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# Valorisation of Local Residues, By-Products and Wastes into Ceramic Materials for Civil Engineer Application

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## Extended Abstract

Natural sand is the primary substance needed in construction field, mainly in concrete formulation, but also to make asphalt and glass. The Global Aggregates Information Network (GAIN) estimated a rise of global aggregates demand from 50 to 60 billion tonnes per annum by 2030; this increase is far from reaching its climax, considering upcoming population increase, urbanisation and economic growth [1]. Even if natural sand is generally considered as an unlimited resource, only less than 5 % (marine sand) of the quantity available on Earth reach properties requirements to be used as building materials. Moreover, overexploitation of the last few available deposits leads to several negative impacts on environment such as degradation of beaches, marine biodiversity troubles and increasing pollution due to import growth [1].

Alternative materials such as industrial wastes and by-products present great potential to replace natural sand. For example, it has been proven that glass wastes [2][3] and granite wastes [4] may be used to replace sand as a degreasing agent and enhance fired bricks properties such as water absorption and shrinkage, while improving firing conditions (energy saving). The use of this alternative sands (use of waste, in most case not valorised) could reduce carbon footprint of new building constructions and avoid suffering an upcoming natural sand shortage.

The purpose of this work is to experimentally evaluate the potential of six inorganic industrial residues, by-products and wastes from Occitanie region (France) to replace natural sand for the production of local building bricks. The results will allow to develop a circular economy specific to the territory's industrial wastes. The materials involved here are domestic glass waste, wood pellet combustion ash, granite powder & mud, blast furnace slag and foundry core sand. Visual aspect, firing shrinkage, bulk density, compressive strength and leaching were studied on fired pressed clay bricks containing from 5 to 40 % of by-products.

Results showed that glass, granite powder, blast furnace slag and foundry sand can be integrated to brick composition up to 20 % while maintaining satisfying properties. Mixes of glass, slag and foundry by-products also showed promising results and could allow a multi-wastes valorisation into a single brick formulation.

Influence of by-products incorporation on complementary parameters such as freeze-thaw stability will have to be investigated before beginning industrial-scale tests and evaluating environmental viability of the new formulations.

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