FEASIBILITY OF FULL RECYCLING OF RAP WITH WASTE COOKING OIL AS A REJUVENATOR IN HOT- AND WARM-MIX ASPHALT CONCRETE

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ABSTRACT

This paper presents the studies carried out so far within the scope of an ongoing project funded by the European Union and the Portugal 2020 program, with the title CoolAsphalt. The project aims to develop asphalt mixture products based on fully recycling RAP – Reclaimed Asphalt Pavement and waste cooking oil as a rejuvenator for low to medium-traffic roads.
In Portugal, those types of roads are about 75.000 km. Over the last decade, the country has produced circa 6.5 million tons of asphalt mixtures annually. Considering the main highway and municipal roads are already developed, there is excellent potential for the future production and use of RAP. According to EAPA, for twelve European countries considered in the 2020 report, the ratio between the production of RAP and new asphalt mixtures is around 14%.
According to the US Department of Agriculture, in 2019, global vegetable oil consumption reached 204.88 million metric tons, and the growth rate is about 2% yearly. A considerable percentage of vegetable oil is used for cooking, generating waste cooking oil (WCO), which is only partially valued for different purposes, such as biodiesel and soap. Therefore, the asphalt mixtures industry is an additional potential value-chain to the WCO.
The results refer to design studies of the asphalt mixtures to be tested throughout the project, the evaluation of workability, water sensitivity, stiffness, and resistance to permanent deformation before ageing. The study assesses hot- and warm-mix asphalt concrete to support the next stage of the project, in which prototypes of real-scale pavements will be constructed.
The tested compositions included the evaluation of mixtures with 100, 80 and 60% of RAP and two additives used as rejuvenators: WCO and BHO - bio heating oil (a cheaper by-product of WCO). The results show that the range of acceptable possibilities to apply in pavements is relatively varied, allowing the design of asphalt mixtures to fulfil the adequate requirement for handling asphalt mixtures during construction and when in service. There is, however, an open issue related to ageing to be addressed in the following stage of the project.