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Production of lightweight aggregates from washing aggregate sludge and fly ash

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Increasing generation of wastes is one of the main environmental problems in industrialised countries. Heat treatment at high temperatures can convert some types of wastes into ceramic products with a wide range of microstructural features and properties (Bethanis et al., 2004).
A lightweight aggregate (LWA) is a granular material with a bulk density (bd) not exceeding 1.20 g/cm3 or with a particle density not exceeding 2.00 g/cm3 (UNE-EN-13055-1, 2003). They have become a focus of interest because the low particle density and the low bulk density entail a decrease in the load transmitted to the ground, and less work and effort are required to transport them (De' Gennaro et al., 2004). The benefits associated with these low densities, which are due to the formation of voids and pores, are very good thermal and acoustic insulation and materials with a good resistance to fire (Benbow, 1987; Fakhfakh et al., 2007).
The objective was to recycle fly ash, used motor oil from cars and mineral wastes from washing aggregate sludge, in order to obtain a usable material such as lightweight aggregates, and also to ensure that they are of good quality for different applications.
Raw materials have been physically, chemically and mineralogically characterized. On the basis of the results obtained, they were mixed, milled to a grain size of less than 200 μm (Yasuda, 1991), formed into pellets, pre-heated for 5 min and sintered in a rotary kiln at 1150ºC, 1175ºC, 1200ºC and 1225ºC for 10 and 15 min at each temperature (Theating).
Effects of raw material characteristics, heating temperature and dwell time on the following LWAs properties were determined: loss on ignition (LOI), bloating index (BI), loose bulk density (bd), apparent and dry particle density (ad, dd), voids (H), water absorption (WA24h) and compressive strength (S).
The products obtained were lightweight aggregates in accordance with norm UNE-EN-13055-1 (bd $\leq$1.20 g/cm3 or particle density $\leq$2.00 g/cm3). LWAs manufactured with 75%:25% and 50%:50% proportions of washing aggregate sludge:fly ash, heated at different temperatures and dwell times, were expanded LWAs (BI > 0). They showed the lowest loose bulk density, the lowest dry and apparent particle density, the lowest water absorption and the highest compressive strength.
The possible applications of sintered pellets, taking into consideration compressive strength and water absorption values, could be similar to those of Arlita G3 (insulation, geotechnical applications, gardening and/or horticulture) and/or Arlita F3 (prefabricated lightweight structures and insulation lightweight concretes), two varieties of the most widely marketed LWAs in Spain.
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