

Mechanical Properties of Concrete Containing 100% Recycled Homogeneous Ceramic Aggregates

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Abstract. Construction industry contributes up to 70% of the wastes in the world. Consequently, utilizing recycled aggregates which do not have negative effect on the properties of concrete help to decrease pressure on environment and reduce depletion of natural resources. Depends on the grade, mix design and application of the concrete 65 to 85% of the concrete is consist of aggregates. In this experimental work focuses on replacing 100 % of natural aggregates by recycled fine and coarse aggregates from homogenous ceramic tile waste. Effect of this replacement on properties of concrete specimens such as compressive strength and flexural strength was investigated. The specimens were cast in 100 x 100 x 100 mm cube for compressive strength test and 100x100x500 mm size for flexural strength test. After 28 days curing, the compressive strength of specimen containing 100% recycled aggregates was obtained strength values of 97% of control specimen which are satisfactory for structural application.

1. INTRODUCTION

The ceramics is a common word used to refer to ceramic products. General ceramics products include wall tiles, floor tiles, sanitary ware, household ceramics and technical ceramics. Ceramic tiles are manufactured by firing clay, feldspar and quartz at high temperatures. The world tile production is increased from 7 million m² in 2005 to 12.5 million m² in the year 2014 [1]. In ceramic industry, about 15-30% production goes to waste. However, the ceramic waste is durable, hard and highly resistant to biological, chemical and physical degradation forces. Therefore, there is a need on ceramic industry to find a way for the ceramic waste disposal [2]. Recently, there are few studies focusing on the use of ceramic waste powder with the size of 45 µm as cement replacement in concrete [3,4]. Besides, many researches have been done to investigate the effect of ceramic waste as coarse aggregates from different sources. However, very limited study done to investigate the effect of ceramic fine aggregates as sand replacement. The review from literatures shows that there is lack of studies

regarding the influence of the utilization of ceramic fine aggregates on the mechanical properties of concrete. Previous researchers reported that the concrete incorporating ceramic fine aggregates up to 50% as natural aggregates replacement could achieved similar properties with normal concrete [5,6] and up to 40% for coarse aggregates [7]. Suzuki et al., (2009) used porous coarse ceramic waste aggregates for the internal curing of high performance concrete and showed that there was a high effectiveness of the ceramic aggregates in the reduction of autogenous shrinkage. Torkittikul and Chaipanich, (2010) suggested that the use of 50% ceramic fine aggregates as the natural aggregates replacement in order to have similar workability and compressive strength as normal concrete. Meanwhile, Khatib, (2005) studied the long term compressive strength and suggested the utilization of 50% of ceramic fine aggregates in the substitution of natural fine aggregates for concrete production and reported that even at 100% replacement the reduction in strength was only 10%. Torgal and Jalali, (2010) also mentioned that the replacement of sand by ceramic fine aggregates is a