PHYSICAL AND MECHANICAL CHARACTERISTICS OF POROUS ASPHALT MIXTURE INCORPORATING KENAF FIBER

NUR EZREEN BINTI JASNI

MASTER OF SCIENCE

UNIVERSITI MALAYSIA PAHANG

SUPERVISOR'S DECLARATION

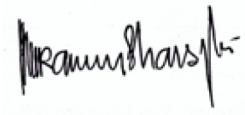
We hereby declare that We have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science.

(Supervisor's Signature)

Full Name : TS. DR. KHAIRIL AZMAN BIN MASRI

Position : SENIOR LECTURER

Date : 07 JANUARY 2022



(Co-supervisor's Signature)

Full Name : DR. RAMADHANSYAH PUTRA JAYA

Position : ASSOCIATE PROFESSOR

Date : 07 JANUARY 2022

STUDENT'S DECLARATION

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.

(Student's Signature)

Full Name : NUR EZREEN BINTI JASNI

ID Number : MAG19003

Date : 07 JANUARY 2022

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NUR EZREEN BINTI JASNI

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ABSTRAK

Campuran asfalt berliang (PA) juga dikenali sebagai permukaan bergred terbuka di atas dasar batu di bawahnya, membolehkan air mengalir. Faktor ini boleh menjejaskan kekuatan bitumennya. Jumlah batu baur kursus yang tinggi menggalakkan struktur lompang udara mempunyai kesan tertentu terhadap sifat PA. Sifat bahan terdiri daripada ujian batu baur dan bitumen. Kajian ini memperincikan batu baur melalui ujian analisis ayak untuk membentuk penggredan batu baur baharu untuk PA yang dikenali sebagai Penggredan Baharu campuran Asfalt Berliang (NPA). Penyelidikan ini juga menilai analisis morfologi dan kimia dan menentukan sifat kejuruteraan campuran asfalt berliang yang diubah suai dengan menggabungkan kenaf fiber. Ujian pada bitumen termasuk takat lembut, penembusan, dan kemuluran. Analisis penapisan dibuat berdasarkan lima (5) penggredan batu baur negara ASEAN untuk mendapatkan penggredan bagi NPA. Negara yang termasuk ialah Malaysia, Vietnam, Thailand, Singapura, dan Indonesia. Ujian morfologi dan kimia termasuk '*Scanning Electron Microscopy (SEM)', 'X-ray Difractions (XRD)'* dan '*Fourier Transform Infrared Spectroscopy (FTIR)'* untuk memeriksa struktur dalaman campuran PA. Manakala, ujian prestasi mekanikal PA telah dijalankan untuk menganalisis masalah utama PA menggunakan ujian '*Marshall Stability, Permeability', 'Binder Draindown' dan 'Cantabro Loss'* untuk mengenal pasti kekuatan dan sifat PA konvensional dengan penambahan kenaf fiber berbanding dengan penggredan baharu PA yang menggabungkan kenaf fiber. Analisis yang dibuat mendapati spesifikasi Singapura mempunyai semua kriteria dari segi penggredan batu baur untuk batu baur halus dan selebihnya daripada spesifikasi batu baur Thailand untuk garis bawah manakala bagi garis atas, spesifikasi Vietnam terbukti mempunyai semua kriteria dalam semua penggredan lima negara. Penambahan 0.3% kenaf fiber meningkatkan prestasi PA. Keputusan menunjukkan bahawa kenaf fiber meningkatkan sifat mekanikal campuran asfalt yang diubah suai dan dikawal. Penggunaan kenaf fiber dalam PA boleh meningkatkan prestasi turapan asfalt terhadap tekanan biasa seperti alur, racauan dan letihan. Hasil kajian ini dijangka dapat menyumbang PA yang lebih baik dan tahan lama berbanding reka bentuk PA semasa khususnya untuk negara tropika seperti Malaysia.

ABSTRACT

Porous asphalt mixture (PA) also known as open-graded surfaces over a stone bed underneath, allows water to go through. This factor can affect its adhesive strength. The high amount of course aggregate promotes the structure of air voids have certain impacts on the properties of PA. The materials properties are consisting of both aggregate and bitumen tests. This study details out the aggregates by sieve analysis test in order to develop new aggregate gradation for PA that known as New Gradation of Porous Asphalt mixture (NPA). This research also evaluates the morphological and chemical analysis and determine the engineering properties of modified porous asphalt mixture incorporating kenaf fiber. The test on the binder includes the softening point, penetration, and ductility. Sieve analysis was done based on five (5) ASEAN countries' aggregate gradation to obtain the gradation for NPA. The countries included are Malaysia, Vietnam, Thailand, Singapore, and Indonesia. Morphological and chemical test including Scanning Electron Microscopy (SEM), X-ray Diffractions (XRD) and Fourier Transform Infrared Spectroscopy (FTIR) in order to examine the interior structure of the PA mixture. While, mechanical performance test for PA were conducted to analyze the main problems of PA using Marshall stability test, Permeability test, Binder Draindown test and Cantabro Loss test to identify the strength and the properties of the conventional PA with the addition of kenaf fiber compared to the new gradation of PA incorporating kenaf fiber. From the analysis, Singapore specification have all the criteria in terms of aggregate gradation for fine aggregate and the rest are from Thailand aggregate specification for lower line while for upper line, Vietnam specifications were proved to have all the criteria within all five countries gradations. The addition of 0.3% kenaf improved the performance of the PA. The results showed that the fibers improved the mechanical properties of the modified and control asphalt mixture. The use of kenaf fibers in PA could enhance the performance of asphalt pavements against common distresses as rutting, raveling and fatigue. The outcome of this study is anticipated to contribute better and more durable PA than the current PA design in especially for tropical country like Malaysia.

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