

and should not be construed as limiting the invention in any respect, as will be evident to those skilled in the art.

In the examples to follow, the procedure used to prepare the filter cake and the laboratory procedure used to illustrate the process of removing the filter cake are as follows:

Filter Cake Deposition:

1. Select a 44.45 mm aloxite disk of 5 darcy permeability.
2. Permanently glue a "handle" to the disk to allow handling of the disk without disturbing the filter cake.
3. Attach the disk to the bottom of an API filter cell with a non-permanent "glue" such as silicone sealant.
4. Pour the fluid from which a filter cake is to be prepared into the API cell.
5. Pressure the cell to 100 psi and filter the fluid through the aloxite disk for 16 hours.
6. Empty the API cell and pry the aloxite disk off the bottom of the API cell while being careful not to disturb the filter cake.

Test Procedure:

1. Glue the aloxite disk on which the filter cake was deposited to the inside of a pint jar lid.
2. Screw the lid with the aloxite disk attached onto a pint jar filled with the soak solution heated to the desired soaking temperature.
3. Invert the pint jar and place it in a water bath or constant temperature oven set at the desired soaking temperature for the desired soaking time. The soak time can be varied to determine the optimum time for soaking.
4. Transfer the pint jar lid containing the aloxite disk to a pint jar containing the wash solution. The wash solution is a 3% by weight potassium chloride solution unless otherwise indicated.
5. Roll the pint jar in a roller oven at the soaking temperature.
6. Check the filter cake every 5 minutes to determine the time required to clean the disk. The disk is considered clean when no filter cake covers the disk.
7. Optimum soak time for the soak solution is established by measuring the effectiveness of the wash.

The calcium peroxide used in the examples is a commercially available peroxide available from FMC Corporation as Perme Ox. It has an active peroxide content of 60% minimum, and thus an active oxygen content of 13.3% minimum.

In these examples and throughout the specification, the following abbreviations may be used: API=American Petroleum Institute RP13B; °C.=degrees centigrade; kg=kilogram; %=percent; m=meter; mm=millimeter.

EXAMPLE 1

A completion fluid containing 128.5 kg/m³ of sized sodium chloride bridging particles, 3.1 kg/m³ of xanthan gum biopolymer, and 12 kg/m³ of an epichlorohydrin crosslinked hydropropyl starch derivative in a saturated sodium chloride brine was used to prepare filter cakes as disclosed hereinabove.

A soak solution having a pH of 6.9 containing 17.1 kg/m³ calcium peroxide and 42.4 kg/m³ sulfamic acid in a saturated sodium chloride brine was heated to the desired soaking temperature of 65.55° C. The filter cake was soaked in this solution for one hour and then transferred to the wash solution. The filter cake was completely removed within 15 minutes.

EXAMPLE 2

Example 1 was repeated except that the soak solution additionally contained 0.001% by weight ferrous ion, added as ferrous ammonium sulfate. The filter cake was completely removed within 5 minutes.

EXAMPLE 3

Example 2 was repeated except that the soak solution contained 8.57 kg/m³ calcium peroxide, 21.1 kg/m³ sulfamic acid and 0.0015% by weight ferrous ion, and had a pH of 1.8. The filter cake was completely removed within 5 minutes.

EXAMPLE 4

A filter cake was prepared as in Example 1. A soak solution having a pH of 5.3 containing 14.3 kg/m³ calcium peroxide, 32.8 kg/m³ sulfamic acid, and 0.0015% by weight ferrous ion, added as ferrous ammonium sulfate, in a calcium chloride solution having a density of 1259 kg/m³, was heated to the desired soaking temperature of 48.9° C. The filter cake was soaked in this solution for four hours and then transferred to the wash solution. The wash solution was a calcium chloride brine having a density of 1259 kg/m³. The filter cake was completely removed within 5 minutes.

COMPARATIVE EXAMPLE A

The procedure of Examples 1-3 was repeated using as the soak solution a saturated sodium chloride solution. The filter cake was removed in 35 minutes; however, there remained a gelatinous film of the polysaccharide polymers on the surface of the disk.

EXAMPLE 5

Example 1 was repeated except that the soak solution had a pH of 1.7 and contained 35.7 kg/m³ of sulfamic acid, the soaking temperature was 48.9° C., and the soaking time was four hours. The filter cake was completely removed within 5 minutes.

EXAMPLE 6

Example 4 was repeated except that the soak solution contained as the activator 5 kg/m³ of solution comprising 50% by weight ethyleneglycol monobutylether and 50% by weight dipropyleneglycol in place of the ferrous ammonium sulfate. The filter cake was completely removed in five minutes.

What is claimed is:

1. A method for removing the filter cake from the surface of a hydrocarbon-containing subterranean formation, the filter cake comprising bridging particles and at least one polysaccharide polymer, which comprises contacting the filter cake with a solution comprising an aqueous brine, a peroxide selected from the group consisting of alkaline earth metal peroxides, zinc peroxide, and mixtures thereof, and an acidic substance to provide the soak solution with a pH in the range from about 1 to about 8, for a period of time at least sufficient to decompose the polysaccharide polymers therein to such an extent that the filter cake forms a loosely adherent mass on the surface of the formation, and thereafter contacting the filter cake with a wash solution in which the bridging particles are soluble to remove the remaining filter cake solids.

2. The method of claim 1 wherein the bridging solids within the filter cake are water soluble, wherein the aqueous brine in the soak solution is saturated with