

MICROWAVE PARAMETERS FOR BITUMEN EMULSION AND ITS APPLICATION IN HIGHWAY ENGINEERING

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This project report is dedicated to my family
for their endless support and encouragement

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ABSTRACT

Bitumen emulsion is used as a bonding material between two layers and partially acts as a water proofing agent; it gained more importance when there were environmental concerns with cutbacks bitumen. A very few properties of bitumen emulsions are known so far from its physical and chemical prospective. However, a new method to measure its dielectric properties i.e. permittivity by applying electromagnetic waves (microwaves) with open ended coaxial probe (OCP) method was investigated in this study at different temperatures and frequency of 8 to 12 GHz. After examining the physical properties of certain bitumen emulsion a correlation was established on the basis of dielectric constant (permittivity) with the existing conventional property viscosity at temperature of 25, 40, 50 and 60°C. On the basis of these properties different characteristics of the bitumen emulsion were found and hence, a correlation was established to predict its behavior. A good correlation factor was found for the four types of samples used in the study which were 0.98 for SS-1K, 0.99 for MS-1K, 1.00 for RS-1K and 0.99 for K1-40. This study has provided an effective parameter to measure and predict the behavior of bitumen emulsion at different temperature, which can be applied in highway industry.

ABSTRAK

Bitumen emulsi digunakan sebagai bahan ikatan antara dua lapisan dan juga bertindak sebagai ejen kalis air, ianya menjadi lebih penting apabila kebimbangan terhadap penggunaan bitumen cutback yang dikhuatiri boleh menyebabkan pencemaran alam sekitar. Sangat sedikit sifat-sifat fizikal dan kimia bitumen emulsi diketahui setakat ini. Walaubagaimanapun, kaedah baru untuk mengukur sifat-sifat dielektriknya iaitu ketelusan dengan menggunakan kaedah gelombang elektromagnetik (gelombang mikro) dengan prob sepaksi terbuka dihujung (OCP) telah dikaji dalam kajian ini pada suhu yang berbeza dan frekuensi 8 hingga 12 GHz. Setelah menjalankan ujian terhadap sifat-sifat fizikal beberapa bitumen emulsi, satu hubungkait telah dibina berdasarkan pemalar dielektrik (ketelusan) dengan sifat-sifat konvensional kelikatan sedia ada pada suhu 25, 40, 50 dan 60 ° C. Berdasarkan sifat – sifat ini, ciri-ciri lain bitumen emulsi ditemui dan dengan itu, satu hubungkait dibina untuk meramal kelakuannya. Faktor hubungkait yang terbaik telah ditemui untuk empat jenis sampel yang digunakan di dalam kajian ini iaitu 0.98 untuk SS-1K, 0.99 untuk MS-1K, 1.00 untuk RS-1K dan 0.99 untuk K1-40. Kajian ini menyediakan parameter efektif untuk mengukur dan meramal kelakuan bitumen emulsi pada suhu berbeza di mana boleh diaplikasikan dalam industri pembinaan lebuh raya.