

Fenomena *Urban Heat Island* (UHI) terjadi ketika suhu udara di kawasan perkotaan lebih panas dibandingkan dengan wilayah di sekitarnya. Salah satu penyebabnya adalah perkerasan jalan yang menyerap dan menyimpan panas. Penelitian ini menganalisis pengaruh penggunaan *steel slag* sebagai bahan pengganti agregat halus terhadap performa termal perkerasan. *Steel slag*, sebagai limbah industri baja dengan konduktivitas termal tinggi, diharapkan mampu menurunkan suhu permukaan perkerasan sekaligus mendukung pengelolaan limbah berkelanjutan.

Steel slag dalam penelitian ini digunakan sebagai bahan pengganti agregat halus dengan variasi campuran sebesar 0%, 20%, 40%, dan 60%. Nilai KAO ditentukan tiap variasi campuran. Sampel dibuat menjadi dua *layer* menggunakan *thermocouple* untuk mengukur suhu yang diletakkan pada kedalaman 1,5 cm dan 7,5 cm serta diuji dalam *heating box* selama 24 jam. Dengan 12 jam lampu dinyalakan (*heating*) dan 12 jam lampu dimatikan (*cooling*). Pengukuran suhu direkam dengan alat *temperature recorder*.

Hasil penelitian menunjukkan nilai KAO untuk variasi *steel slag* 0%, 20%, dan 40% berturut-turut adalah 5,22%, 5,28%, dan 4,94%. Variasi *steel slag* 60% tidak dapat ditentukan karena tidak memenuhi persyaratan minimum parameter VMA. Pada kondisi *heating*, sampel *steel slag* 40% mampu menurunkan suhu permukaan hingga 2,8°C dibandingkan sampel tanpa *steel slag*, tetapi meningkatkan suhu *layer* 2 sebesar 0,8°C. Hal ini disebabkan dari sifat konduktif *steel slag* yang membuat suhu panas di permukaan lebih cepat ditransfer menuju lapisan di bawahnya. Pada kondisi *cooling*, suhu permukaan sampel *steel slag* 40% relatif lebih panas dibandingkan variasi lainnya. Sebaliknya, pada *layer* 2 sampel *steel slag* 40% relatif lebih dingin. Hal ini disebabkan sampel dengan *steel slag* menyerap lebih banyak panas ketika *heating* akan melepaskan panas lebih banyak ke lingkungan saat *cooling*. *Steel slag* dapat digunakan sebagai bahan alternatif agregat alami karena mampu mengurangi efek UHI di siang hari, tetapi perlu diperhatikan kenaikan suhunya ketika malam hari.

Kata kunci: *urban heat island*, konduktivitas termal, *steel slag*, performa termal, *cool pavements*

The Urban Heat Island (UHI) phenomenon occurs where the air temperature in urban areas is higher than the surrounding rural area. The UHI phenomenon is caused by population growth due to urbanization, which leads to a higher demand for land use. One of them is road pavement that absorbs heat and is impermeable to water, thus increasing the ambient air temperature. This research examines the use of steel slag as an alternative material to reduce pavement surface temperature. Steel slag as a material that has high thermal conductivity properties and as a waste material is expected to make the city cooler and more sustainable as well as an alternative material to replace conventional aggregates.

This research uses steel slag as a substitute for fine aggregates with variations in the mixture of 0% (without steel slag), 20%, 40%, and 60%. The KAO value was determined for each variation to be used in the thermal performance test. The samples were made into two layers with KAO and then the temperature was measured using thermocouples placed at a depth of 1.5 cm and 7.5 cm and tested in a heating box. The test was conducted for 24 hours with 12 hours of lights turned on (heating) and 12 hours of lights turned off (cooling). The temperature measurement results were recorded with a temperature recorder.

The results showed that the KAO value for 0% steel slag variation was 5.22%, 20% steel slag was 5.28%, and 40% steel slag was 4.94%. The 60% steel slag variation was not determined because it did not meet the minimum requirements of the VMA parameter. The test results of temperature changes under heating conditions showed that the 40% steel slag sample was able to reduce the surface temperature by 2.8 °C compared to the sample without steel slag, but the temperature in layer 2 increased by 0.8 °C. This is due to the conductive nature of steel slag which makes the heat on the surface more quickly transferred to the layer below. In the cooling condition, the 40% steel slag sample is hotter at the surface temperature than the 20% steel slag sample and without steel slag. Conversely, in layer 2, the 40% steel slag sample is cooler than the sample without steel slag. This is because samples with steel slag absorb more heat when heating will release more heat to the environment when cooling. Therefore, steel slag can be used as an alternative mixed aggregate material because it is able to reduce the surface temperature of the pavement during the day so as to reduce the UHI effect but it is necessary to pay attention to the temperature increase at night.

Keywords: urban heat island, thermal conductivity, steel slag, thermal performance, cool pavements