Chapter 6
Comprehensive Evaluation for Mortars and Concretes Incorporating Wastes

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ABSTRACT

Sustainability is concerned with the most efficient use of resources where the residues play an essential role. Trends in concrete technology include natural or artificial additions and additives in order to reduce the consumption of cement. The characterization of the wastes is of great importance with respect to the amount that must be incorporated into the matrices of construction materials both for its economic and engineering impacts (strength and durability). The authors study the impact in strength, durability, and sustainability of the use of finely ground waste of ferroalloys in concrete. The behavior of durability of sustainable concrete also is evaluated. The proportioning between traditional materials and these additions involves preliminary tests on pastes and mortars. Also, they study the impact of the use of different plastic wastes (polyethylene) in different percentages. They evaluated consistency, compressive strength, suction capability, and leaching.

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INTRODUCTION

Modern society has developed based on the use of concrete in its different forms and applications, becoming the most consumed material after water. Concrete is the most used construction material in the world, a composite material consisting mainly of aggregates immersed in a cement matrix. Every year the global concrete industry uses 1.6 trillion tons of cement, 10 trillion tons of rock and sand and 1 trillion tons of water. Demand is expected to reach 18 trillion tons per year, starting in 2050.

These statistics indicate the impact that the manufacturing of concrete produces in nature. For this reason, achieving a sustainable concrete requires to moderate the degradation of the soil, energy consumption and pollution of the environment. Some of the measures that contribute to the concept of sustainable concrete are: to rationally dose the constituent materials of a concrete, to use added cements, to use recycled aggregates, to take advantage of the reuse of water, and to use alternative fuels in the manufacture of the constitutive materials.

The popularity of concrete is due to the many advantages offered by this material. It can be durable and of high resistance with a correct combination of cementitious materials and additions, additives, aggregates and water. Generally it can be elaborated with the raw materials available in each place. It also has an assortment of applications among which can be mention: a high reflectance value helps to reduce the heat island effect in built-up areas, it can be used without terminations and with the correct mixture it is resistant to the weather; it can be porous to help absorb infiltration water, it can be incorporate waste and recycled materials into the mix, reducing the consumption of raw materials (Chun, Claisse, Naik, & Ganjian, 2007).

The construction, use, repair, maintenance and demolition activities consume resources and generate waste. According to the report of the United Nations Environment Program (2014) and the Sustainable Building and Construction Initiative (SBCI), the construction industry consumes between 25% and 40% of global energy consumption, it generates between 30% and 40% of solid waste and 20% of liquid waste and emit between 30% and 40% of greenhouse gases. An alternative to help environmental sustainability is the reduction of the use of materials to make concrete, especially cement. The supplementary cementitious materials (SCM) allow to replace a part of the cement in a mixture for concrete.

Many of these materials come from industrial waste (Maldonado & Helene, 2007). The questions that are asked when a waste is incorporated into a material of great use such as concrete are: can it be incorporated into concrete? Can it be incorporated into reinforced concrete? How is its relationship with the environment regarding the reduction of solid waste? How much could be incorporated in the proportioning of the mixtures? How would the regulations apply in these cases? These questions are answered when there are results of research and laboratory and field work.
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