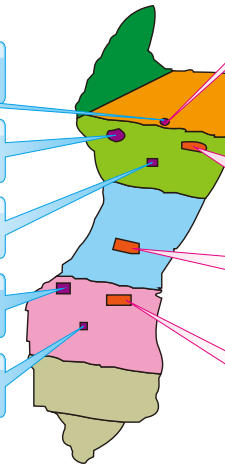


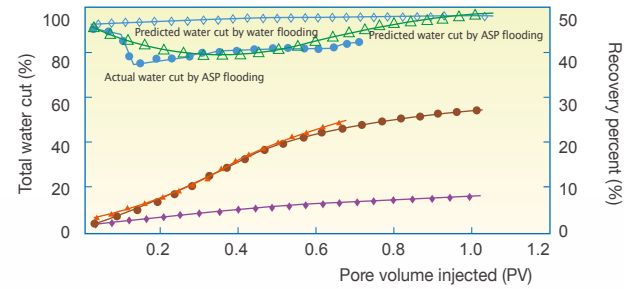
Pilot field test

- North well group—small well spacing
Time: 1997.12–1998.12
Wells: 3 injectors/4 producers
Recovery increment: 23.24%
- Duanxi of Bei-1 block
Time: 1997.03–2002.05
Wells: 6 injectors/12 producers
Recovery increment: 21.90%
- Western part of central block
Time: 1994.09–1996.05
Wells: 4 injectors/9 producers
Recovery increment: 21.40%
- Western part of Xing-2 block
Time: 1996.09–1999.10
Wells: 4 injectors/9 producers
Recovery increment: 19.16%
- Central part of Xing-5 block
Time: 1995.01–1997.04
Wells: 1 injector/4 producers
Recovery increment: 25.00%

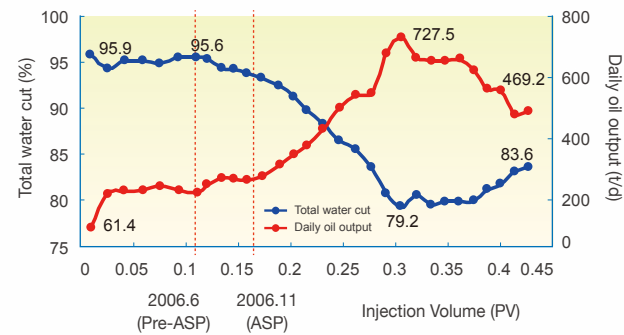


Industrial field test

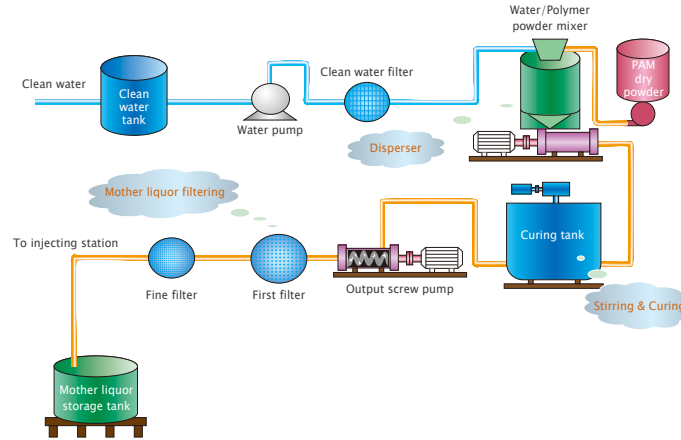
- Labeidong block
Initial time: 2008.05
Wells: 44 injectors/62 producers
- Duandong of Bei-1 block
Initial time: 2006.07
Wells: 49 injectors/63 producers
- Nan-5 block
Initial time: 2006.07
Wells: 29 injectors/39 producers
- Central part of Xing-2 block
Initial time: 2000.04
Wells: 17 injectors/27 producers



