THE LOW pH DESCO® DEFLOCCULANT DRILLING FLUID SYSTEM

Inhibitive – High Performance Drilling Mud System

Introduction:

When drilling in areas with reactive shales such as the Gulf of Mexico and surrounding land areas such as the Eagle Ford shale it is often considered essential to drill with oil-based drilling muds. Inhibitive water-based muds using salts are an alternative, but bring with them a host of other associated problems such as increased disposal costs and increased use of expensive polymers to achieve the appropriate fluid loss needed to inhibit reactive clays. The Low pH Desco® Deflocculant drilling fluid system is an alternative water-based fluid that provides inhibitive qualities without the problems and additional expense associated with traditional inhibitive salt systems.

The Low pH Desco® Deflocculant drilling fluid system has significant advantages over other water-based systems due to the use of Drispac® Polymers. Drispac® Polymers provide fluid loss control, inhibition and encapsulation of formation clays plus Drispac® Polymers allows a lower MBT to be maintained.

Low pH Desco® Deflocculant mud systems are effective because they do not have a high concentration of hydroxide ions (OH^-) associated with other water-based drilling fluids in use today. The recommended pH range of a Low pH Desco® Deflocculant drilling fluid system is 8.0 – 8. 3 and never over 8.5. Desco® Deflocculant is effective at neutral pH and functions well in the recommend range of this system. Typically, lignosulfonate drilling muds perform best at a pH range of 10.5 – 11.5, which is needed to activate or solubilize the lignosulfonates and lignites. At a pH above 8.5, formation clays hydrate and disperse due the presence of hydroxide ions. The end results may include a washed out hole, poor borehole stability, formation damage, poor logs and cement jobs, reduced rates of penetration, increased dilution rates to the drilling fluid system, increased cost per foot and an increased probability of stuck pipe. For more information on low pH muds see “Formation Clay Chemistry” by Browning, W.C. and Perricone, A.C., Milwhite Mud Sales Company SPE-AIME October 1962 and “Clay Chemistry and Drilling Fluids” by Browning, W.C. and Perricone, A.C., Milwhite Mud Sales Company SPE 1963.

The Low pH Desco® Deflocculant drilling fluid system is very versatile and should be run as a low solids non-dispersed polymeric system. However it can be used as dispersed polymer system depending upon formations drilled and density required.

Other advantages of this Low pH System include:

- Minimum formation damage
- Reduction in stuck pipe
- Higher tolerance to contamination by CO_2, HCO_3 and CO_3
- Low toxicity

- Gauge hole
- Increased rate of penetration (ROP)
- Reduction in cost per foot
- Excellent borehole stability
- Decreased circulation and trouble time
- Reduced bit balling
- Differential pressures are not as critical
- Easy and simple drilling fluid system to run
- Reduced loss of circulation problems associated with oil based drilling muds
- No reclamation of product costs or disposal costs associated with oil-based drilling fluids

Further benefits include better corrosion control as Desco® Deflocculants are excellent oxygen (O_2) scavengers. The corrosion rate of a mud from Kingfisher County, Oklahoma, was 126 mpy (mils per year). The addition of 1 lb/bbl of Desco® Deflocculant reduced this rate to 23 mpy; an additional 1 lb/bbl of Desco® Deflocculant further reduced the rate to 10 mpy.

The makeup of Low pH Desco® Deflocculant drilling fluids depends upon the makeup of the water available for use in the drilling of the well. The system may be run with fresh water, sea water, or salt brines up to near saturation. Calcium contamination should be controlled at less than 600 ppm for economic reasons to reduce the cost of treating the system with Drispac® Polymers and if possible at 300 ppm or less in seawater based fluids. If calcium levels are higher than that it is recommended to treat with sodium bicarbonate (bicarb, $NaHCO_3$) in fresh water systems. In seawater or salt water brines if the system has a low pH, it can be treated with sodium carbonate (soda ash, Na_2CO_3), bicarb or both. Reducing the calcium levels should be done prior to treating the system with Drispac® Polymers as this reduces the chance that the polymer will be treated out of the system. In formation waters with high levels of calcium, sodium sulfate (Na_2SO_4) may be used to treat the system. See Drilling Specialties' Technical Note #3 on page 8.

Low pH Desco® Deflocculant Drilling Fluid System
Basic Formulation in Freshwater

PRODUCT NAME	GENERIC NAME	APPROX. CONCENTRATION
Barite	Barium Sulfate	To density
Untreated Bentonite	Wyoming Bentonite	5 -10 ppb
Desco® Deflocculant, CF Desco® II Deflocculant or Drill-Thin® Thinner	Sulfomethylated Tannin Compound	1-3 ppb or as needed in weighted systems or high temperature muds
*Drispac® Regular Polymer Or Drispac® Plus Regular Polymer	Polyanionic cellulose	0.25 – 1.0 ppb in systems up to 12.0 ppg
*Drispac® Superlo® Polymer Or Drispac® Plus® Superlo® Polymer	Polyanionic cellulose	0.30 – 1.25 ppb in systems over 12.0 ppg

Note:
* Combinations of Drispac® Regular Polymer and Drispac® Superlo® Polymer may be used to achieve the desired rheological and fluid loss properties needed to drill the well. For more information see the product brochure on Drispac® Polymer. Drispac® Polymers may be solubilized by itself in freshwater.

