STUDY THE EFFECT OF CHITOSAN AS AN EMULSIFIER AND AS AN ADDITIVE OVER CATIONIC BITUMEN EMULSION

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November 2014

DECLARATION

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ABSTRACT

Chitosan has amine and amino groups which have the ability to generate cationic type surfactants when combine with H+ ions. Thus its action as a cationic emulsifier is suitable for negatively charged siliceous aggregates used for road paving in Sri Lanka. This study consisted of two parts. Firstly, water soluble Chitosan was tested for suitability of using as an emulsifier in the production of cationic bituminous emulsions and secondly Chitosan was used as an additive to mix with bitumen emulsion. In the first part, currently using amine emulsifier was replaced at 20% intervals and tested for emulsion properties; emulsion viscosity, storage stability, settlement test, sieve test and breaking of emulsion. In the second part, Chitosan was added to emulsion and viscosity, storage stability and break time were tested. Results of first part indicated that Chitosan replacement was only possible up to 10% replacement for cationic slow setting type of emulsions but rheological properties of rapid setting emulsions could be improved by replacing up to 60% of amine emulsifier with Chitosan. A significant increase in viscosity from 16 SSU (with 0% Chitosan) to 43 SSU (with 60% Chitosan) was observed for rapid setting emulsions. Storage Stability showed the optimum value of zero at 40% replacement and all the values up to 60% replacement were found to be within the ASTM specified level of ±1%. Break time measurements suggested that for slow setting type emulsions Chitosan use as an emulsifier has increased the emulsion breaking rate. Further high viscous and stable rapid setting emulsion could be obtained without hindering the compliance to ASTM standard by replacing the amine emulsifier with Chitosan. Results of second part suggested that Chitosan acts as a viscosity modifier and increases the emulsion viscosity from 26SSU to 92SSU when added at 0.2% of emulsion weight. But this addition has increased the settling tendency of emulsion thus most suited to be mixed at the point of use. In both cases, at a critical amount of added Chitosan was observed. This maximum limit was found to be 0.2% (w/w).

Key words: Chitosan, Bitumen Emulsion, Viscosity Modifier

DEDICATION

I dedicate this thesis to my father who could not see my achievements in his life and to my mother who has brought me thus far on her shoulders.

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my thesis supervisors Dr. A D U S Amarasinghe and Dr. M A B Prashantha for their guidance, understanding, kind support, encouraging advices, criticism, and valuable discussions throughout my thesis.

I am greatly indebted to Mr. B.R.Perera, Chairman, Maga Neguma Emulsion Production Company (Pvt) Ltd for supporting and providing me every opportunity to use the instruments in the company laboratory.

Special thanks go to Mr. S. Nanayakkara, Additional General Manager, Neguma Emulsion Production Company (Pvt) Ltd for his technical support and especially the guidance provided for me like a father to me.

I wish to thank Miss. Lakmali Jayawardane, Mr. Amila Attanayeka and Mr. Hemal Wimalasuriya, who have always being right beside me and gave their fullest commitment to make this work successful.

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LIST OF ABBREVIATIONS

Abbreviation	Description
ASTM	American Society of Testing and Materials
CPC	Ceylon Petroleum Corporation
CRS	Cationic Rapid Setting
CSS	Cationic Slow Setting
DD	Degree of Deacetylation

LIST OF APPENDICES