

DEVELOPMENT OF EMULSIFIED MODIFIED
BITUMEN FROM INDUSTRIAL WASTE

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.


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ABSTRAK

Emulsi bitumen dicirikan sebagai sebuah sistem pelbagai fasa yang mengandungi asfalt, air dan satu atau lebih surfaktan untuk menstabilkan campuran emulsi bitumen dan ia digunakan untuk salutan dinding. Selain itu, peningkatan kuantiti sisa pembuatan di global membawa kepada isu alam sekitar yang teruk yang memerlukan satu strategi pengendalian sisa yang lebih baik. Walau bagaimanapun, formulasi bitumen emulsi terubah suai daripada sisa pembuatan seperti sisa minyak yang telah ditapis akan menjadi pendekatan yang berpotensi untuk menangani masalah ini. Objektif kajian ini adalah untuk menggunakan dalam penyelidikan ini, bitumen gred 60/70 akan diubah suai dengan sisa minyak yang ditapis dan diemulsikan menggunakan enam pengemulsi berbeza (anion, kation, dan bukan ionik) untuk digunakan untuk salutan permukaan. Untuk mengformulasikan produk bitumen yang telah diubah suai (EMB). Emulsi yang telah diformulasi akan dianalisis dan kemudian disalut pada substrat dinding kering dan prestasinya akan dibandingkan dengan emulsi industri. Emulsi yang dirumus telah diuji dan kemudian disalut pada substrat dinding kering, dengan prestasinya berbanding dengan emulsi bitumen industri. Mengikut keputusan, emulsi EMB yang dirumus mempunyai kelikatan emulsi yang jauh lebih rendah, lekatan yang baik, dan tempoh penuaan yang setanding. Lebih penting lagi, nilai pemindahan haba (q) dalam EMB A3 pada 60 °C, 45 °C dan 27 °C ialah 1.80 W, 0.37 W dan 0.41 W, masing-masing. Hasil penyelidikan juga mendedahkan satu kecenderungan dimana semakin tinggi kandungan bitumen di dalam kationik EMB, semakin tinggi kemampuan emulsi bitumen untuk menebat haba. Dari segi kesan penyalutan dan penebatan pada substrat, emulsi bitumen yang telah dirumuskan (EMB A3) adalah setara dan memiliki prestasi yang hampir sama dengan IBE. Walau bagaimanapun, lebih banyak kajian yang diperlukan untuk memiliki pemahaman yang lebih baik terhadap mekanisma-mekanisma dan faktor-faktor yang mempengaruhi formulasi EMB bagi membangunkan emulsi bitumen yang ideal, boleh dilaksanakan dan mesra alam sekitar.

ABSTRACT

Bitumen emulsion is a multi-phase system composed of asphalt, water, and one or more surfactants to stabilise the mixture and it is used for wall coating. Furthermore, the growing volume of global manufacturing waste has resulted in serious environmental issues that necessitate a better waste management strategy. However, the formulation of emulsified modified bitumen from manufacturing waste, such as refined waste oil, could be a viable solution to these issues. The objective of this study is to formulate emulsified modified bitumen (EMB) products, 60/70 grade bitumen were modified with refined waste oil and emulsified with six different emulsifiers (Anionic, Cationic, and Non-Ionic) to be used for surface coating. Samples were formulated by modifying the ratios of bitumen, refined waste oil, and the type of emulsifiers used while keeping other parameters constant. The formulated emulsions were tested and then coated on a drywall substrate, with their performance compared to that of the industrial bitumen emulsion. According to the results, the formulated EMB emulsions had significantly lower emulsion viscosity, good adhesion, and comparable ageing period. More importantly, the heat transfer values (q) in EMB A3 at 60 °C, 45 °C, and 27 °C are 1.80 W, 0.37 W, and 0.41 W respectively. The study also discovered that the higher the bitumen content in cationic EMBs, the greater the ability of the bitumen emulsion for heat insulation. In terms of coating and insulation impact on the substrate, the formulated bitumen emulsion (EMB A3) performs similarly to the industrial bitumen emulsion. More research, however, is required to gain a better understanding of the mechanisms and factors influencing EMB formulation in order to develop an idea for a feasible and environmentally friendly bitumen emulsion.

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