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PAPER MILL SLUDGE AND GLASS CULLET AS MATERIALS FOR TILE PRODUCTION

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Abstract

Europe produces about 1.3 billions tons/year of special sludge, principally due to manufacturing industries, minerals treatments and others. These data show the severe impact of these materials on the environment and drive all public administrations to favour new processes capable to lessen them. Sludge processing and reuse must be seen as a way to transform these materials from a problem, as they actually are, to a resource. Waste processing and reuse is, in fact, an alternative to the finding new landfill void spaces available for waste disposal.

A possible way to reduce the sludge impact on environment is to process and transforming them into raw materials for the ceramic industry. By a ceramic process, i.e. sintering at high temperatures, it is possible to obtain semi-vitreous products unable to release most of the hazardous elements contained in the starting materials. In the present investigation, paper mill sludge was subjected to a previous thermal treatment and then blended by attrition milling in different proportions with glass cullet to obtain powders of different composition.

Powders were pressed into specimens which were air sintered at temperatures as close as possible to the softening point by means of a muffle furnace. Powders were then pressed into tablets and submitted to thermo-dilatometric tests to evaluate shrinkage and softening temperatures on heating up to 1280°C.

Water absorption, density, strength, hardness, fracture toughness, XRD and SEM images were also examined.

The mechanical properties of some sintered specimens are fairly good due to the formation of small grains that, in some cases, are embedded into a vitreous matrix. It was observed that, although the shrinkage on firing is too high for the production of tiles, in all the compositions investigated the sintering procedure leads to fine microstructures and good mechanical properties.

Owing to the low content of hazardous elements in the starting powders (< 50 ppm), and considering that the sintering procedure is effective in the inertization of most of heavy metals ions, no elution tests were done on the sintered materials.

Finally, we point out that, using waste materials and following a simple technological procedure, paper mill sludge and glass cullet can be recycled into ceramics thus preserving environment from waste products.