

Effect of chemical demineralization on organic matter in Chinese Huadian oil shale

Xin Ru¹, Zhiqiang Cheng^{1,2}, Mengzhu Liu¹, Dawei Ding¹, Junfeng Li¹

¹*College of Chemistry, Jilin University, China,* ²*College of Resource and Environmental Science, Jilin Agricultural University, China*

In this study, mineral matter in Huadian oil shale was selectively removed by four acids (HCl-15 wt%, HNO₃-15 wt%, CH₃COOH-30 wt%, and HF-15 wt%). Regardless of which acid was used, the specific surface area of the mineral matrix in oil shale increased significantly. Specifically, using HF led to the maximum degree of demineralization (47.49%). The content and chemical structure of the soluble organic matter in Huadian oil shale was investigated by sequential extraction with three different solvents (hexane, toluene, and methanol) and gas chromatography-mass spectrometry (GC-MS). The results of GC-MS illustrated that the extracts in hexane, toluene and methanol were normal alkanes (C₁₇-C₃₀), aromatic compounds and heteroatomic compounds respectively. The nitric acid is believed to react with the insoluble organic matter in the oil shale resulting in the total extraction yield increasing significantly. Furthermore, the insoluble organic matter in the solid residue was analyzed by a system combined computerized filament pyrolyzer and GC-MS. The pyrolysis product analyses (pyrolysis temperature was 600°C) of the demineralized illustrated that using acetic acid could obtain a maximum yield of volatile hydrocarbons (about twice that of the untreated sample). This can be explained as the acetic acid can promote the catalytic effect of clay minerals on cracking insoluble organic matter in Huadian oil shale. This research not only provides quantitative and qualitative information about the organic matter in Huadian oil shale, but also can be regarded as a theoretical basis for study of interactions between organic matter (soluble and insoluble) and clay minerals.