

EMISI KARBON DARI KENDARAAN BERMOTOR DI JALAN MALIOBORO DAN JALAN PASAR KEMBANG, KOTA YOGYAKARTA

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INTISARI

Pencemaran udara akibat kendaraan bermotor merupakan isu global, termasuk di Indonesia, di mana jumlah kendaraan terus meningkat setiap tahun. Gas buang seperti karbon monoksida, hidrokarbon, dan nitrogen oksida menjadi kontributor utama pencemaran udara. Salah satu upaya mengurangi emisi ini adalah melalui kebijakan *Car-Free Night* (CFN), seperti yang diterapkan di Kota Yogyakarta sejak 2020 di Jalan Malioboro dan Jalan Jenderal Ahmad Yani. Selama CFN berlangsung, kendaraan bermotor kecuali BRT dan kendaraan darurat dilarang melintas, mengalihkan lalu lintas ke Jalan Pasar Kembang. Penelitian ini bertujuan menganalisis emisi karbon di kawasan Malioboro sebelum dan selama CFN, serta perubahan tingkat emisi karbon di Jalan Pasar Kembang saat CFN berlangsung.

Penelitian ini dilakukan di Kawasan Malioboro, Yogyakarta, meliputi Jalan Malioboro dan Jalan Pasar Kembang, lokasi CFN yang berlangsung pukul 18.00-21.00 WIB. Data penelitian berupa rekaman CCTV 24 jam yang dianalisis menggunakan model YOLO dan DeepSORT untuk mendeteksi, menghitung, dan mengklasifikasikan kendaraan. Data tersebut diolah dengan metode inventarisasi faktor emisi kendaraan bermotor. Uji akurasi menggunakan F1-Score, precision, dan recall dilakukan untuk memastikan akurasi model. Analisis difokuskan pada perubahan emisi di Malioboro dan dampaknya pada Jalan Pasar Kembang saat CFN.

Hasil menunjukkan bahwa model YOLO memiliki F1-Score sebesar 85% pada siang hari, namun turun di bawah 50% pada malam hari karena kurangnya cahaya. Meskipun demikian, pola perubahan lalu lintas tetap dapat diamati. Penghitungan faktor emisi menunjukkan CFN mengurangi emisi karbon secara signifikan di Jalan Malioboro, namun meningkatkan emisi di Jalan Pasar Kembang akibat pengalihan lalu lintas. Penelitian ini menyimpulkan bahwa CFN efektif mengurangi emisi karbon di Jalan Malioboro, namun mengakibatkan lonjakan emisi di jalan alternatif karena kepadatan lalu lintas. Hal ini selaras dengan penelitian sebelumnya terkait dampak penutupan jalan bagi kendaraan bermotor.

Kata kunci : Car-Free Night, Emisi Karbon, Model YOLO, Faktor Emisi

MOTOR VEHICLE'S CARBON EMISSION IN MALIOBORO STREET AND PASAR KEMBANG STREET, YOGYAKARTA

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ABSTRACT

Air pollution caused by motor vehicles is a global issue, including in Indonesia, where the number of vehicles continues to increase annually. Exhaust gases such as carbon monoxide, hydrocarbon, and nitrogen oxide are the main contributors to air pollution. One effort to reduce these emissions is through the *Car-Free Night* (CFN) policy, as implemented in Yogyakarta City since 2020 on Malioboro Street and Jenderal Ahmad Yani Street. During CFN, motor vehicles, except BRT and emergency vehicles, are prohibited from passing, redirecting traffic to Pasar Kembang Street. This study aims to analyse carbon emissions in the Malioboro area before and during CFN and to examine changes in carbon emission levels on Pasar Kembang Street during CFN.

The study was conducted in the Malioboro area, Yogyakarta, focusing on Malioboro Street and Pasar Kembang Street, where CFN takes place from 6:00 PM to 9:00 PM. The data used were 24-hour CCTV recordings analysed using YOLO model and DeepSORT to detect, count, and classify vehicles. These data were processed using the motor vehicle emission factor inventory method. Accuracy testing was performed using F1-Score, precision, and recall to validate the model. The analysis focused on changes in emissions in Malioboro and their impact on Pasar Kembang Street during CFN.

The results show that the YOLO model achieved an F1-Score of 85% during the day but dropped below 50% at night due to reduced lighting conditions. Nevertheless, traffic pattern changes remained observable. Emission factor calculations indicate that CFN significantly reduced carbon emissions on Malioboro Street but increased emissions on Pasar Kembang Street due to redirected traffic. This study concludes that CFN effectively reduces carbon emissions on Malioboro Street but causes an emission surge on alternative roads due to increased traffic density. These findings align with previous studies regarding the impact of road closures on motor vehicle traffic.

Keyword : Car-Free Night, Carbon Emissions, YOLO Model, Emission Factors