



Rapid, Reliable, and Cost-Effective: The “Sh_Pyroil” Advantage for Direct Hydrocarbon Saturation (So) Evaluation and STOIP Calculation

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Summary

Article text should be Arial 11pt, left and right justified. 2 pages including at least one graphic is suggested. Please use the headings that are appropriate for your work, deleting the ones that are not.

Theory / Method / Workflow

A fast and economical geochemical method, thermal extraction by pyrolysis, for direct measurement of hydrocarbon saturation can give reliable oil saturation evaluation to help with testing and perforation decisions. The aim of this study was to: (1) use pyrolysis (thermal breakdown) on core samples to extract hydrocarbons, and (2) compare hydrocarbon saturation from thermal extraction and logs.

Pyrolysis is typically used to assess the quality and maturity of source rocks. We applied this simple geochemical pyrolysis method to core samples from the reservoir and water zone at one-foot resolution. There was a good agreement between the hydrocarbon saturation from pyrolysis extraction and conventional logging. We propose a modified version of the pyrolysis method that directly measures hydrocarbon saturation without requiring any parameter assumption for saturation calculation (e.g. “m” and “n” factors in Archie equation). Usually, a pyrolysis method provides S1 peak, which is the free or mobile oil/bitumen extracted by heat, S2 peak, which is the hydrocarbon generated by organic matter as the temperature increases, and S3 peak, which is the CO₂ produced by non-hydrocarbon organic matter under combustion. We limited the pyrolysis acquisition program to only the S1 peak (free oil), which reduced the pyrolysis runtime to only 3 minutes and gives direct and reliable hydrocarbon saturation.

Results, Observations, Conclusions

One way to improve the accuracy of saturation estimates in challenging reservoirs based on log data is to use Dean Stark for core saturation measurement, which is a common practice. However, this also requires resistivity independent saturation logs to enhance the confidence in the saturation evaluation, leading to higher costs. In this study, we present a novel method that uses the modified pyrolysis technique for hydrocarbon saturation assessment, which offers a more exact, direct, and reliable measure of saturation, thus boosting confidence without increasing costs.

Novel/Additive Information



The core measurement gave S1 values that were adjusted to the weight of the rock, while the whole core was losing moisture during storage. This adjustment method allowed direct measurement of hydrocarbon saturation with high resolution (1 foot intervals) and over a long distance (100 feet). The study showed a strong relationship between hydrocarbon saturation measurement using core analysis and log interpretation. In carbonate reservoirs with low-permeability and low-porosity where log interpretation is not trustworthy, the modified pyrolysis technique can offer a low-cost, quick, and reliable way to assess hydrocarbon saturation. This technique works for both core and cuttings samples, as long as any depth problems related to cuttings are fixed, and the section drilled with Oil Based Mud (OBM). Both old and new cores and cuttings through any oil column can provide useful saturation data

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