FORMULATION OF EMULSIFIED MODIFIED BITUMEN FROM INDUSTRIAL WASTE

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Extended Abstract

Bitumen is normally produced from crude oil that is extracted from the ground which makes bitumen one of the non-renewable forms of product. Bitumen is used mainly in road paving, roofing application, road construction, waterproofing products, building materials, and industrial coatings. It is estimated that the current world consumption of bitumen is 102 million tonnes per year, where 85% of bitumen are used as binder for pavements, 10% for roofing application, and the rest are used for various purposes (Asphalt Institute and Eurobitume, 2011).A vast environmental problem issues arises in Malaysia cause by the excessive manufacturing activity that lead to a miss-management of industrial waste has leads to the used of industrial waste in the Emulsified Modified Bitumen (EMB) formulation. Industrial waste such as polystyrene, polyethylene and used automotive oil can be used as alternative to formulate bitumen. Then a suitable emulsifier needs to be added to produce the final product which is EMB. Then the modified bitumen will be emulsified by using four difference type of emulsifier which are abietic acid, ammonium salt, alcohol ethoxylation and alkyltrimethylenediamine. The emulsifier will yield a charge depends on its properties to bind the oily bitumen with water. Physical characteristic studies were performed by thermogravimetric Analysis (TGA), differential scanning calorimetry (DSC), flash point test, density rest and moisture content test. Fourier Transform Infrared Spectroscopy (FTIR) analysis was measured to determine the material's molecular composition and structure. As the result from TGA, the high density polyethylene 1 (HDPE 1) was 0.3235% degraded at lower than 200 °C, 98.17% at 402.9 °C, and 1.510% at 900 °C. Whereas, the high density polyethylene 2 (HDPE 2) had 0.0852% of its components degraded at lower than 200 °C, 97.33% at 402.9 °C, and 2.606% at 900 °C. Polystyrene sample, with 0.4476% of its components degraded at lower than 200 °C, 97.16% at 402.9 °C, and 2.355% at 900 °C. From DSC analysis, samples of HDPE 1 and 2 showed approximately the same trend, which deviated from the polystyrene sample. This was because both HDPE 1 and 2 came from the same group of polymer. Amongst the three samples, none of them showed significant resonances around 3450 cm^{-1} from FTIR analysis, then, it can be said that the water contents in all these samples were negligeable. The key parameters for the mixing process are ratios of raw materials from industrial waste, temperature, time and speed of the mixer. Eight samples (details listed in table 2) of EMB were formulated and the best three (B, F, H) amongst it was chose for performance analysis. The result shows bitumen formulated has the same grade of penetration value with EMB industry grade which are B (40/60), F (60/70) and H (200/30). Bitumen H (200/300) then was choosing for the emulsification process where an emulsifier was added to mix bitumen with water. This sample was then being compared with bitumen emulsion grade 80/100 from industry. In short, EMB formulated shows a better physical and chemical properties than EMB from industry.