FABRICATION OF LOW COST CLAY BRICKS FOR BUILDING INDUSTRY

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Clay bricks are one of widely used building materials all over the world. The majority of clay brick makers used conventional methods for brick making. Generally these conventional clay bricks are fired at temperatures 800 ^{0}C-1000 ^{0}C. The major cost of clay bricks is due to the firewood utilization in the firing process and hence the cost can be brought-down by reducing the firing temperature and also minimizing the utilization of labor. The broad aim of this project was to fabricate chemically harden clay bricks for building industry using suitable minerals commonly available in Sri Lanka. Manufacturing of clay bodies with strong bonding at low temperatures using inexpensive chemicals and minerals is a suitable approach in reducing the high demand for firewood in the brick industry. This will in turn help to prevent deforestation.

Commonly available red colour soil and pottery clay were used as the major raw materials whereas Eppawala mineral apatite (EMA), Eppawala rock phosphate fertilizer (ERP) and Red Earth Mineral (REM) were used as additives. In order to obtain appropriate plasticity, phosphoric acid solutions of 0.1M, 0.5M, 1M and 3M were used. EMA, REM were individually mixed with the soil and small scale brick samples were prepared by adding phosphoric acid to obtain plasticity where as water was used in the preparation of ERP added samples.

Since red colour soil is commonly available and has relatively high amount of Fe^{3+} ions compared to pottery clay, red soil was preferred in the production of samples with

different additive ratios while pottery clay was not subjected to that extend. All these samples were fired at three different temperatures such as 200 ^{0}C, 300 ^{0}C and 400 ^{0}C for one hour. The important physical properties, namely green and final density, drying and firing shrinkage, water absorption, compressive strength, bend strength, fracture toughness, material removal rate and impact energy of these brick samples were investigated. These properties were compared with those of unfired counterparts and conventional bricks made with the same soil and fired at 800 ^{0}C.

It was observed that the properties of samples fabricated using phosphoric acid and fired at lower temperatures were superior to those of conventional bricks. On the other hand, the ERP added bricks fired at 300 ^{0}C did not show any promising improvement. In the XRD patterns for the fired samples prepared with phosphoric acid, formation of new crystalline phases has been observed and they are compliance with the XRD peaks for the aluminum phosphate, iron phosphate and also with the magnesium phosphate. It was observed that the addition of phosphoric acid form bond with the Al^{3+}, Fe^{3+}, Mg^{2+} present in soil. In the scanning electron microscopy (SEM) of samples having better mechanical and physical properties, some needle shaped elongated grains were observed and subsequent Energy Dispersive Analysis of X-ray revealed that they are composed with Fe, Al, Mg, rich phosphate compounds. However in the SEM micrographs for ERP added samples and also in the conventional type samples this needle shaped elongated grains were not evident. This needle type elongated grains present in the samples may act as a reinforcement resulting high strength bricks.