

Physical, Morphological, and Rheological Properties of Polypropylene Modified Bitumen

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Abstract : The common method to improve the performance of asphalt binders is through modification. The utilization of recycled plastics for asphalt modification has been the subject of research studies due to their environmental and economic benefits over using commercial polymers. Polypropylene (PP) is one of the most available recycled plastics in Australia. Unlike other plastics, its contamination with other plastics during the recycling process is negligible. Therefore, the quality of recycled plastic is high, which makes it a good candidate for road construction applications. To assess its effectiveness for bitumen modification, three different grades of PP were selected. The PP grades were compared for blendability with bitumen, and the best suitable grade was chosen for further studies. The PP-modified bitumen and the base bitumen were then compared through physical and rheological properties. The stability of the PP-modified bitumen at elevated temperatures was measured, and the morphology of the samples before and after the storage stability was characterized by fluorescent microscopy. The results showed that PP had a significant influence on reducing the penetration and increasing the viscosity and the rutting resistance of the virgin bitumen. Storage stability test results indicated that the difference between the softening point of the top and bottom section of the tube sample is below the defined limit, which means the PP-modified bitumen is storage stable. However, the fluorescence microscopy results showed that the distribution of the PP particles in the bitumen matrix in the top and bottom sections of the tube are significantly different, which is an indicator of poor storage stability.

Keywords : polypropylene, waste plastic, bitumen, road pavements, storage stability, fluorescent microscopy, morphology

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