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Evaluating Bitumen Evolution in Hydrous Pyrolysis Experiments of the Tremembé Formation (Type I Kerogen) via DSI-GC-MS

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Understanding source rock maturation is essential for identifying petroleum reservoirs. Hydrous Pyrolysis (HP) simulates natural thermal maturation by heating rock samples with water, promoting kerogen conversion to bitumen and the generation of oil and gas. Although gas and oil can typically be directly analyzed by gas chromatography (GC), bitumen requires solvent extraction, which can be a time–consuming step that risks losing volatile compounds and introduces biases. Direct Sample Introduction (DSI) coupled with Gas Chromatography-Mass Spectrometry (GC-MS) offers a rapid and efficient way to assess the organic composition of geological samples, requiring minimal preparation compared to the solvent extraction methods, since solid matrices are directly analyzed by insertion in the system in a non-reactive cup.[1,2] This study employed DSI-GC-MS to characterize source rocks subjected to hydrous pyrolysis (HP), simulating thermal maturation. Rock samples (Type I kerogen) of the Tremembé Formation were subjected to HP for 72 h at temperatures from 280 to 365 °C, with an unheated sample serving as a control. About 50 mg of each finely ground sample was introduced into a Frontier Lab EGA/PY-3030D pyrolyzer at 300 °C, interfaced to a Shimadzu GC/MS-QP2020. The GC, equipped with a HP-PONA column, was programmed from 30 °C (5 min) to 320 °C at 15 °C/min (40 min hold), using a 1:25 split and helium at 1.05 mL/min. The MS transfer line and source were kept at 310 °C and 250 °C, respectively, with data acquired with a scan of *m/z* 35-500.[1,3] DSI-GC-MS allowed rapid detection of volatile compounds from the bitumen fraction, correlating hydrocarbon size distribution and intensity with total organic carbon (TOC) and Rock-Eval Pyrolysis results. In addition, tracking selected biomarkers provided insights into changes associated with bitumen production and oil expulsion during thermal maturation. This approach offers a timely alternative to conventional extraction methods, enhancing our understanding of source rock evolution and aiding in the interpretation of HP results.

References

[1]Xia L. et al. *Mar. Petr. Geo*. **2019**, 101, 343-354.

[2]Qing, W. et al. *Fuel Process. Technol*. **2022**, 225, 107058.

[3]Peters, K. E.; Walters, C. C.; Moldowan, J. M. The Biomarker Guide. Cambridge, University Press, **2004**, v. 2.