THE USAGE OF FLINT POWDER IN THE FLOOR TILE BODY

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1. INTRODUCTION

The name of flint (SiO_2) derives from the Latin, meaning "hard stone". It is used for microcrystalline silica and generally synonymous with chert and silex [1]. The density of flint is ~2,7 g/cm^3 and Mohs hardness is 7-8 [2]. Economic flint occurrences in Turkey are observed in the line of Çanakkale and Balıkesir cities. The domestic market uses the flint stone produced here, while the majority of production is being exported.

The aim of this study, to show the usability of flint powder instead of silica sand. For this purpose, 2%, 4%, 6%, 8%, 10% by weight of flint powder were added to the body. Some important parameters of the bodies containing flint powder additions were compared with the body composition being used at present. XRD, DTA, size distribution analysis were used to characterise the bodies; electron micrographs were taken of the flint powder. All these analysis have shown a convincing resemblance between the tested materials.

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[1] Kearey, P., Dictionary of Geology, Penguin Books, 1996.

[2] «Ceram Research Test Report», *Various Tests on Silex Cryptocrystalline Silica from Turkey,* Diciembre 1993, Ref: RB/NS/MC93/265/A.

2. PROCEDURE

Flint powder is the material that emerges during the rounding process in the silex lined mills of flint pebbles. The raw materials tested in this study are Istanbul clays and sand, Çine feldspar, Çanakkale kaolins and flint powder. The raw materials used in this study were prepared and tested in Kalebodur Seramik R&D laboratories. The required grain size distribution for ground raw material is ~ 97% at 63 μm. Tablets were pressed with this size distribution under 400 kg/cm^2 on a laboratory type press. The diameter of the tablets was 5 cm. and they were fired at 1180 °C, which is normal production temperature. The chemical analysis of flint powder used in tests and proportion of raw materials are given below.

L.I.	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	CaO	MgO	Na_2O	K_2O
0,52	98,12	0,76	0,26	0,10	0,08	0,08	0,04	0,04

Table 1. *Chemical analysis of flint powder.*

	CURRENT COMP.	COMP. 1	COMP. 2	COMP. 3	COMP. 4	COMP. 5
KAOLIN 1 (%)	12	12	12	12	12	12
KAOLIN 2 (%)	22	22	22	22	22	22
FELDSPAR (%)	6	6	6	6	6	6
SAND (%)	10	8	6	4	2	-
CLAY (%)	12	12	12	12	12	12
CLAY (%)	38	38	38	38	38	38
FLINT POW. (%)	-	2	4	6	8	10
TOTAL (%)	**100**	**100**	**100**	**100**	**100**	**100**

Table 2. *The proportion of the raw materials.*

RESULTS

Figure 1 and 2 show shrinkage behaviour and water absorption of body against flint powder and temperature. In Figure 1, shrinkage value increases while temperature is increased; on the other hand, increasing the amount of flint powder, decreases the shrinkage. In Figure 2, temperature values and the amount of flint powder change in inverse proportion. For a normal production temperature of 1180 °C, the water absorption values just exceed 3% limit value for 8% and 10% flint powder.

