engineering proceedings

MDPI

Abstract

Investigating the viability of multi-recycling binders extracted from Reclaimed Asphalt through an in-vitro rheological characterization

Gaetano Di Mino [1], Konstantinos Mantalovas [1] and Vineesh Vijayan [1]

[1] Department of Engineering, University of Palermo, Palermo 90128, Italy
gaetano.dimino@unipa.it, konstantinos.mantalovas@unipa.it, vineesh.vijayan@unipa.it,
* Correspondence: vineesh.vijayan@unipa.it

The incorporation of Reclaimed asphalt (RA) in hot mix asphalt mixtures is widely considered a sustainable solution for road infrastructure development. Under the scope of circular economy (CE), the multiple recycling capability of RA has to be assessed in order to ensure its performance at each recycling cycle and also its viability with different additives. The performance of asphalt mixture with RA strongly depends on the type of rejuvenator, binder, and their degree of blending in the mix. For this reason, it is essential to know the properties of aged binder extracted from RA to better understand its rheological properties and optimal dosage of rejuvenation to design a satisfactory blend design for the recycled mixture. To analyse the multi-recycling potential of such recycled mixture with high RA content, it is imperative to study its characteristics at every recycling cycle. Therefore, in this study, a preliminary binder-scale study is carried out to better understand the ageing, rejuvenating effects and morphological changes occurring on bituminous binders at every recycling cycle. The study has been conducted on a RA binder, extracted from RA from a rural road, in Italy and the simulation of multiple recycling is conducted through a laboratory ageing protocol on both binder and asphalt mixture scale. The long-term binder level ageing is performed by Pressure Ageing Vessel (PAV) after the short-term ageing by Rolling Thin Film Oven Test (RTFO). The asphalt mixture ageing is performed through protocols recommended by the Strategic Highway Research Program (SHRP) and the aged binder is extracted from the mixture for further investigations. Multiple recycling is simulated by repeating the ageing procedure after rejuvenating both the aged binder and aged mixture up to the number of recycling needed for the study. The rheological properties of the aged binder obtained from both binder-scale and mixture-scale ageing methods are evaluated using a Dynamic Shear Rheometer (DSR) and Bending Beam Rheometer (BBR). Moreover, the morphological changes that occurred are analysed using SARA (Saturates, Aromatics, Resins, Asphaltenes) fractionation and Atomic Force Microscopy (AFM). The results of the study can help towards answering the uncertainties regarding the performance of high RA% in asphalt mixtures and establishing its viability in multi-recycling towards a full-scale implementation of this sustainable approach.

Keywords: multi recycling; rejuvenators; reclaimed asphalt binders; artificial ageing; aged binder; circular economy; binder morphology

Citation: Di Mino, G.; Mantalovas, K.; Vijayan, V., "Investigating the viability of multi-recycling binders extracted from Reclaimed Asphalt through an in-vitro rheological characterization". *Eng. Proc.* **2021**, *3*, x. https://doi.org/10.3390/xxxxx

Published: date