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Ornamental stone sludge recovery as thermo-eco mortar for plaster.

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Ornamental stone sludge deriving from cutting processes is a topical issue at National and International level. The primary objective of the European Directive 2006/21/EC is to minimize the production of waste, generated by mining industry and encourage its recovery by means of recycling, reuse or recovery operations. The identification of best practices for the recovery of raw materials is one of the goal for circular economy concept.
The main problems of ornamental stone sludge are related to physical and chemical characteristics: heavy metals concentration, due to cutting tools wear, very fine particle size distribution, and huge volume in limited areas. The research aims to exploit the physical and chemical characteristics of the sludge for their proper recovery, thus minimizing waste and bringing economic and environmental benefits to the companies that produce this waste.
From literature few studies were carried out on reuse of sawing sludge as a plaster. Husam D. Al- Hamaiedeh and Waleed H. Khushefati, in 2013, have studied the reuse of sludge deriving from the cutting of granites as an additive for mortars and concrete cement. Pierucci A. et al, in 2007, investigated the reuse of sludge deriving from the processing of marble in mortars and plasters for the restoration of buildings.
In this context the sludge deriving from the cutting of Piedmont silicate rocks is to be reused in substitution of the sands and fine particle normally used to produce plasters. For this purpose the Luserna stone sludge processed with diamond blade and diamond wire, with a low concentration of metals, and Luserna stone sand deriving from flaming process, was chosen. What we want to achieve is a lightened thermal eco-plaster.
The first step concern the sludge characterization: particle size distribution, specific gravity, chemical analysis, leaching test, SEM and XPRD analysis and magnetic separation to identify the metals concentration.
The second step foresees the development of the eco-mortar for plaster mix design and its characterization by means of different tests carried out according to UNI EN 988-1 (Technical specifications for mortar for masonry work. Part 1: Mortars for internal and external plasters). The performed test are as follow: bulk density of fresh mortar, spreading test, dry bulk density, flexural and compressive strength before and after freeze and thaw cycle, definition of compressive strength class and category, adhesive strength (pull out),thermal conductivity at 15 and 68 days of maturation and in dry condition, resistance to salts crystallization cycle, water absorption before and after freeze and thaw cycle and salt crystallization cycle, chemical analysis and leaching test and SEM analysis on final product.
Sawing sludge deriving from the processing of Luserna stone has improved the rheological, thermal and physical performance of the environmentally friendly plaster, conferring a light macroporous cellular structure by means adding organic foam, thus facilitating its installation even for high thicknesses.