
Question 61: What measurement and/or predictive methods are you using to determine crude oil blend compatibility?

Dennis Haynes (NALCO Champion)

Various methods exist to determine blend compatibility; one method would be a comparative asphaltene instability point determination via an anti-solvent titration, or another method used is the Wiehe insolubility number to solubility blend number method. The methods available have a wide range of uses yet are not universally applicable to all crude blend scenarios.

Greg Savage (NALCO Champion)

The crude contaminants that cause fouling are frequently not identified in conventional crude assays. Some refiners observe that when two crudes are blended together, they will cause fouling and yet will not cause fouling when each crude is processed individually or blended with other crudes. Mixing a crude, or multiple crudes, containing asphaltenes with another crude can cause the asphaltenes to be destabilized and agglomerate to form solid foulant particles. This is caused by the second crude solvating the resins that were present to disperse the asphaltenes, leading to asphaltene agglomeration. Typically, this is observed when a heavy asphaltic crude is mixed with a more paraffinic crude. The proportions of each crude type and the order in which they are mixed also strongly determine the potential for asphaltene destabilization.

Resins in crude oil are bound to the large asphaltene structures and serve to keep them suspended and dispersed in the crude. The strength of the resin-asphaltene interaction decreases upon heating and the resins are removed from the asphaltenes. This allows the asphaltenes to agglomerate and form particles of foulant. The extent to which the asphaltenes are stabilized at higher temperatures depends upon the strength of the asphaltene-resin interaction. The more strongly the resins are bound to the asphaltenes, the less prone the asphaltenes are to agglomeration and fouling.

The NALCO Crude Stability Index (CSI) is used to determine the stability of fouling precursors in the crude (predominantly the asphaltenes) by titration with an aliphatic solvent. The 'peak' in the titration curve (the so-called 'flocculation point') is indicative of their stability. The amount of solvent added at the peak minimum is noted and converted to a 'CSI Value'. This allows a direct comparison of crudes and refinery slates and indicates the fouling tendency due to asphaltene destabilization of the crude prior to refinery processing. The test is done on raw crude samples and can determine relative crude stability.

Additionally, the CSI can be used to measure intrinsic stability by testing two dilutions of the oil, low and high concentration, in toluene solvent. This method correlates very well with the Intrinsic Stability as determined by ASTM D7157 – 05.

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