ABSTRAK

Peningkatan pembangunan infrastruktur di Indonesia berdampak pada tingginya kebutuhan terhadap material konstruksi seperti beton. Salah satu inovasi beton modern adalah beton mutu tinggi memadat mandiri (*Self-Compacting Concrete/SCC*) yang mampu mengalir dan memadat tanpa bantuan alat pemadat. Meskipun demikian, SCC masih menghadapi tantangan dari segi durabilitas, khususnya terhadap karbonasi yang dapat menurunkan pH beton dan memicu korosi tulangan. Penelitian ini bertujuan untuk mengevaluasi pengaruh karbonasi terhadap kuat tekan dan penurunan pH beton SCC serta mengetahui efektivitas penggunaan metakaolin sebagai bahan tambahan pozzolan dalam memperlambat laju karbonasi. Penelitian dilakukan secara eksperimental menggunakan benda uji silinder beton diameter 75 mm dan tinggi 150 mm dengan variasi kadar substitusi metakaolin 10%, 12,5%, 15%, 17,5%, dan 20%. Pengujian karbonasi dipercepat dilakukan dengan perendaman dalam larutan karbonat 4% selama 15, 37, dan 51 hari, kemudian diuji menggunakan indikator phenolphthalein 1%. Hasil menunjukkan bahwa substitusi metakaolin sebesar 15% memberikan performa terbaik dalam menurunkan laju karbonasi hingga 44,41% dibanding beton normal, dengan koefisien karbonasi pada kondisi atmosfer normal sebesar 3,71 mm/tahun½. Penambahan metakaolin juga menurunkan workabilitas beton, namun masih berada dalam batas toleransi sesuai EFNARC 2002. Penelitian ini menegaskan bahwa penggunaan metakaolin dapat meningkatkan durabilitas beton SCC terhadap karbonasi.

Kata kunci: Self-Compacting Concrete (SCC), karbonasi, metakaolin, koefisien karbonasi, kuat tekan beton

ABSTRACT

The rapid development of infrastructure in Indonesia has increased the demand for construction materials such as concrete. One modern innovation is high-strength self-compacting concrete (SCC), which can flow and compact without external vibration. However, SCC still faces durability challenges, particularly carbonation, which can reduce the pH of concrete and trigger reinforcement corrosion. This study aims to evaluate the effect of carbonation on the compressive strength and pH reduction of SCC and to determine the effectiveness of metakaolin as a pozzolanic additive in slowing down the carbonation rate. The experimental method used cylindrical specimens with a diameter of 75 mm and a height of 150 mm, incorporating metakaolin at substitution levels of 10%, 12.5%, 15%, 17.5%, and 20%. Accelerated carbonation testing was conducted by immersing the samples in a 4% carbonate solution for 15, 37, and 51 days, followed by phenolphthalein spray tests. The results showed that a 15% metakaolin substitution yielded the best performance, reducing the carbonation rate by up to 44.41% compared to normal concrete, with a carbonation coefficient under normal atmospheric conditions of 3.71 mm/year½. While the addition of metakaolin reduced fresh concrete workability, it still met the SCC requirements as outlined in EFNARC 2002. This study confirms that metakaolin enhances the durability of SCC against carbonation.

Keywords: Self-Compacting Concrete (SCC), carbonation, metakaolin, carbonation coefficient, compressive strength