

Study of Efflorescence on Different Types of Bricks and Determination of the Relationship between Degrees of Efflorescence and the Types of Bricks

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Abstract- The work presents a practical investigation on the degree of efflorescence on different types of bricks available. A relationship between the type of brick and degree of efflorescence is observed. The study is performed on five different types of total eight samples. For this purpose the general procedure for a brick production is followed by making two samples of customized brick from two different types of soil which include black soil and red soil. Other samples are readymade first-class, second-class and third-class bricks. The first-class brick is provided by the Department of Chemical Engineering, BUET, whereas the rest two samples are collected from two different brickfields in Gazipur (Bangladesh). The black soil and red soil is collected from brickfields in Savar (Bangladesh). The test of efflorescence is conducted according to Civil Engineering Standard. The degree of efflorescence is found lowest for first class brick, higher for second class and highest for third class. The customized two brick samples attained first class and second class properties and showed efflorescence accordingly. The whole experimentation is conducted at Corrosion Lab in Department of Chemical Engineering, BUET.

Keywords- Study, Efflorescence, Brick, Soil.

I. INTRODUCTION

Bricks are made of soils of various types. Brick consists of soluble salts in it. The evaporation of water from the hydrated salt on the brick to the air causes a powdery leftover or deposit on the surface; this is called the brick efflorescence [3]. The general color of it is white. Yellow and greenish deposits are also seen in many cases. It cannot be taken lightly as it can be a massive structural concern of weakness of the brick structure [6]. The occurrence of efflorescence is an action when there is a water soluble salt present in the brick masonry. When the water enters the porous brick spaces the salts get dissolved and the solution migrates out of the brick containing salts. After evaporation the water goes away but the salts remain on the surface as a powdery deposit [11]. The degree of efflorescence also depends on the salt content on the brick and the water solubility of that salt [4]. Because brick is made from clay, the salt content of brick actually depends on the salt content of clay. Thus the degree of efflorescence is directly related to the type of brick and type of soil [8]. Although while making bricks, proper firing has effect on the degree of brick efflorescence [13], the study only focuses on the relationship between degrees of efflorescence with type of brick. For this reason all the selected samples are ensured to be properly burnt brick.

The three main types of brick found in general are the first class brick, second class brick and third class brick [17]. The classification is based on the compressive strength of the brick and variation in type of clay [10]. A pair of sample for each type of brick is collected from brick fields. Test of efflorescence is conducted on them.

The two basic types of soil used for brick production in Bangladesh are Red soil and Black soil in local brickfields [15]. Red soil has iron-rich salts and Black soil contains phosphate or ammonia-rich salts [1]. Two soil samples are collected to make two customized brick and test of efflorescence is also conducted on them. The degree of efflorescence is found to be different on the different samples.

II. METHODOLOGY

Material Selection

Common building clay bricks are designated as BDS 208:2002 under the engineering products designated by BSTI [2]. Following materials are used for the experimental study:

- Each Pair of Sample for 1st, 2nd and 3rd Class Brick
- Two customized Bricks
- Distilled Water
- Custom Made Plastic Tray
- Custom Made Brick Frames
- Electric Furnace

Custom Made Plastic Tray

Four poly-tetra-fluro ethylene based tray are made from Carpentry shop, BUET. The dimension is , 40cm ×40cm ×12.5cm.

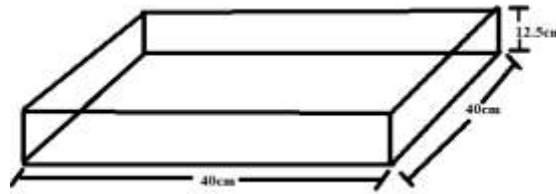


Fig.1: Sketch of Customized Tray for the Test of Efflorescence

Custom Made Brick Frames

Two wooden frames are made from Carpentry shop, BUET. They are used for the brick preparation from two different soil samples. The inner dimension is, 25cm × 12cm × 7.5cm. The wood thickness is 2cm.



Fig.2: Photograph of Customized Wooden Frame for Making Two Custom Brick Samples

Making of Custom Brick Samples

Following Procedures are followed to make two custom bricks [12].

