USE OF KAOLIN AND BEIGE BAHIA MARBLE RESIDUE IN THE PRODUCTION OF CERAMIC TILES

[(1)]Jander L. Fonseca, [(1)]Talita F. C. Gentil, [(1)]Jonei Marques da Costa, [(2)]Naedja V. Pontes, [(3)]Raimison B. de Assis, [(1)]Tércio G. Machado

[(1)] Instituto Federal de Educação, Ciência e Tecnologia da Bahia – IFBA/Jacobina
[(2)] Instituto Federal de Educação, Ciência e Tecnologia do Piauí – IFPI/Paulistana
[(3)] Instituto Federal de Educação, Ciência e Tecnologia da Bahia – IFBA/Santo Amaro

1. ABSTRACT

The proposal of this work is to use the tailings from the processing of kaolin and Bahia beige marble in the production of ceramic tiles. In this study the mineral residues were characterized by fluorescence and X-ray diffraction, and different formulations of these residues were prepared. Samples were compacted in a uniaxial press with a pressure of 3 MPa, then identified and placed in an oven for 24 h at a drying temperature of 110ºC. They were then fired at 850° C and 900° C for 60 minutes at a heating rate

of 10°C/min. After firing, the technological tests of Water Absorption - AA, Apparent Porosity - PA, Linear Shrinkage - LS and resistance to flexion at three points were performed. The preliminary results suggest that it is possible to incorporate these residues in formulations for tile manufacture, obtaining a product with higher physical properties than those observed in ceramic bodies with only kaolin residues.

2. INTRODUCTION

The extraction of Beige Bahia marble, known as Travertino Nacional marble, started from the use of rock as a Portuguese stone for paving in the 1950s. It was later extracted in the form of blocks for cutting slabs and effectively used as marble. [1]

In the region of Piedmont da Chapada, the extraction of Bahia Beige blocks takes place particularly in the city of Ourolândia, processing being performed in the city of Jacobina-BA. During the extraction of this mineral (marble), environmental impacts occur, such as the discharge of liquid effluents from rock washing, maintenance of equipment, maintenance of the local structure, the removal of vegetation cover from the soil that contributes to the increase of solids concentration. turbidity of the waters due to the carriage, especially in the rainy season. Inadequate disposal of tailings piles also favors silting of the watercourses and obstructions of springs. [2,3]

In the state of Rio Grande do Norte, the largest concentration of companies that work in the extraction and processing of kaolin is found in the municipality of Ecuador. Coarse solid waste from kaolin is deposited in piles that extend, depending on production, over a large area of the company, which is reserved exclusively for depositing this material. [5]

The purpose of this work was to use the Beige Bahia marble waste from the city of Ourolândia - BA and the kaolin waste from the city of Equador - RN, for incorporation into the ceramic body for tile manufacture.

3. EXPERIMENTAL AND MATERIALS

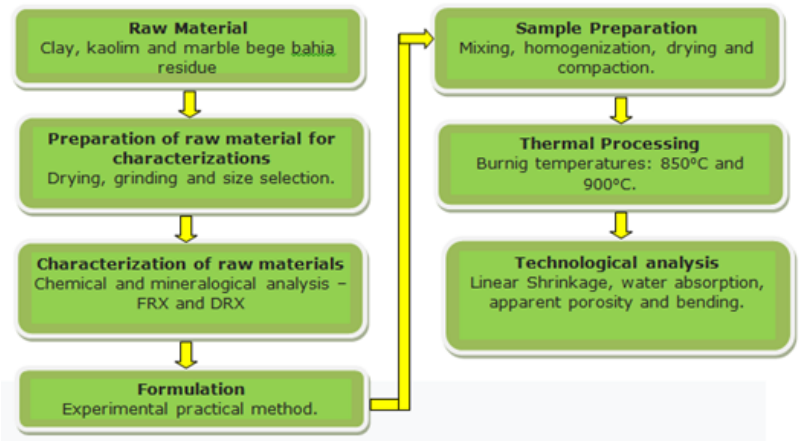

Figure 1 *- Flow chart for the production of ceramic tiles with kaolin residue and Bahia beige marble.*

Sample Formulation

SAMPLE NOMENCLATURE	CLAY (%)	KAOLIN RESIDUE (%)	MARBLE BEIGE BAHIA RESIDUE (%)
A	80	10	10
B	75	10	15
C	70	10	20

Table I - *Composition and nomenclature of the formulations.*

4. RESULTS AND DISCUSSION

Characterization of raw materials

Elements	Clay (%)	Kaolin Residue (%)	Marble Beige Bahia Residue (%)
SiO_2	56,14	70,36	5,79
Al_2O_3	32,33	19,20	1,04
Fe_2O_3	6,41	4,07	0,34
K_2O	1,76	5,32	0,48
TiO_2	0,96	0,19	0,08
CaO	0,38	-	82,02
SO_3	0,22		-
MgO	1,40	-	9,70
MnO	-	0,14	-
Cl	-	-	0,44
Others	0,40	0,72	0,11

Table 1 - *Chemical analysis of clay in nature, kaolin and beige Bahia marble residues.*

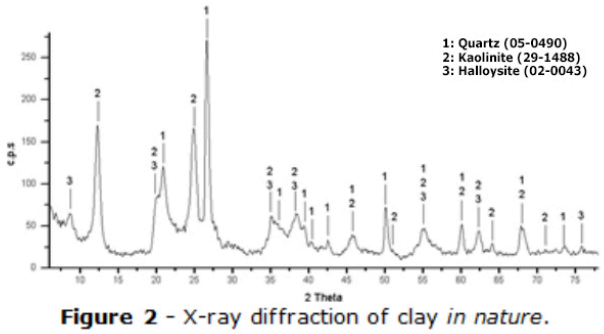

Figure 2 - X-ray diffraction of clay *in nature*.

