INTISARI

Urbanisasi yang didorong oleh perkembangan teknologi telah menyebabkan peningkatan wilayah terbangun dan suhu permukaan di perkotaan, sehingga memicu fenomena *Urban Heat Island* (UHI). UHI berdampak pada peningkatan konsumsi energi, emisi polutan, serta menurunnya kenyamanan dan kesehatan masyarakat. Salah satu solusi yang dikembangkan untuk mitigasi UHI adalah teknologi *cool pavement* yang mampu menurunkan suhu permukaan jalan. Penelitian ini bertujuan untuk mengevaluasi kinerja termal dan ketahanan abrasi dari dua jenis *cool pavement*, yaitu *heat-reflective coatings* (HRC) berbasis cat dan pelapisan *hydrated lime* (HL), serta menganalisis dampak abrasi terhadap performa termal permukaan.

Penelitian ini menggunakan metode yang meliputi pembuatan benda uji *hot mix asphalt* (HMA) yang dilapisi dengan *heat-reflective coating* (HRC)—berbasis *epoxy resin*, *acrylic emulsion*, dan cat reflektif BeCool—serta *hydrated lime* (HL) dengan variasi ukuran partikel (No. 200 dan No. 400) dan dosis (50, 100, 150, 200 g/m²). Uji kinerja termal dilakukan menggunakan *heating box* selama 24 jam untuk mensimulasikan siklus selama satu hari (siang dan malam), sementara uji abrasi dilakukan secara kering menggunakan alat *wet-wheel abrasion tester* untuk menentukan kehilangan massa dan koefisien abrasi, disertai analisis visual menggunakan metode *image processing*.

Hasil penelitian menunjukkan bahwa sampel berlapis mampu menurunkan suhu permukaan secara signifikan dibandingkan dengan sampel kontrol. Sampel berlapis HL dengan ukuran partikel No. 400 dan dosis 200 g/m² menunjukkan efektivitas kinerja termal yang ditandai dengan penurunan suhu tertinggi sebesar 21.89°C. Pelapisan HRC berbasis acrylic emulsion juga memberikan performa termal yang kompetitif. Dari sisi ketahanan abrasi, HL menunjukkan keunggulan, terutama pada kombinasi ukuran partikel No. 400 dan dosis 100 g/m² yang menghasilkan kehilangan massa paling rendah. Meskipun abrasi menyebabkan penurunan efektivitas termal dan peningkatan suhu permukaan, beberapa sampel HL dan HRC tetap mampu mempertahankan kemampuan pendinginannya secara signifikan. Temuan ini menegaskan bahwa HL merupakan alternatif yang potensial, efektif, dan ramah lingkungan dalam upaya mitigasi fenomena UHI.

Kata kunci: *Urban Heat Island*, *Heat-Reflective Coatings*, *Hydrated Lime*, Ketahanan Abrasi, Kinerja Termal

ABSTRACT

Urbanization driven by technological developments has led to an increase in built-up areas and surface temperatures in urban areas, triggering the Urban Heat Island (UHI) phenomenon. UHI has an impact on increased energy consumption, pollutant emissions, and decreased community comfort and health. One solution developed to mitigate UHI is cool pavement technology, which can reduce road surface temperatures. This study aims to evaluate the thermal performance and abrasion resistance of two types of cool pavement: heat-reflective coatings (HRC) based on paint and hydrated lime (HL) coatings, as well as to analyze the impact of abrasion on surface thermal performance.

This study employs methods including the preparation of hot mix asphalt (HMA) test specimens coated with heat-reflective coatings (HRC)—based on epoxy resin, acrylic emulsion, and BeCool reflective paint—as well as hydrated lime (HL) with varying particle sizes (No. 200 and No. 400) and doses (50, 100, 150, 200 g/m²). Thermal performance testing was conducted using a heating box for 24 hours to simulate a one-day cycle (day and night), while abrasion testing was performed dry using a wet-wheel abrasion tester to determine mass loss and abrasion coefficient, accompanied by visual analysis using image processing methods.

The results showed that the coated samples significantly reduced surface temperature compared to the control samples. The HL-coated sample with particle size No. 400 and a dosage of 200 g/m² demonstrated the highest thermal performance effectiveness, with a maximum temperature reduction of 21.89°C. The acrylic emulsion-based HRC coating also provided competitive thermal performance. In terms of abrasion resistance, HL demonstrated superiority, particularly in the combination of particle size No. 400 and a dose of 100 g/m², which resulted in the lowest mass loss. Although abrasion caused a decrease in thermal effectiveness and an increase in surface temperature, some HL and HRC samples were still able to maintain their cooling capacity significantly. These findings confirm that HL is a potential, effective, and environmentally friendly alternative in efforts to mitigate the UHI phenomenon.

Keywords: Urban Heat Island, Heat-Reflective Coatings, Hydrated Lime, Abrasion Resistance, Thermal Performance