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OCTOBER | VOL 3 | ISSUE 14
$4.99
8 52667 72435 1

TECH TALK

Micro-filtration of produced water with sound waves

BY GARY BEERS • FOR ENERGY PIPELINE

PROBLEM OF MICRO-RESIDUALS

There are many conventional processes for the separation of particles and oil from produced water; however, a shared major problem is the inefficiency at removing micro-residuals (i.e., dispersed particles or droplets less than 20 microns). Follow-on complex processes, involving membrane filters and chemical additions, are usually employed to remove the micro-residuals. These polishing efforts involve the use of consumables (filters, membranes, chemicals), have high energy costs, and – unfortunately, still exhibit inefficient separation.

A SOLUTION : MICRO-FILTRATION WITH SOUND WAVES

In 2012, a novel application of acoustic technology was developed to capture and separate micro-residuals without using physical membranes, chemicals or centrifugation. This breakthrough approach is sustainable, environmentally benign, and operates a lower energy cost.

HOW DOES TECHNOLOGY WORK?

When a liquid containing tiny particles and oil droplets flows through a horizontal, standing acoustic, forces are setup to create an "invisible" filter. The energy of the wave drives particles to the node (Figure 1) and, once in close proximity to each other, the particles agglomerate. The particles remain "trapped" at the nodes while the water continues to flow through the standing wave. When the water passes through this two-dimensional array of standing waves, a layer of agglomerated particles exists along the common axis for each set of nodes.

An animation showing the creation of these particle layers is available on the internet (www.fdsonics.com/technology).

Through a patented process (FloDesign Sonics), another standing wave is added and the particles in the layer are further aggregated at new nodes – which can be seen in the above animation. To complete the separation process, the waves are turned off and then the heavier particles sink while the oil droplets and buoyant particles rise. The settled particles can be disposed of as a solid waste and the oil can be recovered.

APPLICATION FOR PRODUCED WATER TREATMENT

This proprietary technology (Acoustic Wave Separation, AWS), funded by a $1.6 million grant from National Science Foundation) and by investors ($25 million), is designed to treat produced water from hydraulic fracturing (fracking) operations. Initial testing has been completed with a 170 barrel/day prototype and efforts are underway to fund and develop a pilot plant. Compared to current methods for treating produced water, energy and chemical costs can be reduced by 75 percent with this approach. The after treatment with the AWS system, the produced water meets or exceeds the EPA's standards for a safe discharge (Acoustic Technique Presents Fresh Take on Water Treatment, National Science Foundation, 2016).

For over 50 years, **GARY BEERS**, has worked in numerous fields of environmental science as a consultant, regulator and educator. This career included senior management position with major consulting, nonprofit and public organizations. He has founded several successful firms to capture emerging resource management markets. One of his latest ventures, EnviroScienceINFO, provides content for public media.

FIGURE 1