

INTISARI

Drainage performance merupakan kemampuan *Porous Asphalt* (PA) untuk menyerap dan mengalirkan air ke dalam pori. Material *clogging* pada PA salah satunya bersumber dari polutan kendaraan, menumpuk akibat limpasan air dan lalu lintas. Penelitian ini menganalisis *drainage performance* dari PA yang mengalami *clogging* akibat polutan kendaraan serta pengaruh kondisi *dry-wet cycles*.

Dalam memahami pengaruh *clogging* akibat polutan kendaraan terhadap *drainage performance* PA, dilakukan pengujian permeabilitas dengan alat AF-16 Maruto terhadap benda uji PA (kadar pori 12% dan 20%) berbentuk silinder untuk mengetahui kemampuan infiltrasi. Pengujian XRF dilakukan untuk mengetahui kadar serta kandungan unsur material *clogging*. Sampel material *clogging* diambil pada daerah simpang dengan menggunakan mesin *vacuum*, ditimbang beratnya, serta dianalisis ukuran butirnya dengan saringan. Material *clogging* diaplikasikan pada benda uji saat pengujian permeabilitas dan dilakukan sebanyak 10 siklus (*wet cycles*). *Dry cycles* dilakukan sebanyak 5 siklus, dengan menggunakan lampu halogen 50 watt, untuk mengetahui pengaruh pengeringan terhadap permeabilitas PA.

Hasil penelitian menunjukkan, dengan pengujian menggunakan alat XRF dimungkinkan material *clogging* polutan kendaraan bersumber dari keausan mesin, ban, dan lapisan rem (Al dan Fe), bahan bakar (S, Sr, dan Ba), serta dari pelumas (unsur Mn dan Zn). Kadar polutan kendaraan yang teridentifikasi pada sampel 01, 02, 03, dan 04 berturut-turut sebesar 32,74 (mass%), 33,03 (mass%), 41,01 (mass%), dan 32,53 (mass%). *Clogging cycles* yang dilakukan dengan material *clay-sand*-polutan kendaraan sebanyak 10 siklus menyebabkan permeabilitas pada PA 12 (1,99—0,21 cm/s) dan PA 20 (6,33 —1,47 cm/s) menurun. Setelah 5 siklus *dry-wet*, rasio koefisien permeabilitas *wet cycles* material *clogging clay-sand* (0,26) lebih rendah dari material *clogging clay-sand*-polutan kendaraan (0,48). dikarenakan efektivitas pengangkutan polutan kendaraan (oli bekas) yang sangat baik saat terinfiltrasi. Akan tetapi, saat material *clogging clay-sand*-polutan kendaraan dalam kondisi kering, rasio koefisien permeabilitas turun menjadi 0,19 pada durasi 12 jam dan 0,07 pada durasi 24 jam. Hal ini menunjukkan bahwa pengeringan dengan durasi lebih lama memperparah deposit material *clogging*, mempercepat proses penyumbatan pori, dan mengurangi *drainage performance* PA dengan sangat signifikan.

Kata kunci: *Porous Asphalt, Clogging, Drainage Performance, Polutan Kendaraan, XRF*

ABSTRACT

Drainage performance in Porous Asphalt (PA) is defined by its ability to drain the water (permeability) through its pores. However, PA exhibits a reduction in permeability due to clogging by vehicle pollutants. This study was carried out to analyze concentrations of vehicle pollutants and investigate the permeability lost due to clogging cycles under two exposure methods (dry-wet cycles).

The effect of vehicle pollutant clogging on the drainage performance of Porous Asphalt (PA) was investigated through a series of permeability tests conducted using the AF-16 Maruto apparatus. Cylindrical PA specimens with porosity levels of 12% and 20% were tested to assess infiltration capacity. X-ray fluorescence (XRF) spectroscopy was employed to determine the elemental composition and content of the clogging materials. Samples of clogging materials were collected from traffic intersections using a vacuum device, weighed, and analyzed for particle size distribution via sieving. These materials were subsequently applied to the PA specimens during permeability tests, which included 10 wet cycles and 5 dry cycles using a 50-watt halogen lamp to assess the effect of drying on permeability.

The research results indicate that testing using XRF (X-ray Fluorescence) enables the identification of vehicle pollutant clogging materials as the likely source such as engine wear, tire abrasion, brake pads (Al and Fe), fuel combustion (S, Sr, and Ba), and lubricants (Mn and Zn). The pollutant concentrations in samples 01, 02, 03, and 04 were quantified as 32.74%, 33.03%, 41.01%, and 32.53% by mass, respectively. Permeability tests revealed that clogging cycles involving clay-sand-vehicle pollutant mixtures reduced permeability from 1.99 cm/s to 0.21 cm/s in PA 12 and from 6.33 cm/s to 1.47 cm/s in PA 20 after 10 wet cycles. Comparatively, the permeability coefficient ratio for clay-sand clogging materials (0.26) was lower than that for clay-sand-vehicle pollutant clogging materials (0.48) after 5 dry cycles. However, for clay-sand-vehicle pollutant clogging materials, the permeability coefficient ratio further declined to 0.19 after 12 hours of drying and to 0.07 after 24 hours. These results demonstrate that prolonged dry cycles intensify clogging material deposition, accelerate pore occlusion, and severely impair the drainage performance of porous asphalt.

Keywords: Porous asphalt, Clogging, Drainage Performance, Vehicle pollutants, XRF