

Using Aromatic and Light Hydrocarbon Isomers, the Generation Temperatures for Oils Derived from Sulfur-Rich Kerogens

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Abstract

The link between isomer ratios of some hydrocarbons and temperature can be utilised to gauge thermal maturity and direct petroleum exploration. In the literature, the C7 Dimethylpentanes (DMPs) are widely utilised to determine the temperature at which produced oils are generated. These light hydrocarbons are very helpful, but source mixing, thermochemical sulphate reduction, water washing, and evaporative fractionation can all have an impact. For oils derived from sulfur-rich kerogens (i.e., Type II-S), proper temperature computation is especially crucial because oil formation starts earlier at lower temperatures due to an early shattering of carbon bonds. Standard maturity techniques may underestimate the thermal maturity of Type II-S oils due to the sulphur enrichment of kerogen; consequently, alternative techniques specific to sulfur-rich sources, such as the aromatic Methylidibenzothiophene (MDBT) isomers, are required to precisely determine generation temperatures and maturity. There are few studies connecting lighter hydrocarbons to longer-chained aromatic hydrocarbons. In this study, the 4-MDBT/1-MDBT ratio is used to directly compute the maturity and generation temperatures for Type II-S oils by integrating the light hydrocarbon DMPs and aromatic, sulfur-bearing MDBTs.

Keywords: Methylidibenzothiophene; Dimethylpentane; Generation temperatures; C7 hydrocarbons

Introduction

Marine kerogen is widespread throughout the planet, and the known quantities of low- to moderate-sulfur oils are dwarfed by the potential reservoirs of high-sulfur oils. Sorg 6-14 wt% and S/C > 0.04 are anomalously high sulphur content oils produced from sulfur-rich marine kerogen. In order to aid in exploration, it is crucial to limit the thermal evolution of sulfur-rich kerogen in different basins [1]. For maturity approaches that rely on the isomerization of particular chemicals common to Type II marine sources, increased organosulfur in source rocks present a problem. Chemically bound Sulphur decreases the activation energy of kerogen and starts early free-radical cracking of carbon bonds because sulfur-carbon bonds are weaker than carbon-carbon bonds. [2]. Oil is produced at substantially lower temperatures in source rocks with high organosulfur kerogen than in those with low Sulphur kerogen. Therefore, when estimating conventional and unconventional oil and gas possibilities sourced by kerogen, the temperature and timing of oil and gas generation are critical [3]. There are many techniques described in the literature for determining the produced hydrocarbon phase directly from source rocks and for estimating the thermal maturity of various source rocks utilising oils. Sulphur plays a substantial role in kerogen's chemistry [4]. The lack of a discernible difference in the methylphenanthrene isomers for Type II-S source rocks may be attributed to the relative abundance of liptinite and vitrinite. All kerogen types can be affected by biomarkers that can be used to determine maturities, such as triaromatic steroids, steranes, and hopanes.

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Depending on the biomarker's isomeric and thermal stability, isomerization equilibrium for biomarkers at high thermal maturities ranges from 0.9 to 1.3, making them less dependable [5]. Despite being helpful maturity markers, these must be verified by other techniques, particularly for samples taken from the late oil and condensate window. It is necessary to develop maturity indicators specifically for kerogen that can be dependable for both low and high maturity samples due to the uncertainty that can occur with other regularly used maturity indicators. It has been demonstrated that the Methylthiophenes (MTs), a subclass of Polycyclic Aromatic Hydrocarbons (PAHs), are accurate markers of marine kerogen maturity [6].

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