

ABSTRACT

In this study, an experimental investigation on the influence of copper slag as partial substitution of sand as fine aggregate against chloride attack was carried out. Copper slag is by-product of matte smelting and copper refinery. The utilization of copper slag in concrete is environmental friendly since it reduces pollutant waste and beneficial in construction works toward sustainable development. This study is aimed to understand the resistance of concrete using copper slag against deterioration mainly caused by chloride attack through strength properties and durability performance of concrete.

The experiment was conducted with various percentages of copper slag such as 0% as control specimen, 15%, 30%, and 45% replacing by absolute volume of aggregate. Compressive strength test was employed to examine strength properties of concrete at the age of 28 days. In the case of durability performance, non-steady state and steady state migration test were performed at the age of 28 days and 91 days according to NT Build 492 and Japan Society of Civil Engineers (JSCE) G571-2003 respectively. Compressive strength and effective diffusion coefficient were obtained to find out the resistivity of concrete against chloride attack.

The presence of copper slag shows good improvement of compressive strength as the proportion of copper slag added up to 45%. On the other hand, the resistance of concrete was significantly improved when 30% of fine aggregate replaced by copper slag. Moreover, longer water curing period was also observed to improve the ability of concrete resist to chloride penetration. Through the experiment results, the relationship of strength properties and durability performance of concrete was obtained and showed linear improvement. This study found ideal percentage of copper slag as partial replacement of fine aggregate about 30%.

Keywords : copper slag, compressive strength, chloride resistance, durability

INTISARI

Pada penelitian ini dilakukan eksperimen terhadap pengaruh *copper slag* sebagai pengganti pasir sebagian sebagai agregat halus terhadap serangan ion klorida. *Copper slag* merupakan hasil limbah dari peleburan tembaga. Penggunaan *copper slag* di dalam beton adalah ramah lingkungan karena mengurangi polutan limbah dan bermanfaat dalam dunia konstruksi terhadap pembangunan berkelanjutan. Penelitian ini bertujuan untuk memahami ketahanan beton menggunakan *copper slag* terhadap kemunduran kualitas beton terutama akibat serangan ion klorida melalui kekuatan dan durabilitas beton.

Penelitian ini dilakukan dengan variasi persentase *copper slag* yaitu 0% sebagai spesimen kontrol, 15%, 30%, dan 45% dari volume agregat. Kuat tekan beton dilakukan untuk mengetahui kekuatan beton pada umur 28 hari. *Non-steady state* dan *steady state migration test* dilakukan untuk mengetahui durabilitas beton pada umur 28 hari dan 91 hari berdasarkan *NT Build 492* dan *Japan Society of Civil Engineers (JSCE) G571-2003*. Kuat tekan beton dan koefisien difusi efektif didapatkan untuk mengetahui ketahanan beton terhadap serangan ion klorida.

Keberadaan *copper slag* menunjukkan peningkatan pada kuat tekan beton dengan proporsi *copper slag* ditambah hingga 45%. Disisi lain, ketahanan beton meningkat secara signifikan ketika 30% *copper slag* digunakan. Selain itu, waktu curing yang lebih lama mendapatkan hasil meningkatnya kemampuan beton terhadap ketahanan dari penetrasi ion klorida. Dari hasil eksperimen, didapatkan hubungan antara kekuatan dan durabilitas beton dan menunjukkan peningkatan linear. Dari penelitian ini, ditemukan persentase ideal *copper slag* sebagai pengganti sebagian agregat halus adalah 30%.

Kata kunci : *copper slag*, kuat tekan, resistensi klorida, durabilitas