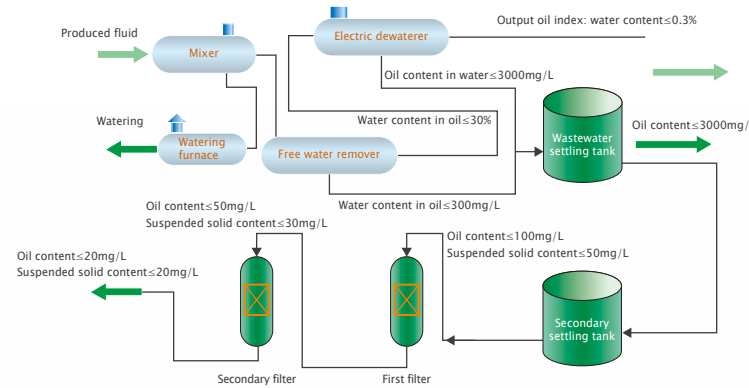
Recovery effect curves in Duandong of Bei-1 block



Composite Production Curves in Nan-5 block

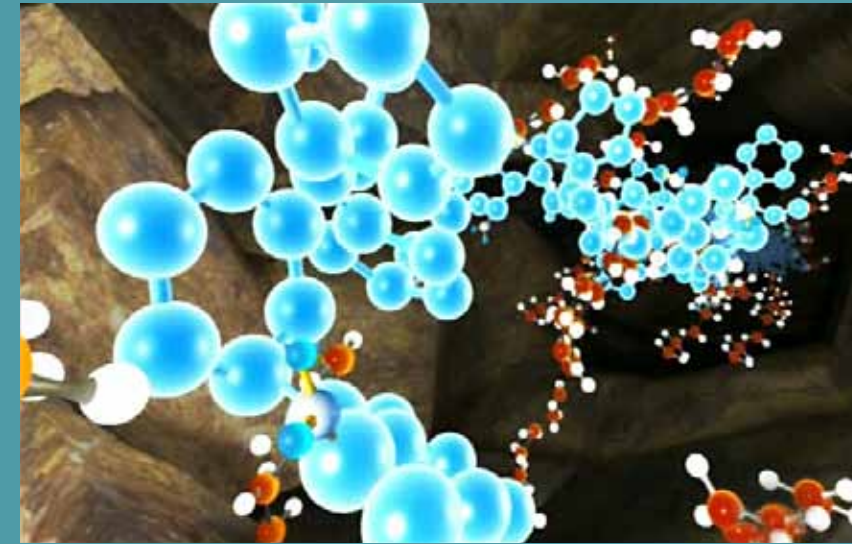


Flowchart of polymer preparation process



Flowchart of produced fluid treatment

A complete treatment process consisting of two stages for oil removal and two other stages for filtering has been developed and put into application. The system outputs water that meets China's discharge standard for industrial wastewater (oil content ≤ 20mg/L and suspended solid content ≤ 20mg/L).



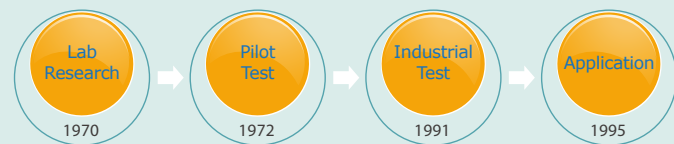
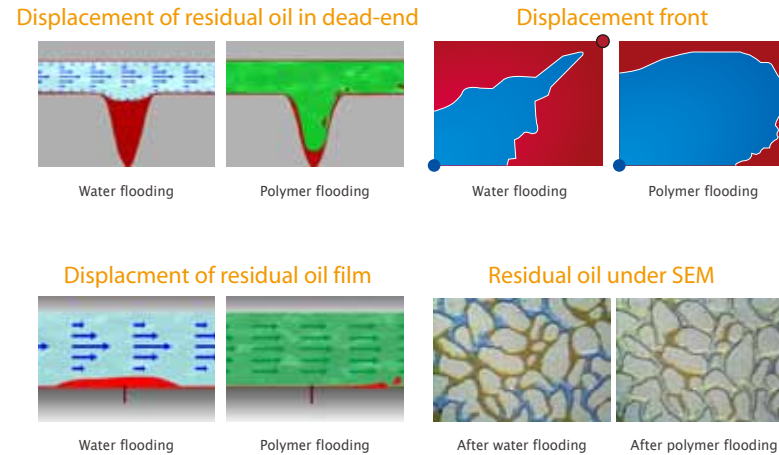
Polymer flooding and ASP flooding in Daqing Oilfield



Polymer Flooding

Polymer flooding is a tertiary recovery method by adding high-molecular-weight polyacrylamide into injected water, so as to increase the viscosity of fluid, improve volumetric sweep efficiency, and further increases oil recovery factor.