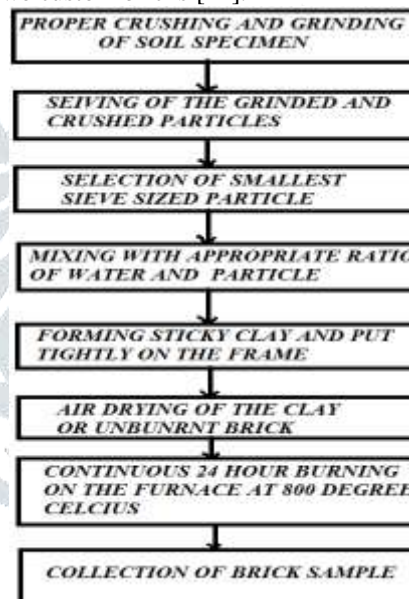


Fig.3: Steps for Preparation of Custom Bricks.

Test of Efflorescence

On total eight brick samples, efflorescence test is conducted according to the standard testing method [20] followed by Civil Engineering. The resulting procedure followed to the following guideline; [20]

RESULT	OBSERVATION
NIL	NO PERCEPTIBLE DEPOSIT OF SALT
SLIGHT	NOT MORE THAN 10% OF THE AREA OF THE BRICKS COVERED WITH A THIN DEPOSIT OF SALT
MODERATE	A HEAVIER DEPOSIT THAN UNDER "SLIGHT" AND COVERING UP TO 50% OF THE AREA OF THE BRICKS SURFACE BUT UNACCOMPANIED BY POWDERING OF THE FLACKING OF THE SURFACE
HEAVY	A HEAVY DEPOSIT OF SALT COVERING 50% OR MORE OF THE BRICKS SURFACE BUT UNACCOMPANIED BY POWDERING OF THE FLACKING OF THE SURFACE
SERIOUS	A HEAVY DEPOSIT OF SALTS ACCOMPANIED BY POWDERING OF THE FLACKING OF THE SURFACE

Fig.4: Result Writing Guideline for Efflorescence Determination.

Testing Conditions

The temperature and pressure maintained at ambient conditions inside the Corrosion lab. Distilled water was used in each case. Duration of the investigation was 60 days.

III. RESULTS AND DISCUSSIONS

After completion of the tests; the efflorescence results in the bricks are found and compared as follows;

TYPE OF BRICK	EFFLORESCENCE RESULT	TIME FOR STEADY STATE OF EFFLORESCENCE (DAYS)
FIRST CLASS	NIL	-
SECOND CLASS	MODERATE	25
THIRD CLASS	HEAVY	34
CUSTOM (RED SOIL)	NIL	-
CUSTOM (BLACK SOIL)	SLIGHT	22

Fig.5: A Comparison of Degree of Efflorescence Among the test Samples.

Comparisons of the Difference in Degree of Efflorescence

The first class brick shows no efflorescence as it is properly burnt [7], it has highest compressive strength [19] and the selected soil composition contains very negligible composition of salts [14] so the efflorescence is ‘Nil’ here. The custom (Red soiled) brick attained the property of first class brick and thus the result is also ‘Nil’ in this case. The reasons for change in degree of efflorescence (which is ‘Moderate’ and ‘Heavy’ for second class and third class bricks respectively) are the decreasing compressive strength and increasing salt content [16]. It is noted that the custom (black soiled) brick attained the property closer to second class brick by showing ‘slight’ efflorescence, although it is provided all of the same conditions that for custom (red soiled) brick, while preparing. These concur to the fact that red soil is better for brick making and black soil promotes more efflorescence [9].

Photographic Illustration of Selected Specimens and Various Phases of Efflorescence



Fig.6: Photograph Showing Selected Pair of First Class Brick with ‘Nil’ efflorescence



Fig.7: Photograph Showing a Customized Brick with ‘Slight’ Efflorescence on Red Marked Areas.



Fig.8: Photograph Showing Selected Pair of Second Class Brick with ‘Moderate’ Efflorescence on Red Marked Areas.



Fig.9: Photograph Showing Selected Pair of Third Class Brick with 'Heavy' Efflorescence.

IV. CONCLUSIONS

In this work a physical relation between degree of efflorescence and types of brick is developed. Brick is the mostly used construction material around the world. A proper brick will ensure a safe and well-built structure. This work will help in selection of brick for construction purposes.

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