STUDY OF THE INFLUENCE OF THE USE OF SOLID WASTE FROM PORCELAIN TILE POLISHING IN THE SINGLE-FIRE PROCESS

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INTRODUCTION

A great drawback to the porcelain tile production process is the waste that arises from the polishing stage. There have been many attempts to use these wastes, which have been very difficult to recycle. The present study was undertaken to find an economic and ecological solution to these potential pollutants.

CHEMICAL ANALYSIS OF THE SOLID WASTE.

Oxide	%
SiO_2	61.1
Al_2O_3	14.1
Fe_2O_3	1.3
CaO	0.5
Na_2O	1.5
K_2O	4.1
MgO	6.3
TiO_2	6.3

Oxide	%
SO_3	0.4
Cl	0.9
ZrO_2	2.0
HfO_2	0.1
BaO	0.1
Cr_2O_3	<0.1
MnO	<0.1
L.O.I.	6.7

CONDITIONS USED

- 2, 4 and 6 % of the solid waste from the polishing branch was added to a standard single-fire formulation (STD).

- Milling was run in laboratory horizontal mills with a capacity of 5.5 litres and a reject of 4,9 to 5,3 % on a 63 μm mesh screen.

- Pressing was performed on a laboratory press with a pressure of 250 kgf/cm^2 and 7 % moisture content.

- The test specimens were fired in an industrial kiln at a temperature of 1115 °C and cycle of 50 minutes.

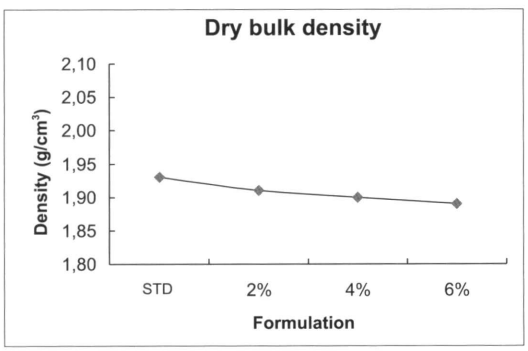
TESTED FORMULATIONS.

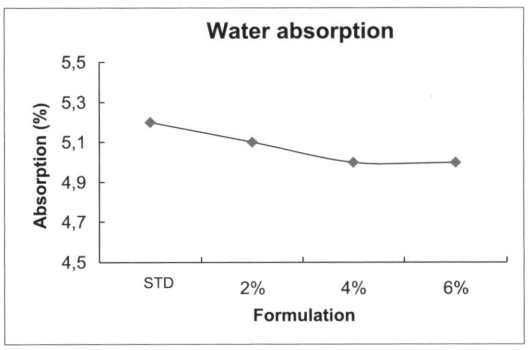
Raw Materials	STD	2 %	4 %	6 %
Single-fire formulation	100%	100%	100%	100%
Polishing waste	-	2/100	4/100	6/100

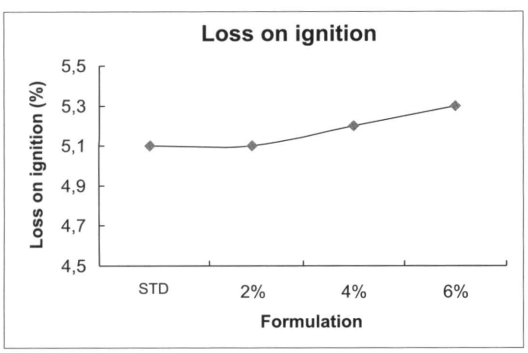
RESULTS OBTAINED.

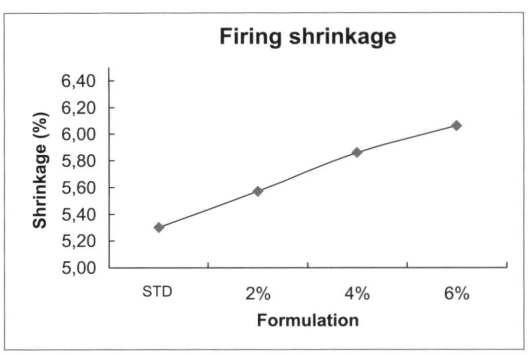
FORMULATION	STD	2 %	4 %	6 %
Milling time (min.)	26	26	26	26
Milling reject on a 63 μm screen	5.2	4.9	5.3	5.3
Pressing moisture content (%)	6.9	7.0	7.5	7.2
Dry bulk density (g/cm^3)	1.93	1.91	1.90	1.89
Dry mechanical strength (Kgf/cm^2)	28	28	22	21
Firing shrinkage (%)	5.30	5.57	5.86	6.06
Water absorption (%)	5.2	5.1	5.0	5.0
L.O.I. (%)	5.1	5.1	5.2	5.3
Fired mechanical strength (Kgf/cm^2)	321	350	339	343
Thermal expans. (25,325°C)(x10^{-7}/°C)	69.6	69.7	70.9	70.8
Black core	Low	Medium	Medium	Medium
Firing kiln	Explorer	Explorer	Explorer	Explorer
Peak firing temperature (°C)	1115	1115	1115	1115
Firing cycle	50 min.	50 min.	50 min.	50 min.

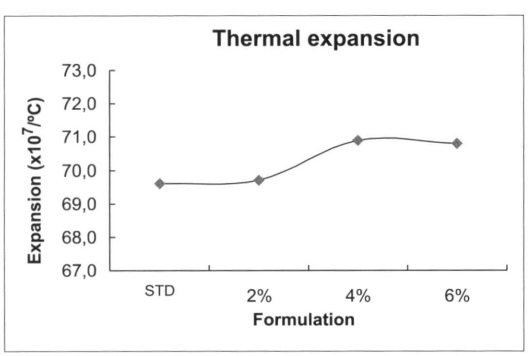
RESULTS OBTAINED.

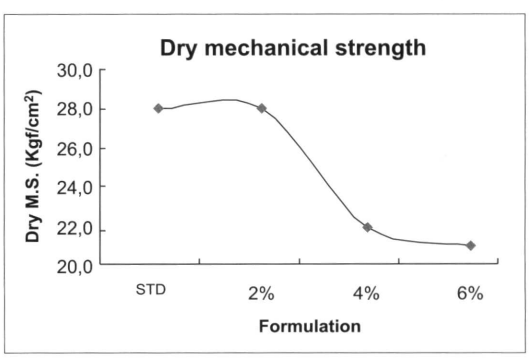












DISCUSSION OF RESULTS

- The solid waste was found to contain a high percentage of MgO from the abrasives used in polishing.
- A reduction was observed of compaction with the rise in the quantity of solid waste in the formulation.
- Firing shrinkage increased.
- Water absorption decreased in all the formulations.
- Thermal expansion tended to rise.

CONCLUSIONS

The results obtained indicate that the use of solid waste from porcelain tile polishing is not feasible for the single-fire process, owing to the rise in black core. There would also be a rise in firing shrinkage and a drop in bulk density, which entails a reduction in dry mechanical strength.