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Effects of Particle Size Distribution on Mechanical Strength and Physical Properties in Engineered Quartz Stone

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Abstract : Engineered quartz stone is a composite material comprising approximately 90 wt.% fine quartz aggregate with a variety of particle size ranges and `10 wt.% unsaturated polyester resin (UPR). In this study, the objective is to investigate the influence of particle size distribution on mechanical strength and physical properties of the engineered stone slabs. For this purpose, granular quartz with two particle size ranges of 63-200 µm and 100-300 µm were used individually and mixed with a difference in ratios of mixing. The void volume of each granular packing was measured in order to define the amount of filler; quartz powder with the size of less than 38 µm, and UPR required filling inter-particle spaces. Test slabs were prepared using vibration-compression under vacuum. The study reports that both impact strength and flexural strength of samples increased as the mix ratio of the particle size range of 63-200 µm increased. On the other hand, the values of water absorption rate, apparent density and abrasion resistance were not affected by the particle size distribution owing to vacuum compaction. It is found that increasing the mix ratio of the particle size range of 63-200 µm caused the higher porosity. This led to increasing in the amount of the binder paste needed. It is also observed that homogeneity in the slabs was improved with the particle size range of 63-200 µm.

Keywords : engineered quartz stone, fine quartz aggregate, granular packing, mechanical strength, particle size distribution, physical properties.
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