Low pH Desco® Deflocculant Drilling Fluid System
Basic Formulation in Seawater

PRODUCT NAME	GENERIC NAME	APPROX. CONCENTRATION
Barite	Barium Sulfate	To density
Untreated Bentonite	Wyoming Bentonite	6 -18 ppb
***Desco® Deflocculant, CF Desco® II Deflocculant or Drill-Thin® Thinner	Sulfomethylated Tannin Compound	2-6 ppb or as needed in weighted systems
Drispac® Regular Polymer Or Drispac® Plus Regular Polymer	Polyanionic cellulose	1.0-2.0 ppb in systems up to 12.0 ppg
Drispac® Superlo® Polymer Or Drispac® Plus® Superlo® Polymer	Polyanionic cellulose	1.20-2.50 ppb in systems over 12.0 ppg

Additional products to be used on an as needed basis for either system above

PRODUCT NAME	GENERIC NAME	APPROX. CONCENTRATION
Flowzan® Biopolymer	Xanthan Gum	As needed to supplement bentonite – 0.25-2.0 ppb
**Soltex® Additive or Potassium Soltex® Additive	Sulfonated Sodium Asphalt or Sulfonated Potassium Asphalt	As needed to stabilize shale and to control HTHP fluid loss 4-6 ppb
Ammonium Bisulfite or Sodium Bisulfite	(NH_4HSO_3) an Oxygen scavenger or ($NaHSO_3$)	As needed to maintain 100-125 ppm excess sulfite for corrosion control
Caustic Soda or Potassium Hydroxide	NaOH for sodium muds Or KOH for potassium muds	As needed to maintain 8.0 pH
Bicarbonate of Soda	Sodium Bicarbonate ($NaHCO_3$)	As needed to control calcium in the drilling fluid @ 300 ppm or less in seawater systems
Soda Ash	Sodium Carbonate (Na_2CO_3)	As need to reduce total hardness in the makeup water
DSCo™ Defoam	Defoamer	Defoamer as needed
*Lignite	Lignite	2-12 ppb

Notes:

* Lignite should be solubilized in alkaline drill water (a pH >10) and bleed into the system.

** Soltex® Additive or Potassium Soltex® Additive may be mixed in this manner as well. Concentrations of products will depend on desired flow and fluid loss properties. By premixing products in this manner, the mud will require less product to obtain desired properties due to increased solubility and also form a more homogeneous drilling fluid system. Low pH Desco® Deflocculant drilling fluid systems drill gauge holes. It is recommended to maintain the API less than 3mls and the HTHP fluid loss, less than 14 mls to minimize wallcake deposition by 7,000 feet as this will ensure that the hole will not become under gauge. Due to greatly increased penetration rates 500 feet interval wiper trips are recommended to be performed especially in high angle or horizontal wells.

*** Desco® Deflocculant, CF Desco® II Deflocculant or Drill-Thin® Thinner should not be solubilized but added dry to the system to insure maximum thinning!

Typical Properties of Low pH Desco® Deflocculant Drilling Fluid Systems used Offshore Gulf of Mexico

Density (PPG)	12.0	14.0	16.0
Funnel Viscosity (sec/qt.)	42	42	47
Plastic Viscosity – PV (cP)	18	25	33
Yield Point (lb/100ft^2)	9	9	8
Gels 10sec/10 min (lb/100ft^2)	2/6	1/4	1/3
API Fluid loss (ml)	4.0	2.5	1.5
HTHP Fluid loss (ml)	12.0 @ 250 °F	10.0 @ 300 °F	8.0 @ 300 °F
Pm	0.1	0.1	0.1
Pf	0.1	0.1	0.1
Mf	0.2	0.2	0.2
pH	8.0	8.0	8.0
Solids %	20%	26%	31%
Chlorides mg/L	8,000	8,000	8,000

Solids Control:

Solids control equipment should be run continuously to control low gravity solids build up. Utilizing the finest shaker screens possible will reduce the amount of water dilution, which will reduce the overall amount of chemical, polymer and barite additions needed for drilling fluid system maintenance.

Recommendations for Combating Cement Contamination in Low pH Mud's:

Pre-treatment:

1) Prior to cementing casing, condition the mud to reduce the 10 minute gel strength and yield point with additional Desco® Deflocculant and water dilution if needed.

