

# Characterization of Industrial Wastes as Raw Materials for the Formulation of Emulsified Modified Bitumen (EMB)

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**Abstract.** This study was conducted to characterize industrial wastes for the formulation of emulsified modified bitumen (EMB), in relation to their physical characteristics and elemental compositions. The aim was to determine which raw materials from industrial wastes could be used for EMB formulation. Bitumen is produced from crude oil extracted from the ground, which categorizes crude oil as one of the non-renewable fossil fuels. Various environmental issues that have risen in Malaysia are caused by the excessive manufacturing activities and the miss-management of industrial wastes. In an effort to mitigate these issues, industrial wastes are being used in various EMB formulations. Industrial wastes, such as polystyrene, polyethylene, and used automotive oil can be used as alternatives to formulate bitumen. Normally, a suitable emulsifier is needed to produce the final product, which is EMB. The emulsifier will yield a charge, depending on its properties, to bind the oily bitumen with water. In this current study, physical characteristic studies were performed using thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), flash point test, density test, and moisture content test. Fourier Transform Infrared Spectroscopy (FTIR) analysis was also performed to determine the material's molecular composition and structure.

Key word: *Emulsified Modified Bitumen (EMB); Non-renewable; Polyethylene; Polystyrene; Used Automotive Oil; Emulsifier*