



HARCROS

Harcros and Enhanced Oil Recovery(EOR)

Harcros has spent the last several years focusing on specialty surfactants for EOR application. The typical Harcros EOR surfactant is capable of reducing interfacial tension, at the surface of an oil droplet, to 10^{-4} dynes/cm (ultra-low IFT). When provided with a sample of formation water and oil, Harcros has the internal capability to tailor a formulated product which will operate at the target temperature and salinity. This unique technology is the subject of several international patents, which are jointly held by the Regents of the University of Texas and Harcros. The efficacy of these *built for purpose* surfactants relies on the presence of a large hydrophobe, relatively large blocks of ethylene oxide and propylene oxide [(EO)₂₅₋₄₀(PO)₂₅₋₄₀], and an end-capping group (i.e., carboxylate or sulfate) that is tailored toward the particular application. This technology competes well with other large hydrophobe technology, but uses more readily available feedstocks. These Harcros surfactants may be used for both ASP and SP technologies.

Harcros has participated in Chemical EOR trials globally, including areas of the Middle East, that have ranged in size from single well tracer tests to partial field trials, requiring hundreds of metric tons of specialty surfactant.

Most recently, results from a single well tracer test, conducted with Harcros surfactants, have been very encouraging. Results from a larger scale field trial have also exceeded expectations

At **Harcros**, we are positioning ourselves in the industry as the “go to” partner for development, drum size scale-up, and full field implementation. Very recently, Harcros installed a mid-scale alkoxylation reactor in its Kansas City plant, specifically for producing intermediate quantities of these unique surfactants. Through current ownership ventures and technology partnerships, Harcros is also capable of manufacturing these products in the United States, India and China in sufficient quantity for full field trials.

Harcros' current industry partners in these efforts are University of Texas (Austin), University of Oklahoma (Norman), University of Kansas (Lawrence), Venus Ethoxylators PVT, India and Advanced Harcros, our Joint Venture alkoxylation partner in Fuyang, China. Harcros is also a shareholder in Ultimate EOR, a privately held technology company, whose sole focus is commercial implementation of EOR technology. Harcros is also a service provider and licensee to Ultimate.

