

Enhancing Concrete Sustainability through Carbonated Recycled Cement Powder: A Review

*Mylvaganam¹ N and Yogarajah¹ E

¹Graduate School of Engineering, Hokkaido University, Sapporo-shi, Hokkaido 060-8628, Japan

*Corresponding author – Email: nithurshanm@gmail.com

Abstract

Concrete is a vital construction material, but the rapid urbanization has led to a significant accumulation of demolished concrete, especially in developing countries. Despite efforts, only a small fraction of this concrete is recycled, leading to environmental challenges. However, countries like Japan have successfully recycled a large portion of their demolished concrete, primarily for use in road subbase and as Recycled concrete aggregate (RCA) which is typically yields lower quality compared to natural aggregate (NA). Additionally, during RCA production, a significant amount of cement powder is generated, which has the potential to be used as a supplementary cementitious material (SCM). Recent research has explored various valorisation methods for recycled cement powder (RCP), with carbonation emerging as the most sustainable option. Carbonated RCP not only stores CO₂ but also improves concrete properties such as compressive strength and durability. Considering the environmental impact of traditional cement manufacturing, the utilization of SCMs, such as carbonated recycled cement powder (cRCP), has emerged as a promising strategy. This approach promotes sustainable recycling practices and contributes to ecological conservation efforts, aligning with the circular economy philosophy. This review highlights recent findings on the accelerated carbonation treatment of RCP, exploring its benefits and applications as a sustainable building material.

Keywords: Concrete recycling; supplementary cementitious materials; Carbonated recycled cement powder; circular economy