University of Michigan

Department of Chemical Engineering
Seminar Series

Tuesday, October 6, 2009
Presentation: 1:30 p.m., 1017 H.H. Dow
Refreshments to Follow: 3062 H.H. Dow (MSE Conf. Room)

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Ann Arbor, Michigan

Himabindu: Designing Synthetic Biointerfaces for Human Embryonic Stem Cell Culture

Human embryonic stem (hES) cells have enormous potential as models of early human development and for regenerative medicine, drug discovery and toxicology. Owing to sensitivity to environmental influences, long-term propagation of hES cells requires naturally-derived substrates, which introduce ambiguity and contaminations into the culture system. We have developed a synthetic polymer coating that supports long-term hES cell proliferation in defined culture media. Throughout the study, hES cells expressed pluripotent cell markers, retained a normal karyotype and maintained the ability to differentiate. This is the first synthetic polymer matrix that can maintain long-term hES cell culture in a defined microenvironment, and represents a significant advance towards clinically-applicable culture systems. Development of a standardized, controllable and sustainable culture matrix for hES cells will contribute significantly to biotechnological and medical applications of hES cells.

Tabish: Revisiting Asphaltene Precipitation from Crude Oils: A Case of Neglected Kinetic Effects

The precipitation of asphaltenes from crude oils can lead to serious challenges during oil production and processing. This research investigates the kinetics of asphaltene precipitation from crude oils using n-alkane precipitants. For several decades, it has been understood that the precipitation of asphaltenes is a solubility driven phenomenon and the previous studies on the effect of time are usually limited to short time scales. By using optical microscopy and centrifugation-based separation, we have demonstrated that the time required to precipitate asphaltenes can actually vary from a few minutes to several months, depending on the precipitant concentration used. Our results demonstrate that no single concentration can be identified as the critical precipitant concentration for asphaltene precipitation. Based on long-term experiments, we have also been able to establish the solubility of asphaltenes as a function of the precipitant concentration and it is shown that the short-term experiments over-predict the solubility. A generalized geometric population balance approach has been used to model the growth of asphaltene aggregates. The results demonstrate that the flocculation process accelerates with increasing amounts of heptane added to the asphaltenic crude. This research opens up a new paradigm for understanding asphaltene precipitation.

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