2) Monitor the returns at the flow line so that any severely contaminated mud can be discarded to the reserve pit. Do this to lessen the contamination of the active system.
3) Add Sodium Bicarbonate at 1 to 2 ppb
4) Sodium acid pyrophosphate (SAPP) can be used as a pre-treatment material; SAPP has a temperature limit of 180 °F to 200 °F degrees.
5) Pre-treat only at the mud suction and not the whole mud system if possible.
6) Add an additional 1 to 2 bbl of Desco® Deflocculant to the active system along with increasing the amount of water being added, especially in mud with an MBT greater than 20 ppb. This should help to mitigate the effects of cement contamination.

<u>Post-Treatment:</u>
Soda ash and soda bicarbonate are both effective as a post-treatment additive, however, the mud will have a high pH after treatment is complete if soda ash is used. When using these materials add material until the M_f of the mud is about 3X the P_f.

<u>Rules of Thumb for Treating Cement Contamination:</u>

1) Pre-treatment: 50 lb of sodium bicarbonate will treat approximately 1 cu ft. of hard cement
2) Post-Treatment: Double the amount of sodium bicarbonate used in pre-treating.
3) It takes approximately 100 pound of SAPP to treat 1 cu ft. of cement.

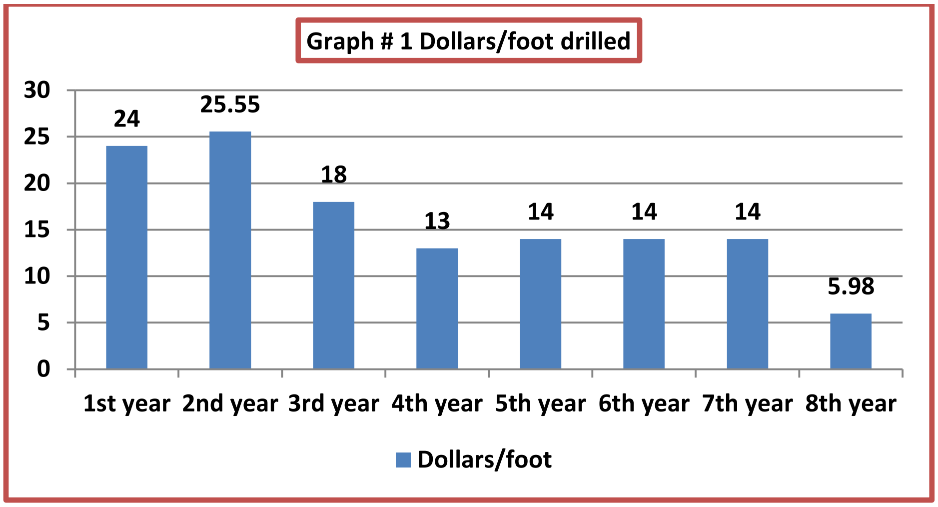
Case Histories:

<u>Case History #1 Viosca Knoll GOM 1981 to 1988</u>

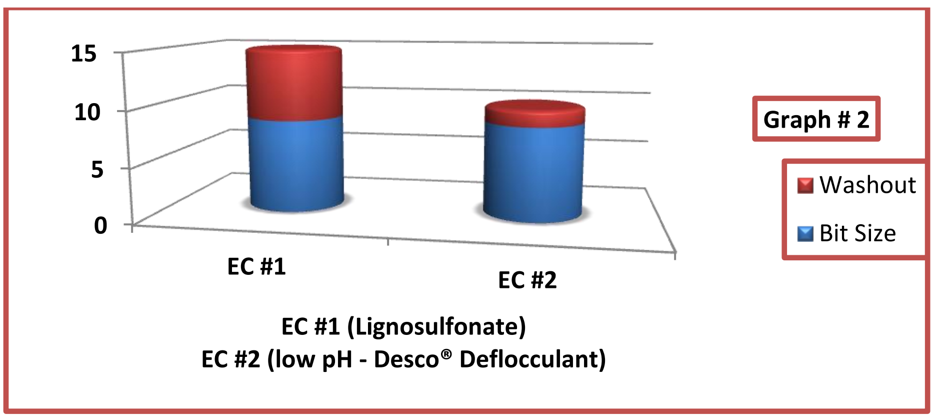
A major oil company, operating in the Gulf of Mexico, realized a significant improvement in its drilling operations once they began using the Low pH Desco® Deflocculant Drilling Fluid System. The operator had a 74% decrease in mud cost per foot, a 98% decrease in stuck pipe time, as well as an impressive increase in rates of penetration. This operator drilled a Viosca Knoll well to a record depth below 25,000' using this system. Overall the operator's mud cost per foot has been reduced over an eight-year period from $25.55/foot to $5.98/foot. Only about 30% of the 76.6% reduction can be attributed to a decrease in retail mud pricing during this time period starting in 1981 through 1988.

