# Optimising Oil Recovery

## Understanding the science

CDS® technology, a versatile colloidal delivery system, can interact with a wide range of surfaces and operate across the entire Hydrophilic-Lipophilic Balance (HLB) spectrum. This unique capability allows CDS® to modify the surface chemistry of rock formations, oils, and other materials to optimise chemical reactions and enhance oil recovery. By tailoring the interactions between surfaces and chemicals, CDS® can improve the efficiency of various oil recovery techniques. Let's look at how CDS® does this.

## Oil-rock repulsion

**Mechanism**: Mechanism: By interacting with rock surfaces and heavy oil molecules, CDS® can alter the surface energy and adhesion properties in the reservoir matrix. This adjustment can make the rock surfaces more "oil-phobic" (repelling oil) or "water-wet" (attracting water), which can reduce oil adhesion to rock surfaces.

**Impact:** When the rock becomes less attractive to oil molecules, the heavy oil becomes less sticky and flows more easily toward the wellbore. This effect can enhance the recovery of heavy oil from the reservoir matrix, improving mobility even if the oil is highly viscous.

## Better treatment reach

**Mechanism:** CDS®'s colloidal nature allows it to distribute effectively within porous media. Its ability to interact across the HLB spectrum can improve the penetration of treatment into deeper parts of the reservoir.

**Impact:** This extended interaction range and targeted surface chemistry adjustment can reduce the need for frequent treatments. CDS® particles can bond to rock surfaces, providing a more sustained improvement in oil flow without requiring re-injection.

# Tailoring wettability

In water-wet or oil-wet reservoirs, wettability greatly influences which fluid (oil or water) preferentially moves through the rock matrix. CDS®'s flexibility in adjusting surface properties along the HLB spectrum means it can tailor the wettability profile of rock surfaces to favor oil or water flow. Here's how it affects performance:

**Mechanism:** In **oil-wet reservoirs**, CDS® can alter the HLB balance of rock surfaces to promote water-wet characteristics, encouraging water to adhere to the rock surfaces and enabling oil to flow out more readily. This can minimise water production issues while maximising oil flow by reducing the adherence of oil to rock surfaces.

**Impact on Water Production and Oil Flow:** By making the reservoir more water-wet, CDS® reduces the tendency for water to flow preferentially, addressing excessive water production. This capability not only improves oil recovery but also reduces the costs associated with handling and separating unwanted water at the surface.

**Mechanism:** In **sandstone formations** with low compressive strength,deeper penetration might be limited. However, CDS®'s adjustable HLB interaction means it can create more lasting wettability changes in the critical matrix area near the wellbore. This can provide longer-lasting modifications to the wettability profile compared to single-effect chemicals, which may not retain effectiveness as oil flow shifts wettability back to its original state.

**Impact:** This extended interaction range and targeted surface chemistry adjustment can reduce the need for frequent treatments. CDS® particles can bond to rock surfaces, providing a more sustained improvement in oil flow without requiring re-injection.


## Wax-repellent tubing walls

**Mechanism:** CDS® can modify the production tubing's internal surfaces, making them less attractive to wax molecules. By adjusting the surface's HLB balance towards a more hydrophilic state, CDS® can inhibit the tendency of wax to adhere and crystallize on tubing walls. Wax molecules prefer surfaces with more lipophilic (oil-attractive) properties, so shifting to a hydrophilic surface reduces wax deposition.

**Impact on Wax Formation:** This adjustment in surface properties can delay or even prevent wax formation as oil cools, allowing smoother oil flow and reducing the frequency of tubing cleanouts or interventions.

## Fewer injections (wax inhibitors)

**Mechanism:** While continuous low-rate injection might still be required to maintain CDS® in the tubing, the particles' surface-modifying effects across the HLB range could allow for less frequent injection intervals. Since CDS® can interact effectively across varying temperatures and pressures, its application at the tubing's bottom may sustain a protective effect as oil travels to the surface.

**Impact on Treatment Longevity:** With the surface-inhibiting properties of CDS®, periodic injections may suffice if wax inhibition remains stable, potentially cutting down the overall injection frequency compared to traditional wax inhibitors.

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