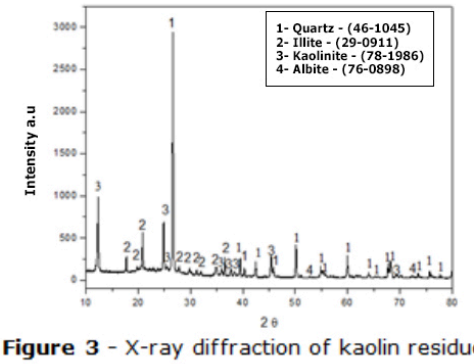

Figure 3 - X-ray diffraction of kaolin residue.

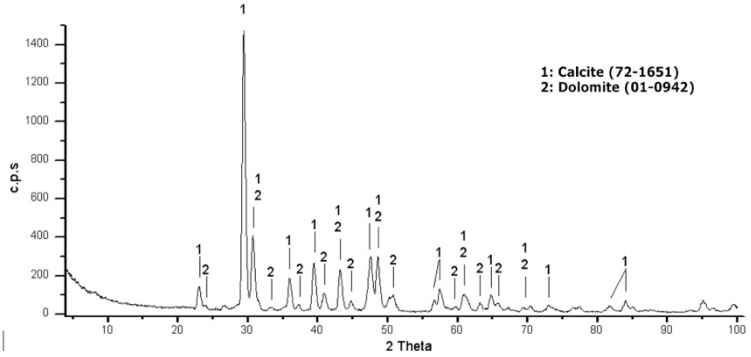

Figure 4 - X-ray diffraction of Bahia beige marble residue.

Technological Tests

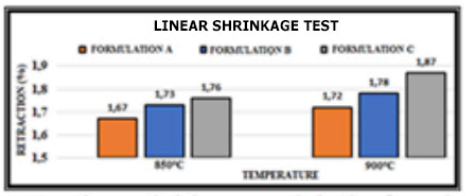

Figure 5 – Linear shrinkage graph in the formulations.

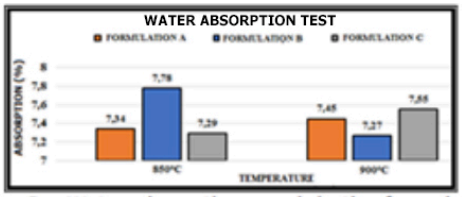

Figure 6 – Water absorption graph in the formulations.

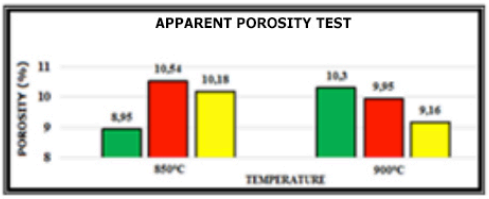

Figura 7 – Apparent porosity graph in the formulations.

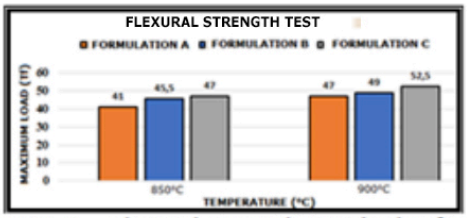

Figure 8 – Flexural strength test in the formulations.

5. CONCLUSIONS

The results of the technological tests show that the incorporation of Bahia beige marble residue and ceramic kaolin residue does not significantly affect the technological properties of the final product and can be used as a substitute for calcite in ceramic formulations. The results indicate that the use of these residues in the ceramic body for ceramic tile manufacture, as well as in blocks, tiles and other ceramic products is interesting. In addition, the disposal of these residues in the environment is reduced and, consequently, the environmental impact caused by the exploitation of ornamental rocks in the plateau diamantine region.

6. REFERENCES

[1] ABC – Associação Brasileira de Cerâmica, In: Cerâmica do Brasil – Anuário Brasileiro de Cerâmica. In: Associação Brasileira de Cerâmica, São Paulo, 2002.

[2] BRAGA, B. *et al*. Introdução à Engenharia Ambiental: O desafio do desenvolvimento sustentável. Pearson Education do Brasil, São Paulo, 2ª Edição, 2005.

[3] R. R. Menezes *et al*. Utilização do resíduo do beneficiamento do caulim para a produção de corpos mulíticos. Revista Cerâmica, São Paulo, v. 53, n. 328, p.388-395, out./dez. 2007.

[4] MONTEIRO, F.M. Efeito da adição de resíduos de caulim e quartzito em massas cerâmicas para revestimento. Programa de Pós-graduação em Eng. Mecânica– PPGEM, UFRN. Tese de doutorado. Natal-RN, 2017.