Abstract

Over the past few decades, recycled aggregate obtained from concrete waste has been used as a raw material in concrete structures. The term 'recycled aggregate', commonly used until recently, typically refers to aggregate that has undergone one round of recycling. This one-time recycling, however, fails to adequately address sustainable development, and the feasibility of multiple-time recycling still remains questionable.

The present dissertation investigates the effect of repeated recycling of concrete waste on various properties of new-made concrete, and comprises two review articles and three original research articles published in internationally reputable journals:

- In the first review article, the relation between the quality of recycled concrete aggregate and the performance of concrete was analyzed.
- In the second review article, the effectiveness of a mix design, entitled an equivalent mortar volume method, was analyzed in terms of the performance of recycled aggregate concrete.
- In the third article, of a research type, the effect of repeated recycling of concrete waste as recycled coarse aggregate on the mechanical and durability of new-made concrete was studied.
- In the fourth research article, to deepen the analysis on recycling, recycled materials with different particle sizes obtained from concrete waste replaced coarse aggregate, fine aggregate, and cement in concrete, respectively, and the effect of these replacements on concrete properties was assessed.
- In the fifth article, of a research type, the effect of powders obtained from repeated recycling of concrete waste on the properties of concrete as a partial cement replacement was investigated.

Each of the presented studies provides new initiatives for repeated recycling and complete recycling of concrete waste, and can contribute to the establishment of a knowledge system for multiple recycling of concrete waste in the context of environmental protection.

Keywords: concrete mix design, recycled aggregate concrete, recycled powder concrete, repeated recycling, closed-loop recycling.