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Investigation of the Usability of Biochars Obtained from Olive Pomace and Smashed Olive Seeds as Additives for Bituminous Binders

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Abstract : Biomass, which is considered to be one of the largest renewable energy sources in the world, has a potential to be utilized as a bitumen additive after it is processed by a wide variety of thermochemical methods. Furthermore, biomasses are renewable in short amounts of time, and they possess a hydrocarbon structure. These characteristics of biomass promote their usability as additives. One of the most common ways to create materials with significant economic values from biomasses is the processes of pyrolysis. Pyrolysis is defined as the process of an organic matter's thermochemical degradation (carbonization) at a high temperature and in an anaerobic environment. The resultant liquid substance at the end of the pyrolysis is defined as bio-oil, whereas the resultant solid substance is defined as biochar. Olive pomace is the resultant mildly oily pulp with seeds after olive is pressed and its oil is extracted. It is a significant source of biomass as the waste of olive oil factories. Because olive pomace is waste material, it could create problems just as other waste unless there are appropriate and acceptable areas of utilization. The waste material, which is generated in large amounts, is generally used as fuel and fertilizer. Generally, additive materials are used in order to improve the properties of bituminous binders, and these are usually expensive materials, which are produced chemically. The aim of this study is to investigate the usability of biochars obtained after subjecting olive pomace and smashed olive seeds, which are considered as waste materials, to pyrolysis as additives in bitumen modification. In this way, various ways of use will be provided for waste material, providing both economic and environmental benefits. In this study, olive pomace and smashed olive seeds were used as sources of biomass. Initially, both materials were ground and processed through a No.50 sieve. Both of the sieved materials were subjected to pyrolysis (carbonization) at 400 ℃. Following the process of pyrolysis, bio-oil and biochar were obtained. The obtained biochars were added to B160/220 grade pure bitumen at 10% and 15% rates and modified bitumens were obtained by mixing them in high shear mixtures at 180 ℃ for 1 hour at 2000 rpm. Pure bitumen and four different types of bitumen obtained as a result of the modifications were tested with penetration, softening point, rotational viscometer, and dynamic shear rheometer, evaluating the effects of additives and the ratios of additives. According to the test results obtained, both biochar modifications at both ratios provided improvements in the performance of pure bitumen. In the comparison of the test results of the binders modified with the biochars of olive pomace and smashed olive seed, it was revealed that there was no notable difference in their performances.

Keywords : bituminous binders, biochar, biomass, olive pomace, pomace, pyrolysis
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