

Forum mixing technology- ForuMIX- enhances operational benefits for desalter in major US refinery

The Challenge

The quality of mixing imparted to the oil and water prior to reaching the desalter vessel is key to maximize the desalting and dehydration efficiencies in refinery operations. It is desirable to disperse the fresh process water in the crude as thoroughly as possible without forming an emulsion so highly stabilized that it is difficult or impossible to break. This may be a challenge with crudes that contain emulsions difficult to resolve. Inadequate mixing can lead to the power system experiencing more erratic voltage readings, more water carryover with the desalted crude, more oil carryunder and less solid removal with produced water, among others. This translates into higher power consumption, higher operating and maintenance costs in the desalter, but also higher water treatment cost, higher probability of corrosion issues downstream caused by the carryover of water-soluble salts. Thus, choosing the appropriate crude-water mixing technology is essential to refinery operations.

In an effort to reduce operating costs given by improper mixing, a Midwest refiner contacted Forum Energy Technologies because of their reputation for providing efficient designs in desalting. The refiner was seeking to test a new inline mixing device to replace the traditional double-port mixing valve in their two-train, two-stage desalting system with inlet salt content of 4-10 PTB and BS&W of 0.1 % v/v. The refiner needed to improve mixing to enhance the operating performance, i.e. desalting efficiency, oil in brine, and dehydration efficiency, to boost operation and maintenance savings.

The Solution

After a technical review, the Forum team recommended the ForuMIX technology in one of the parallel trains to test the performance against the identical second train, which had the traditional double-port mixing valve. The ForuMIX is the most advanced and compact inline mixing device designed specifically for mixing of two fluids. The design provides a homogeneous and adjustable shear force to the injection fluid (water) across the cross section of the main process flow (crude), creating a narrow, uniform droplet size distribution of the water droplets. The more efficient mixing was expected to best utilize wash water, decrease chemical consumption in the desalter, increase salt removal, and provide low water carryover in product oil and low oil carryunder in the effluent water.

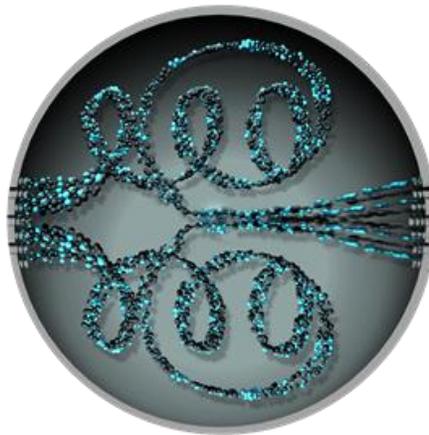
The desalters with the ForuMIX met and exceeded its target desalting efficiency. All parameters performed better than the train with the double-port mix valve:

- Salt in water effluent (5~10% 1st stage, 40~50% 2nd stage improvement)
- Oil in water effluent (>50% reduction)

- Solid removal (42% more oily solids removal, 32% more inorganic solids removal)
- Pressure drop (67% reduction)

Note: The outlet BS&W and salinity was too low to be measured accurately and reliably with current available test methods. The analysis was done on the produced water effluent instead to provide reliable measurements.

Thus, the ForuMIX, provided the best environment to mix the crude oil and water. A homogeneous shear force created an improved droplet size distribution and higher interfacial contact area between the crude and the water. This greatly enhanced the mass transfer between crude oil and water with lower pressure drop. The mixing not only provided a better droplet size distribution, but it also resulted in a higher water droplet density. Both of these facilitate quick, complete coalescence of water droplets inside the desalter, thereby ensuring more efficient water-oil separation.



Internal mixing of crude oil and water in Forum mixing technology- ForuMIX

The Benefit

Forum's mixing technology, ForuMIX, proved to exceed the operating performance of the desalting process in the Midwest refinery. The ForuMIX allowed the refiner to reduce operating and maintenance costs due to reduced: downtime, desalter upsets, chemical injection, and oil in the produced water.

- The design reduced downtime caused by potential downstream corrosion. Lower salt, low water and low solid particle carryover in the desalted crude protected downstream equipment in the refinery.
- The unit is facilitating long run cycles due to the increased ability of the desalter to handle upsets.
- The design reduced the produced water treatment costs by reducing the amount of oil in the effluent water.
- The design reduced power consumption by reducing the pressure drop of wash water injection and mixing into the oil process.