



# Detailed Characterization of Naphthenic Acids in Naphthenate Deposits



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Calcium and sodium naphthenates are respectively solid deposits and emulsions formed by the interaction of naphthenic acids with divalent ( $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ) or monovalent ( $\text{Na}^+$ ,  $\text{K}^+$ ) ions in produced waters. Calcium naphthenate formation, an interfacial phenomenon, is thought to depend largely on tetraprotic naphthenic acids known as 'ARN' acids in the crude, whereas the formation of sodium naphthenate originates from less substituted lower molecular weight naphthenic acids. We present detailed chemical class composition analysis of calcium and sodium naphthenates from the field using high resolution FT-ICR-MS. In all cases, calcium naphthenate deposits consist predominately of tetraprotic acids with  $\text{C}_{80}$  hydrocarbon skeleton while sodium naphthenate emulsions consist mainly of specific monoprotic saturated (fatty acid-like) naphthenic acids. Furthermore, low molecular weight tetraprotic acids with a  $\text{C}_{60-70}$  hydrocarbon skeleton were identified in the calcium naphthenate deposit. Based on this study we show that the high resolution and mass accuracy of FT-ICR MS provides detailed acidic speciation for deposits and emulsions analyzed.

**NaNaphthenate**



**CaNaphthenate**



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