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The effect of a new waste-based bio-surfactant on the stability of bituminous emulsion

Abraham Abe

Department of Chemistry and Chemical Technologies, University of Calabria, Italy

The use of bituminous emulsions is important in road pavement, building and construction industries and they are widely applicable in fundamental processes such as cold mix asphalt, waterproofing processes and microsurfacing. Although bituminous emulsions are widely applicable in industry, not all types of bitumen are ideal for the production of bituminous emulsions. This is as a result of the fact that the chemical composition of one bitumen differs from another to a certain degree depending on several factors. The nature of the starting crude oil and the variation in the cracking processes performed on the bitumen during fractional distillation are some of these factors. This study aims at identifying the factors responsible for the non-emulsionability of certain types of bitumen using Nuclear Magnetic Resonance (NMR) and Dynamic Shear Rheology (DSR) techniques. NMR analysis is carried out in order to investigate and identify the chemical components of bitumen that are responsible for its emulsionability or non-emulsionability and the importance of their role in bitumen's emulsionability. To determine if the rheological (viscoelastic) behaviour of bitumen plays a part in its emulsionability or non emulsionability, DSR analysis is performed. From the data obtained via these techniques, indications on the type of additive to be used to modify non-emulsionable bitumen and improve its emulsionability are obtained. In this study, a highly emulsionable bitumen (labelled as CMR) used in the production of anionic bituminous emulsions was used as the control sample. Two non-emulsionable bitumens (labelled as ADR and ALM) were subjected to the aforementioned techniques in order to analyse their emulsionability. Due to the identification of the chemical components of the analysed bitumens via NMR, the development of suitable additives which improve the bitumen's emulsionability thus rendering it suitable for emulsion production was possible. In addition to the NMR and DSR techniques, a largely uncommon however effective method which determines the acid number of bitumen provided indications on previously unknown factors which influence bitumen's emulsionability. The spectroscopic findings of this study enabled the identification and development of an aliphatic and an aromatic biosurfactant to improve the emulsionability of bitumen..

Speaker Biography

Abraham Abe is a young researcher who is carrying out his Doctoral studies in the department of Chemistry and Chemical Technologies at the University of Calabria, Italy. His research focuses on Physical chemistry characterization of macromolecules of interest (colloidal systems and biomolecules). Development of eco-friendly bioadditives for bituminous systems. Light and atomic force microscopic analysis of biomaterials, colloidal systems and membranes. He is the author/co-author of 10 papers in international peer-reviewed scientific journals. He also has background studies in Biotechnology and has carried out several projects in this field. Some of his previous research was carried out at University College London and Bowen University, Iwo.

abraham.abe@unical.it