Characterization and demulsification of produced fluids from enhanced oil recovery applications

George J. Hirasaki[a], Clarence A. Miller[a], Olina G. Raney[a], Michael K. Poindexter[b], Duy T. Nguyen[b*], John Hera[b]

[a]Rice University, Department of Chemical Engineering, MS-362, 6100 Main Street, Houston, Texas 77005
[b]Nalco Company, Energy Services Division, 7705 Highway 90-A, Sugar Land, Texas 77478
*(*presenting author: dtnguyen@nalco.com)*

During the application of chemical enhanced oil recovery (EOR) floods, breakthrough of injection chemicals can cause stable emulsions. It is generally not possible to predict the level or timing of chemical breakthrough. Some EOR recommendations use a combination of anionic surfactants and polymer (SP); alkali, surfactants and polymer (ASP); and variations on these two themes. Should breakthrough occur, it is critical to have processes that can handle the changing conditions that evolve during the course of oil recovery. The process described in this paper involves the use of demulsification chemicals that can address the production of on-specification oil and water as well as preventing build-up of an unresolved interface.

EOR methods are expected to play a key role in meeting future energy needs. Chemical EOR methods may play an important role in capturing difficult to recover oil. While SP/ASP methods should provide significant recovery, resolution of the produced oil-water mixture is not guaranteed using existing field separation methods. New technology is needed to ensure that chemical EOR floods are a success from a recovery aspect and from a topsides treatment perspective.

Laboratory experiments demonstrated that application of a novel patent-pending demulsifier to emulsions expected during a proposed SP pilot test yielded satisfactory separation of oil and water phases while use of typical nonionic polymeric demulsifiers did not clear the water phase adequately. A similar demulsifier performed exceptionally well in a field demonstration of ASP technology. In this latter case no sales oil was produced using conventional separation chemicals due to stable emulsions and high amounts of bottom sediment and water (BS&W) in the oil phase and high concentration of oil in the water (>10,000 ppm).The operator is now able to produce sales oil with 400 ppm of the new patent-pending chemical. The demulsification mechanism is being investigated with measurements of equilibrium and dynamic interfacial tension as well as droplet size.

When selecting recovery methods, it is important that the full suite of EOR options is potentially available. For chemical EOR, this means preparing for the potential production of injection chemicals, which can create stable emulsions. This paper presents an approach which has shown initial success in breaking such emulsions for the separation of oil and water.