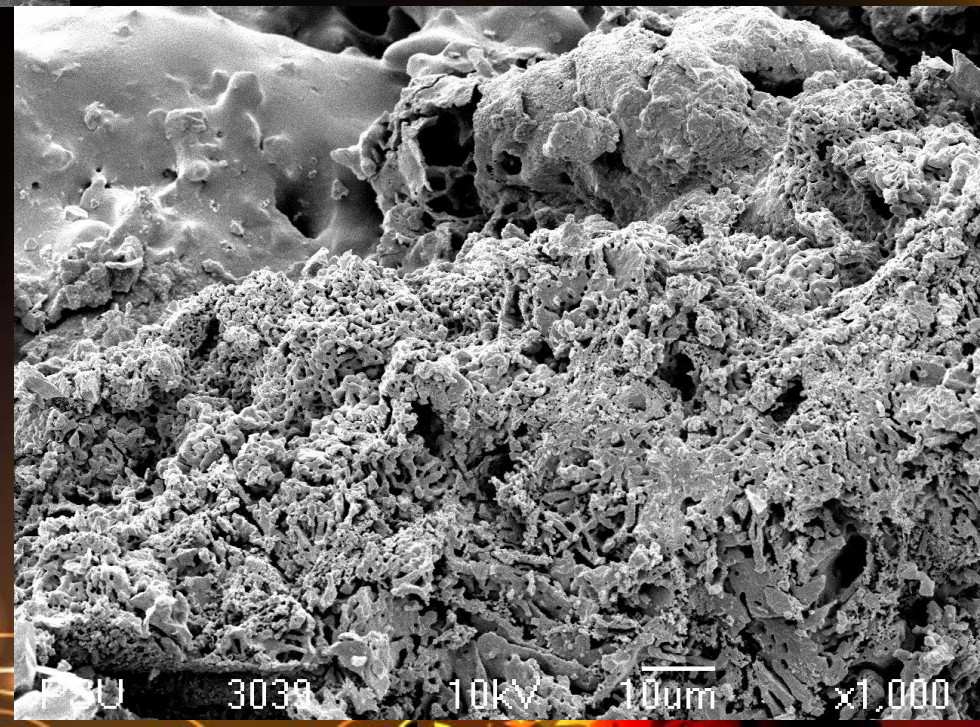




SEM
photomicrographs of
the fracture surface
of specimen SCBA30
sintered at 1,050°C

**SCBA residue with CS
matrices**

**varied irregular pores
in texture**



Conclusion

Regarding to the advantages of less firing shrinkage, less weight loss and greater compressive strength of SCBA–CS brick should stimulate the use of SCBA as a brick additive in the green material. It indicates that SCBA has potential as a material for brick components.

Based on the point of view, the energy-saving and maximum use of ash, it is apparent that mixture with 30% SCBA fired at 1,050°C was optimal for meeting the brick quality of Thai Industrial Standard.

The fired bodies after hydraulic hardening at a dried environment possess the highest values of mechanical strength. The resulting products have specific structure mainly composed of carbons and new formations of FeO, potassium and sodium silicates and aluminates as one crystals or amorphous phases. The new structure of CS/SCBA ceramics possess semihydraulic properties.

A scenic view of a resort with a lake, palm trees, and a large mountain in the background. The text "Thank you for your attention" is overlaid in the center in a pink, italicized font.

Thank you for your attention