

The influence of nano-carbon from coconut shell ash as modifier on the properties of bitumen

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ABSTRACT

Nanomaterials are small-sized materials between 1 and 100 nm which produce a greater surface area than common size materials. Coconut shell is one of the potential agricultural wastes to be used as nanomaterial due to its high strength and hardness. However, poor adhesion bonding was the problem of using this agricultural waste material as a modifier in the bitumen matrix. Therefore, in this study nanocarbon from coconut shell ash (NCA) was produced as bitumen modifier. NCA was produced and characterised using various techniques prior to be utilised at 0.0%, 1.5%, 3.0%, 4.5%, 6.0% and 7.5% by weight of bitumen PEN 60/70. The rheological test, using a dynamic shear rheometer (DSR), was performed on the unaged, rolling thin film oven and pressure ageing vessel samples. Subsequently, X-ray diffraction and atomic force microscopy were performed on the unaged samples. The DSR results revealed that NCA improved the rutting and fatigue cracking parameter of the bitumen. Also, the observations from microstructure properties showed that NCA delayed the ageing of the bitumen, produced a homogenous structure and increased the cohesion and adhesion properties of the bitumen. As a result, a strong bonding between the NCA and bitumen was formed and the properties of bitumen were altered.

KEYWORDS

Nano-carbon; Coconut shell ash; Bitumen; Physical; Rheological

ACKNOWLEDGEMENTS

The support provided by the Malaysian Ministry of Higher Education, Universiti Malaysia Pahang and Universiti Teknologi Malaysia in the form of a research grant for this study is highly appreciated.