Ornamental stone cutting processing and sludge production evaluation with the goal of ending waste.

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The End-of-waste concept was introduced by the 'Thematic Strategy on the prevention and recycling of waste' adopted by the European Commission, in which it proposed to specify the conditions for the cessation of waste status as part of the revision of the Waste Framework Directive (Directive 2008/98/EC). The Directive states that a waste shall lose its status if it is submitted to a recovery operation (including recycling) and comply with specific eligibility criteria. The strategic goal of the End-of-waste is to promote recycling, helping to ensure a high level of environmental protection through the reduction of the consumption of critical raw materials and the quantities of waste destined for disposal.

In the mining sector, the reduction of landfill material may be obtained not only by finding a suitable recovery of the material as a by-product, but also identifying the best available cutting technique to be used on the basis of the physical, chemical and mechanical characteristics of the stones. The choice of the best cutting technique could lead to high efficiency and performance, high quality of the cut surfaces and a very low environmental impact by reducing energy consumption, decreasing the concentration of heavy metals in the sludge and producing less waste.

In this context, an analysis of the procedures for cutting different types of ornamental stones into slabs together with the evaluation of sludge production for the different cutting methods has been carried out.

Three types of analysis were conducted in parallel. The first concerns the characterization of the stones and the choice of the type of cutting machine. The analyses carried out were: petrographic analysis, compression strength, flexural strength, apparent density and water absorption. Also ultrasonic pulse velocity (UPV) and Knoop analyses were performed in order to establish the workability class of the stones, and their classification in accordance with previous research works (EASE R3).

The second analysis involves calculating the amount of sludge produced in the three different cutting technologies, taking into account the same block characteristics. The third analysis was conducted on the sludge resulting from the processing of blocks cut into slabs. A comparison was carried out on the quality of the sludge produced, or type and quantity of metals present, taking into account the three different technologies. The tests carried out were: chemical analysis, magnetic separation test and SEM analysis of the metal fraction.

The study could provide stone producers with a technological, scientific instrument to identify the best cutting techniques for the processing of their stones, in order to obtain a good efficiency process, optimize the recovery process, increase the economic advantages, and evaluate the possible reuse of the sludge through a proactive waste management strategy.