IBEF Symposium

Influence of bitumen nature and emulsion production parameters on product performance

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Content

• Bitumen emulsion production parameters relationship to performance

• Emulsion’s raw materials & « Right First Time » at production sites

• Example of science used as a base for improvement
Bitumen emulsion’s science is complex

- Both emulsion characteristics, and production parameters are inter-related

Production Parameters (inter-related)

Breaking Index = f(Kin. Viscosity)

~ 600 Asphalt Emulsions
(250+ Asphalts & 15+ Emulsifiers)

Slow setting
Medium Setting
Rapid Setting
Reducing number of variables simplifies modelling

• Single variable: Bitumen nature

• Strong impact of bitumen nature on emulsion characteristics and performance
  - Similar impact of emulsifier nature

• “Right First Time” at industrial sites requires adjustments of production parameters
  - Anticipation of change may be enabled by the modeling of some key emulsion properties
Modeling of emulsion breaking index (BI)

- [emulsifier] and raw materials nature impact strongly emulsion BI
  - Relationships driven by both emulsifier & bitumen natures
  - Despite good tendency, interpretation remains complex
  - BI relationship to [Emulsifier] better described by a power function: \( BI = a \cdot [\text{Em}]^\alpha \)
Modeling of Emulsion Viscosity ($\eta$)

- Within the emulsions population studied
  - Major impact of bitumen nature for 65% emulsions
  - Smaller impact of emulsifier nature or concentration for 69% emulsions
  - 69% & 65% emulsions cannot be compared as such

- Bitumen content in emulsion can be extracted by using colloid science
Use of colloid science for predicting emulsion $\eta$

- Krieger – Dougherty equation: $\eta / \eta_0 = (1 - \Phi / \Phi_m) \eta_m \Phi_m$
  - $\Phi_m$ maximum packing fraction
- Assumption: $\Phi_m$ related to [Emulsifier]: $\Phi_m = a [E_m] + b$

- $\Phi_m$ parameters do not depend upon [bitumen]
Conclusion

• Bitumen emulsion is a complex science: product performance is affected by numerous inter-related production parameters

• Reducing number of variables simplifies modelling

• Dataset confirms variation in raw materials (bitumen, emulsifier) can impact significantly emulsion characteristics

• Sound scientific approach is recommended for better control of emulsion production operations, as far as range of variation in raw materials is anticipated

• Research is on going for the inclusion of additional emulsion characteristics and production parameters in predictive models
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