

Fluorescence Spectra - An Effective method of Identification and Quantitative Assessment of Mixed Source Oils with varied thermal maturity

HANJING ZHANG¹, SUMEI LI^{1*} AND YONG CHEN^{2*}

¹State Key Laboratory of Petroleum Resources and Prospecting, China University of Petroleum (Beijing), Beijing, 102249, China (*Corresponding author, Email: sml@cup.edu.cn;)

²School of Geosciences, China University of Petroleum, Qingdao, Shandong, 266580, China (*Corresponding author, yongchenzy@upc.edu.cn)

This study is aimed to establish a fast and effective method - using micro-fluorescence spectroscopy^[1,2] to identify and evaluate mixed source oils with varied thermal maturity in the Dongying Depression, Bohai Bay Basin. Two crude oils sourced from the fourth member of Eocene Shahejie Formation (Es₄) were selected as two end member oils for oil mixing experiment, which were featured by normal maturity (end member A from Well Wx583, reflected vitrinite reflectance R_c=0.91%) and less mature maturity (end member B from Well Wx731, R_c= 0.53%) respectively. The result indicates the artificially mixed oils showing an linear variation of fluorescence color in CIE-XY^[3] (Commission internationale de l'éclairage) chromaticity diagram and apparently an intermediate features between the end member A and B. A negative relationship was observed between fluorescence spectral parameters QF-535 (The ratio of enveloping area between wavelengths 535 and 720nm to that of the 420 and 535nm) and the mixing proportions of the two end members. A formula used for calculating the proportion of the mixed oil is as the follows:

$y = -224.06x + 411.59$ (The correlation coefficient R² is 0.87), in which, X is the fluorescence spectral parameter QF-535; Y is the proportion of the end member A mixed, representing the Es₄ normal mature crude oil. Based on the formula combined with a comprehensive geochemical and geological investigation, we identified and quantitatively evaluated the mixed oils with different maturity in the Wangjiagan Oilfield in the Dongying Depression. For example, the matured Es₄ origin oil from the Well W78 is about 92.5%. This study is important for further petroleum exploration and resource assessment in the area.

[1] Radke M et al (1982). *Geochimica Et Cosmochimica Acta*, 46(1):1-10. [2] Khorasani G K (1987). *Organic Geochemistry*, 11(3):0-168. [3] Robertson A R (1977). *Color Research & Application*, 2(1).