Nanoparticles may aid oil recovery, frack fluid tracking

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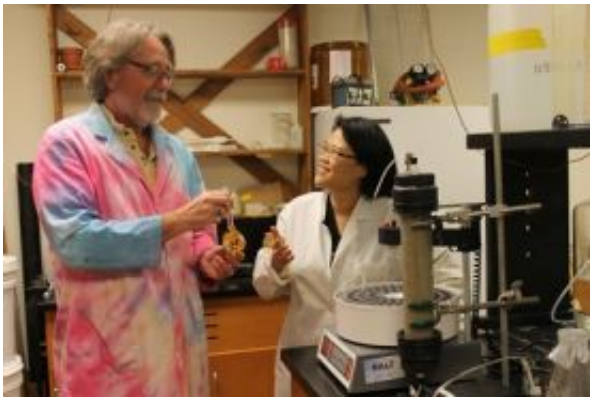

William Sanford and Vivian Li

Two Colorado State University researchers are examining how nanoparticles move underground, knowledge that could eventually help improve recovery in oil fields and discover where hydraulic fracking chemicals travel.

Vivian Li, assistant professor in the Department of Design and Merchandising, and William Sanford, associate professor in the Department of Geosciences,are trying to find patterns in how certain nanoparticles move underground. If successful, they could train the nanoparticles to indicate when specific chemicals are present in the subsurface, including those found in underground water deposits. These modified "smart" nanoparticles, known as tracers, could sense high pH

levels or the presence of hydraulic fracking chemicals.

In the initial phase of their research, funded through a grant from the CSU Water Center, Li and Sanford are testing their specially engineered carbon nanoparticle to see how it moves through the ground. Once they understand how the particle travels through a number of subsurface environments, it could eventually be used to search for chemicals in some of earth's most hostile underground environments.

"We also want to see how nanoparticles affect the composition of the natural environment and how certain elements found in the ground alter the composition of the nanoparticle," explained Li.

Temperature, water saturation, and the physical and chemical composition of the soil are the primary factors that can alter the movement of nanoparticles.

Controversial practice

Hydraulic fracturing of wells has caused a political firestorm in recent years, as Colorado residents have questioned the health and safety risks of injecting chemicals into the ground to free oil and natural gas. There is still debate about whether these chemicals are harming the environment, and some question where the chemicals go after injection, fearing they may be contaminating groundwater supplies.

Using tracers, Li and Sanford theorize they could inject the particles into the earth near fracking sites and allow them to follow subsurface water flow paths to a distance away from the injection site. If the recovered tracers are fluorescent, they are reacting to the fracking chemical they were engineered to detect, demonstrating the path those chemicals traveled.

In continuation of Li's post-doctorate work, these tracers could also be used to improve the recovery of oil from reserves deep within the earth, which would allow scientists to increase the amount of oil that can be pumped, saving time and money on drilling new wells.

"Only about 50 percent of the earth's oil reservoirs are being tapped," Li said. "With the potential to quickly drain the current oil reserves, the need to improve oil recovery and find the other hidden 50 percent becomes extremely important."

Harsh conditions

However, these reservoirs are often very deep in the ground and can be home to extreme conditions that make it difficult for nanoparticles to survive. Many nanoparticles that have been developed cannot withstand the high salinity of the oil reserve and deteriorate in the process of finding the oil. However, Li and Sanford believe they have engineered a nanoparticle that can both survive in the harsh environment and keep its smart abilities for a long period of time.

"The uses of these nanoparticles are potentially quite extensive," explained Sanford. "By creating smart particles we can see how contaminants are distributed in the subsurface, the recovery of economic minerals in water can be done, and the uses in the oil industry are many-fold."

Still in the early stages of the research, Li and Sanford are patenting their new nanoparticle and continue to test it in preparation for studies in the field.

Provided by Colorado State University