

# Assessment on the Physical, Mechanical Properties and Leaching Behaviour of Fired Clay Brick Incorporated with Steel Mill Sludge

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## [1] ABSTRACT

- Clay was replaced with 0%, 5%, 10% and 15% of steel mill sludge (SMS) and fired at 1050°C (heating rate of 1°C/min)
- Few tests such as firing shrinkage, dry density, compressive strength and Toxicity Characteristic Leaching Procedure (TCLP) have been conducted
- The results showed that incorporation up to 15% of SMS have reduced the properties up to 27.3% of firing shrinkage, 8.1% of dry density and 67.3% of compressive strength
- The leaching behaviors of Zn and Cu from SMS were reduced up to 100% from 7414 to 9.22 ppm (Zn) and 16436 to 4.654 ppm (Cu) after incorporated into fired clay brick
- Therefore, recycling of steel mill sludge up to 15% into construction building materials not only alleviates the disposal problems but also promoting alternative for new raw materials in building industries.

## [3] RESEARCH AND DEVELOPMENT

### Parameter

### Results

- | Parameter                          | Results   |
|------------------------------------|---|
| Characterization                   | <ul style="list-style-type: none"> <li>The elements present in the steel mill sludge are almost similar to the clay soil</li> <li>Heavy metals concentration in SMS are much higher compared to clay soil with Zn (16436 mg/L), Cu (7414 mg/L), Pb (4391 mg/L), Sn (657 mg/L), Cr (351 mg/L) and Ni (104 mg/L)</li> </ul> |
| Physical and mechanical properties | <ul style="list-style-type: none"> <li>Firing shrinkage, dry density and compressive strength decreased with increasing percentage of SMS while initial rate of suction was increased</li> <li>The optimum percentage of SMS incorporated into fired clay brick during brick pro-</li> </ul>                              |
| Leaching test                      | <ul style="list-style-type: none"> <li>The parameters such as Zn and Cu were selected due to high concentration of heavy metals in raw SMS</li> <li>The leachate concentrations of heavy metals of all manufactured bricks were below the permissible limit set by USEPA</li> </ul>                                       |

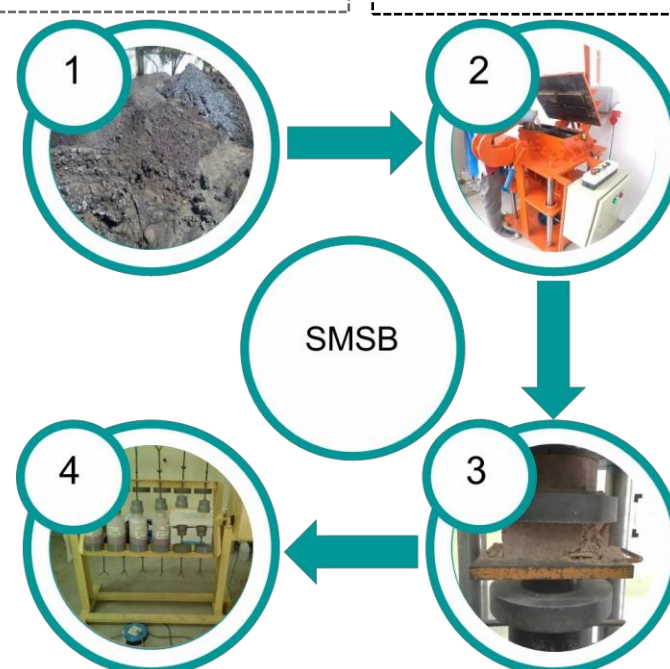
## [2] METHODOLOGY

### Raw materials preparation and characterization

- Clay soil
- Steel Mill Sludge (SMS)

### Brick manufacturing

- Control brick
- Steel Mill Sludge Brick (SMSB)



### Leachability test

- Toxicity Characteristic Leaching Procedure (TCLP)

### Physical and mechanical properties

- Firing shrinkage
- Dry density
- Initial rate of suction
- Compressive strength

## [4] CONCLUSION

### Outcome:

- Elements that present in steel mill sludge are almost similar to the elements in clay soil.
- Incorporation of 15% steel mill sludge is capable in improving a better physical and mechanical properties of brick as well as complied with the environmental standard of leaching procedure.
- Recycling of steel mill sludge into fired clay brick could serve as one of the desirable alternatives to replace the disposal method for the sludge while producing good quality brick.

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