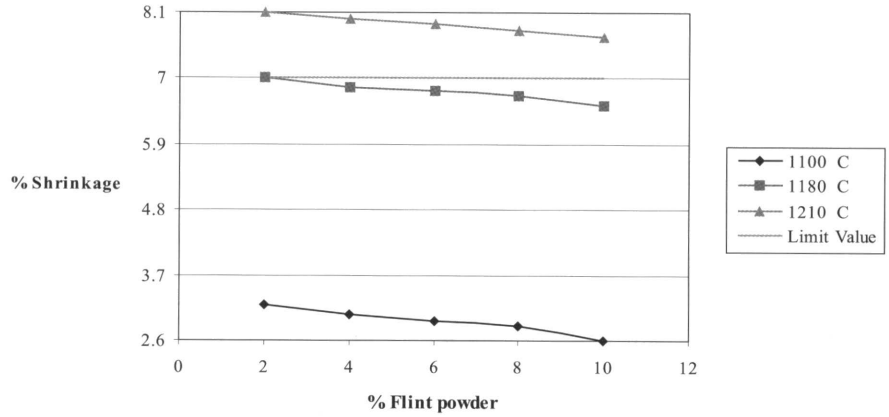

Figure 1. *Variation of shrinkage with flint powder and temperature.*

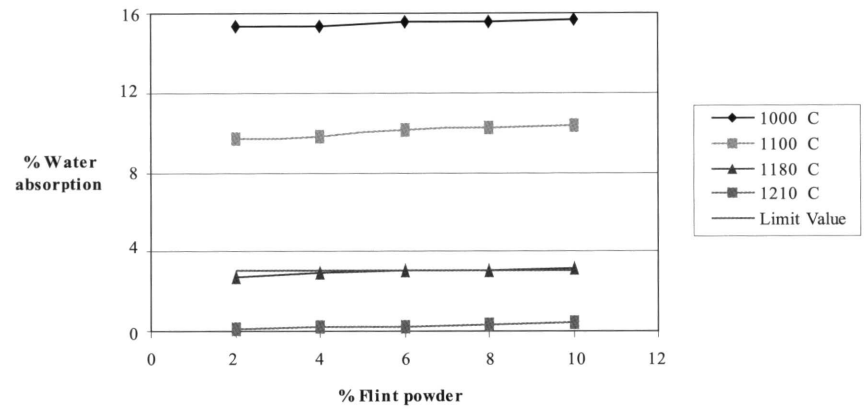

Figure 2. Variation of water absorption with flint powder and temperature.

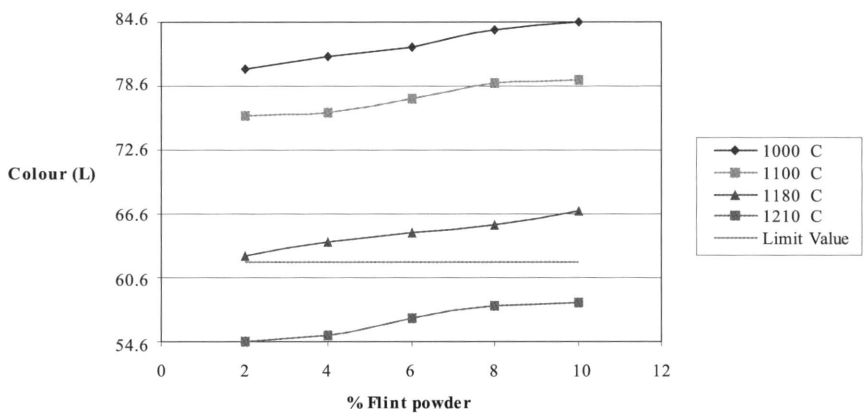

Figure 3. Variation of colour (L) value with flint powder and temperature.

In the Figure 3, the important parameter, colour (L) change is shown with the flint powder percentage and temperature. Figure shows that, increasing temperature makes the colour (L) of the body darker. In contrast, higher amounts of flint powder make the body colour (L) lighter. Under normal production temperature, the colour (L) value is 62,6 against 2% added flint powder. When the amount of flint powder approached 10%, the colour value of body reached 66,89. The colour of the body fired at 1210 oC, was blow the required colour (L) value of 62.

The fact of not needing special equipment to produce flint powder is a serious advantage. Flint powder is the waste material from the flint grinding process. Using this sort of material both dramatically decreases production cost and supports environmental protection. The common use of the raw material that have high silica content in ceramic industry implies another advantage for flint powder. In addition, from the viewpoint of unwanted constituents, it provides the required specifications such as enough low Fe_2O_3, TiO_2 and CaO content. In Turkey, the proportion of raw material cost and transportation cost to general production cost in a plant is getting higher. Therefore, supplying cheaper raw material with cheaper transportation costs is a vital problem for plants. Flint powder with its extremely low production and transportation costs meets the plant expectation. With all these specifications flint powder is suitable for use in floor tile bodies.

ACKNOWLEDGEMENTS

The authors would like to thank to Dr.Süleymen Bodur and Hasan Bodur for their support given to research and development activity. Also thanks to A.Kadir _en for their contribution and valuable assistance.