World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:9, No:09, 2015

Properties of Sustainable Artificial Lightweight Aggregate

Authors : Wasan Ismail Khalil, Hisham Khalid Ahmed, Zainab Ali

Abstract : Structural Lightweight Aggregate Concrete (SLWAC) has been developed in recent years because it reduces the dead load, cost, thermal conductivity and coefficient of thermal expansion of the structure. So SLWAC has the advantage of being a relatively green building material. Lightweight Aggregate (LWA) is either occurs as natural material such as pumice, scoria, etc. or as artificial material produced from different raw materials such as expanded shale, clay, slate, etc. The use of SLWAC in Iraq is limited due to the lack in natural LWA. The existence of Iraqi clay deposit with different types and characteristics leads to the idea of producing artificial expanded clay aggregate. The main aim in this work is to present of the properties of artificial LWA produced in the laboratory. Available local bentonite clay which occurs in the Western region of Iraq was used as raw material to produce the LWA. Sodium silicate as liquid industrial waste material from glass plant was mixed with bentonite clay in mix proportion 1:1 by weight. The manufacturing method of the lightweight aggregate including, preparation and mixing of clay and sodium silicate, burning of the mixture in the furnace at the temperature between 750-800˚C for two hours, and finally gradually cooling process. The produced LWA was then crushed to small pieces then screened on standard sieve series and prepared with grading which conforms to the specifications of LWA. The maximum aggregate size used in this investigation is 10 mm. The chemical composition and the physical properties of the produced LWA are investigated. The results indicate that the specific gravity of the produced LWA is 1.5 with the density of 543kg/m3 and water absorption of 20.7% which is in conformity with the international standard of LWA. Many trail mixes were carried out in order to produce LWAC containing the artificial LWA produced in this research. The selected mix proportion is 1:1.5:2 (cement: sand: aggregate) by weight with water to cement ratio of 0.45. The experimental results show that LWAC has oven dry density of 1720 kg/m3, water absorption of 8.5%, the thermal conductivity of 0.723 W/m.K and compressive strength of 23 N/mm2. The SLWAC produced in this research can be used in the construction of different thermal insulated buildings and masonry units. It can be concluded that the SLWA produced in this study contributes to sustainable development by, using industrial waste materials, conserving energy, enhancing the thermal and structural efficiency of concrete.

Keywords : expanded clay, lightweight aggregate, structural lightweight aggregate concrete, sustainable
Conference Title : ICBSE 2015 : International Conference on Building Science and Engineering
Conference Location : Berlin, Germany
Conference Dates : September 14-15, 2015