



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student : GAURAV GOEL

Roll Number : 156104014

Programme of Study : Ph.D.

Thesis Title: **RECYCLING OF ORGANIC MATERIALS FOR PREPARATION OF FIRED BRICKS**

Name of Thesis Supervisor(s) : Dr Ajay Kalamdhad

Thesis Submitted to the Department/ Center : Civil Engineering

Date of completion of Thesis Viva-Voce Exam : 20 Sep 2018

Key words for description of Thesis Work : paper mill sludge, degraded municipal solid waste, fired brick, pore forming, recycling, sustainable development.

SHORT ABSTRACT

This doctoral research thesis presents and discusses the possible use of redundant organic wastes and low value compost for its full exploitation as a partial substitute to prepare sustainable and energy efficient masonry bricks. As a testbed to demonstrate this concept, this study made use of two soils (laterite and alluvial) and five different type of organic wastes (paper mill sludge (PMS), water hyacinth (WH), paper mill sludge compost (PMSC), water hyacinth compost (WHC), degraded municipal solid waste (DMSW)) as an additive and partial substitute to soil for making fired bricks. These waste types are selected because of their abundance and due to their properties being similar to soil. The incorporation of the aforementioned additives into brick making not only minimises the disposal problem but will provide the timely benefit of saving the precious fertile soil essentially critical for agricultural purposes.

The research was carried out in three stages. In the first stage, detailed investigation of integrating five different percentages of selected waste samples into fired bricks was done. The pre-production activities included mineralogical, chemical, thermal and index properties characterisation of two kinds of soils (laterite and alluvial) and all five types of wastes to analyse the structure-property relationship. Cuboid bricks with dimension 61 mmx29 mmx19 mm were formed using hand moulding. This size was scaled down from commercial available size of 230 mmx110 mmx70 mm (BIS:1077-1992). The performance of incorporating wastes into the mix was tested by evaluating physical properties of bricks such as linear shrinkage, compressive strength, water absorption, mass loss on ignition, and bulk density as recommended by the relevant Indian and ASTM standard codes. The effect of incorporating wastes into bricks on the energy consumption during the firing process was estimated at the laboratory scale. The leaching of toxic heavy metals from the brick body in order to address and evaluate the degree of environmental impact associated with waste amended bricks was conducted. Possible emissions that would evolve during the firing process of waste amended bricks were also measured. Based on this three-stage investigation, it is anticipated that this thesis will pave way for making our society more sustainable by green manufacturing of fired bricks.