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Construction and Demolition Waste (CDW) Recycling

Producing new materials from CDW's fine particles, after liberation of the its sands, for environmental and construction industry purposes

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Abstract

The building industry, even though it contributes significantly to a nation's socioeconomic development, is directly responsible for negative environmental effects including high-energy use and CO2 emission, among others. In addition, large quantities of non-biodegradable construction and demolition waste (CDWs) are typically piled up in landfills after a structure has reached the end of its useful life, during reconstruction, alteration, extension, maintenance, and demolition of buildings and other infrastructure [1]. This causes problems in terms of technology, the environment, economics, and society. Only in Europe, the construction and demolition activities produce as much CDW as China, where it impressively surpassed 1.13 billion tons in 2014 [1, 2]. Therefore, the valorization of industrial waste and rubble as secondary raw materials is being prioritized by sustainable development and circular economy initiatives [3].

Additionally, one of the 21st century's most difficult concerns is waste management. CDW has drawn significant attention in the trash debate since it is among the heaviest and most significant waste streams produced globally and in the European Union [1].

For the larger particles of the various components contained in those wastes, the majority of recycling facilities provide effective sorting and recycling choices. However, they are ineffective on Construction and Demolition Fines Particles (CDF), despite the fact that they are made up of comparable materials and account for one-third of the CDW produced. Because of this, CDF are frequently landfilled even though they can account for up to 30% of all CDW produced and could probably be recycled [1].

Furthermore, the presence of moisture and organic matter (OM), along with the high gypsum concentrations present in CDF, might result in the formation of impermeable layers in landfill facilities. OM may compost in those layers under anaerobic conditions, producing methane (CH4) and hydrogen sulfide (H2S). Due to the high costs associated with managing these gases, landfill operators are increasingly likely to reject the use of CDF as a daily covering material and as a filling material. Because of the recent environmental problems associated with the landfilling of CDF, creative alternate routes as well as CDF recycling paths must be developed [4]. Moreover, from an environmental standpoint, using fine recycled aggregates as sand might lessen illegal dumping of the fine fractions of CDW and sand mining, both of which have significant

negative effects on the environment globally. It can also cut energy usage and CO2 emissions.

This work presents an efficient and competitive process to properly characterize and sort the different materials found in CDF together with an acceptable quality of the final products. Firstly, a manual separation of the 4 – 0.5 mm fraction is performed. Next, XRD and XRF analysis are done to determine the chemical and mineralogical composition of the wastes. Then optical microscopy and scanning electron microscopy is done to complete the characterization and determine the morphological and mineral liberation characteristic of particles. Finally, gravity separators to separate aggregates, concrete paste, gypsum, brick and mortar do the separation. At the end, after liberation of the CDW' sands, new materials can be produced and the composition of it is confirmed.

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