Critical-Point Drying for Kerogen Microstructural Preservation

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Kerogen, the source of producible hydrocarbons, has garnered renewed interest because of the recent development of hydrocarbon source rocks (shales) as economic oil and gas resources. The amount and composition of kerogen in shale determines the quality and volume of hydrocarbon generated by thermal maturation, and the microstructure (e.g., porosity) of matured kerogen affects the ability to produce those hydrocarbons.

Kerogen microstructure is poorly understood, in large part because acid demineralization used for kerogen isolation preserves its chemical composition but substantially alters its microstructure. Thus, a method is needed for isolation of this solid, insoluble, organic phase that maintains both chemical and microstructural characteristics. Here, we present chemical isolation that effectively removes mineral from shale and preserves the kerogen chemical properties combined with a critical-point drying procedure using liquid CO_2 that also preserves kerogen microstructure. Microstructural preservation is demonstrated by scanning electron microscopy and surface area measurements using multi-stage nitrogen-adsorption techniques. This novel approach to isolation of kerogen is a critical step to better quantify kerogen microstructure in shale, and to better predict the storage, transport, and production of hydrocarbons within organic matter in shale.