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Algal Biochar as an Asphalt Additive to Resist Ultraviolet Aging

Background

Asphalt aging is implicated in many distresses of materials reported in the roofing and paving industry. Among the issues brought on by excessive ultraviolet (UV) aging are increased susceptibility to thermal cracking due to excessive hardening and loss of stress relaxation capacity in aged bitumen, the binding component in roof shingles and asphalt pavement. Studies have shown that increased UV radiation decreases the outdoor service life of construction materials [1]. This is especially notable for asphalt composites having high UV adsorption capacity which in turn heats the matrix and negatively impacts its thermomechanical properties [2,3].

Invention Description

To protect against UV aging and extend service life, researchers at Arizona State University have developed a biochar additive for asphalt made from a protein- and nucleic acid-rich algae. In addition to providing benefits to the value chain of algal biofuel, the use of the biochar at a 5% dosage by weight improved the aging index of bitumen by 36-61% based on various industry metrics. These results were obtained through standard tests of asphalt material including dynamic shear rheometer (DSR) and Fourier transform infrared spectroscopy.

Potential Applications

- Additive for delaying ultraviolet aging in bituminous composites
- Asphalt composite production
- Roofing materials

Benefits and Advantages

- Delays ultraviolet (UV) aging in bituminous composites
- Extends service life of bitumen-based outdoor structures under intense sun exposure
- Promotes resource conservation and sustainable construction practices

Faculty Profile of Professor Elham H. Fini

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[2] Feng, Z.-G., Yu, J.-Y., Zhang, H.-L., Kuang, D.-L., & Xue, L.-H. (2013). Effect of ultraviolet aging on rheology, chemistry and morphology of ultraviolet absorber modified bitumen. Materials and Structures, 46(7), 1123-1132.

[3] Wu, S., Zhao, Z., Li, Y., Pang, L., Amirkhanian, S., & Riara, M. (2017). Evaluation of aging resistance of graphene oxide modified asphalt. Applied Sciences, 7(7), 702.