When oil is displaced by water, the oil/water mobility ratio is so high that the injected water fingers through the reservoirs. By injecting polymer solution into reservoirs, the oil/water mobility ratio can be much reduced, and the displacement front advances evenly to sweep a larger volume. The viscoelasticity of polymer solution can help displace oil remaining in micro pores that cannot be otherwise displaced by water flooding.

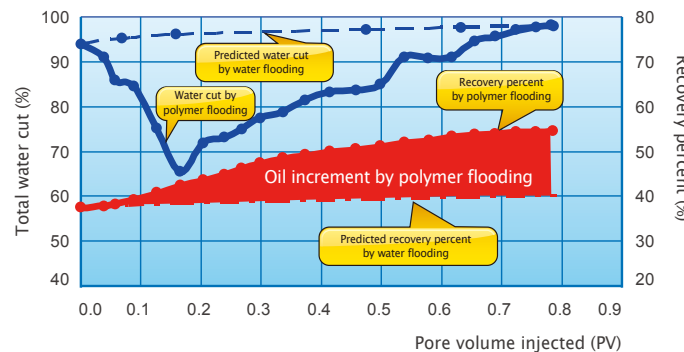


Four stages of Daqing's polymer flooding practice

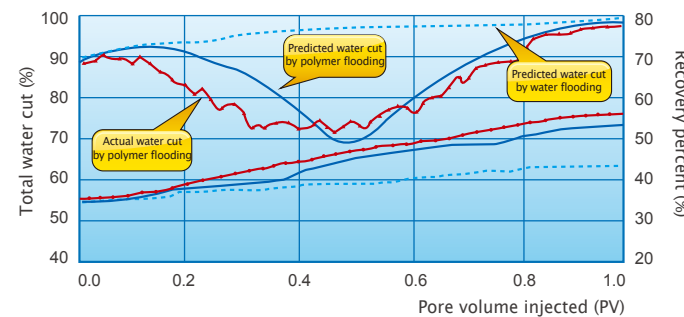
In 1989, polymer flooding saw its first pilot test in the western part of the central block, demonstrating an 11% increase of recovery factor as compared to water flooding. In 1991, industrial field tests were deployed in multiple well groups of large spacing in Duanxi of Bei-1 block and La'nan-1 block. In 1995, polymer flooding was first put into industrial application in the western part of block North-2.

After years of research and practice, Daqing has become the world leader in polymer flooding in terms of application scale, technical solution, and economic benefit. In fact, this tertiary recovery method has become one of the important driving forces to the sustainable development of the oilfield.

Polymer flooding can increase oil recovery to more than 50%, 10%+ higher than that by water flooding.



Pilot field test result in the central block

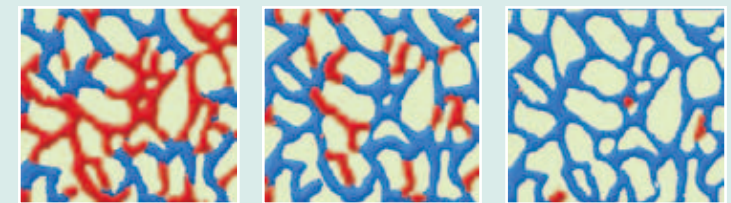


Industrial test result in Duanxi of Bei-1 block

Alkaline/Surfactant/Polymer Flooding

ASP flooding is a tertiary recovery method that much improves ultimate oil recovery by injecting a compound system of alkaline, surfactant and polymer, thus extends reservoir life. Besides increasing the viscosity of injected fluid, decreasing the oil/water mobility ratio, and enlarging sweeping volume in reservoirs, ASP flooding may result in more efficient oil displacement than polymer flooding.

Residual oil under SEM



After water flooding After polymer flooding After ASP flooding

Daqing Oilfield embarked on studies of ASP flooding in the 1980s.

All the five pilot field tests successively carried out in different blocks since 1994 showed about 20% higher recovery factor than water flooding.

Excellent results were obtained from four industrial field tests at a larger scale since 2000. Industrial surfactants independently developed by Daqing Oilfield were used in the tests.

From an enlarged industrial test carried out in 2007, ASP flooding was expected to add more than 300 million tons to the field's recoverable reserves. Such an increment is equivalent to the discovery of a new oilfield with 800 million to 1 billion tons of oil in place.

By September 2011, oil recovery at the test blocks had been increased by 17.8-25.7%.