

MINERALOGICAL AND TECHNOLOGICAL PROPERTIES OF THE ESKİŞEHİR SEPIOLITE (TURKEY), AND ITS USAGE POSSIBILITIES AS ENSTATITE-BASED WALL TILE PRODUCTION

Kağan KAYACI¹, Ş. Can GENÇ^{1,2}, Yıldız YILDIRIM¹

¹ Kaleseramik Research & Development Center, Çanakkale, Turkey.

² İstanbul Technical University, Dept of Geological Engineering, Maslak-İstanbul, Turkey.

1. ABSTRACT

The Eskişehir sepiolite occurs in the lacustrine sediments, alternating with the montmorillonite and the dolomitic carbonates. There are different zones, which vary from pure sepiolite to dolomite-bearing sepiolite or sepiolite-bearing dolomite within the succession. According to XRF results, MgO, SiO₂ and the LOI are the dominant constituents. The Eskişehir sepiolite was used in different ratios instead of the common clays which are used in the ceramic tile production. The major mineral phases of the fired bodies were enstatite, anorthite and $\pm$ amorphous components. No technological discrepancies were observed in the fired bodies. As a result, sepiolitic clays can potentially be used instead of traditional plastic clays in wall tile compositions at a maximum rate of 10%.

2. MATERIALS

The sepiolites (Sep-A, Sep-B) used in this study were obtained from the Eskişehir-Sivrihisar (Turkey) region, the kaolin and clays came from Ukraine, and marble from Çanakkale-Çan (Turkey) region. The oxide compositions of the raw materials are shown in Table 1.

	L.O.I.	SiO ₂	Al ₂ O ₃	TiO ₂	Fe ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O
Sep-A	21.48	43.12	7.90	0.62	2.61	8.00	14.22	0.26	1.43
Sep-B	33.71	24.68	1.74	0.20	0.44	15.6	23.04	0.12	0.18
Marble	44.02	0.65	0.34	0.01	0.05	55.02	1.06	0.05	0.04
Kaolin	65.40	62.23	22.30	1.10	0.23	0.29	0.14	0.26	1.11
Clay	8.78	56.70	24.23	1.05	2.34	0.69	1.04	0.19	2.04

Table 1: Chemical analysis results of the selected samples.

3. COMPOSITION STUDIES

The standard wall tile body consists of marble, kaolin and clay, and the raw material usage rates are given in Table 2. In the study, body recipes were prepared by using sepiolite A and B instead of 3, 5, 10, 20, 30 and 40% Clay, and group A and B compositions were formed as a function of the sepiolite addition rates.

Sample	STD	A-3	A-5	A-10	A-20	A-30	A-40
Sep-A		3	5	10	20	30	40
Marble	12	12	12	12	12	12	12
Kaolin	38	38	38	38	38	38	38
Clay	50	47	45	40	30	20	10

Sample	STD	B-3	B-5	B-10	B-20	B-30	B-40
Sep-B		3	5	10	20	30	40
Marble	12	12	12	12	12	12	12
Kaolin	38	38	38	38	38	38	38
Clay	50	47	45	40	30	20	10

Table 2. Developed Wall Tile Recipes

4. RESULTS

In the optimum usage rate of sepiolite (10%), the measured moisture expansion was 0.022 and 0.019 in recipes A-10 and B-10, and it was determined that it was far below the critically predicted level, especially for large size (30x60cm, 25x75cm, 30x90cm etc.) wall tiles. The L^* value of the bodies tends to increase depending on the sepiolite ratios.

The rapid firing behavior curves of standard and sepiolite-added bodies indicated that the temperature values at which sintering occurs the fastest are 1006°C in the standard body, 861°C in the bodies with sepiolite addition (40%). When evaluated from this point of view, it was determined that the addition of sepiolite instead of clay in the body composition of the wall tile reduces the sintering point of the body.

XRD analysis of the standard and test bodies (Fig 1) shows that a significant amount of residual quartz is observed in all of the bodies. In addition, anorthite and enstatite phases were detected. With the increase in sepiolite, an increase in anorthite and enstatite phases and a decrease in quartz and glassy phases were observed.

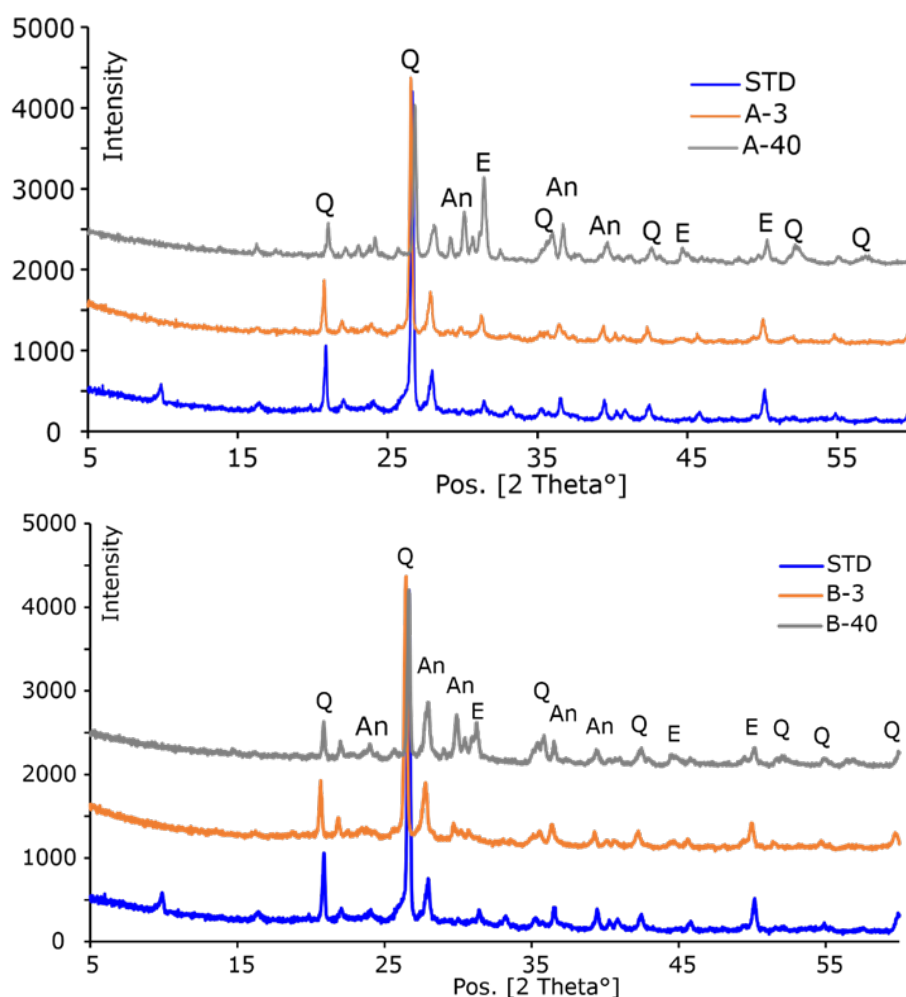


Figure 1. XRD analysis of the standard body and test bodies with Sepiolite-A and Sepiolite-B additions (An: Anorthite, Q: Quartz, E: Enstatite).

5. CONCLUSIONS

In this study, the usability of sepiolite instead of clay in wall tile bodies and its effects on wall tile technical properties were investigated. It was determined that the final product properties are in accordance with TS EN 14411 standards in cases where the sepiolite addition does not exceed 10% in the wall tiles. In light of all these physical and thermal properties, it was concluded that the controlled use of sepiolite up to a maximum of 10% instead of clay in wall tile body compositions is appropriate