Substantial cost reductions in this operator's entire drilling program have been achieved by reducing the incidence of stuck pipe, as well as overall well costs attributed to stuck pipe time. For example over the same eight-year period, the stuck pipe time went from 29% to less than 1%. Additional savings were realized from a reduction in loss circulation, increased gumbo inhibition and an increase in penetration rates. See graphs below.

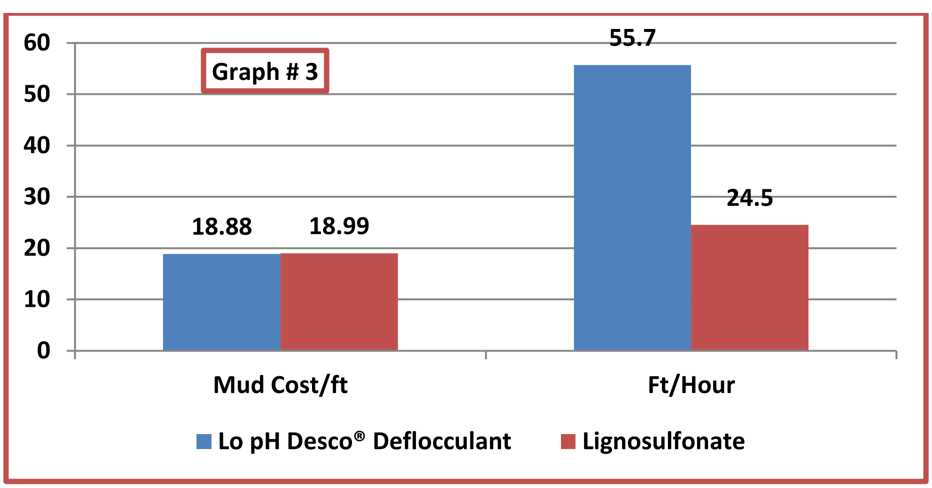
The following charts give graphic representation of the advantages of using a Low pH Desco® Deflocculant Drilling Fluid System



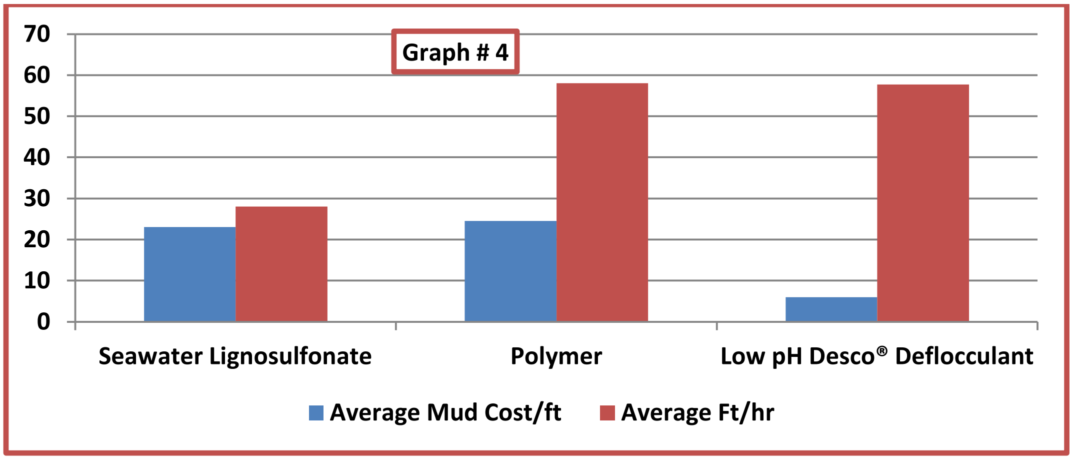
Comparison of average hole size in inches for East Cameron #1 vs. East Cameron #2



Low pH Desco® Deflocculant system (South Marsh Island) vs. Seawater Lignosulfonate



Average Feet/Rotating Hour – Drilling Fluid Cost/Foot



Case History #2 Well Summary Matagorda Island – November 1989

Mud-up was at 3,100'. All working pits were jetted and cleaned and 1150 barrels of Low pH Desco® Deflocculant system with Drispac® Plus Polymer was built. Solids control equipment consisted of 2 Brant shale shakers with 20/40 mesh screens (eventually 40/60 and 60/80 were used), a decanting centrifuge, 2 mud cleaners with 150 and 180 mesh screens respectively. Lignosulfonate mud bills in this area run about $50,000 with high mud bill of $75,000 the final mud bill for this well was $100,000 at list price. However, the overall well cost was lower than offset wells due to less days on location and less rotating hours. The overall rotating hours totaled 108 covering 5,900' for an average of 59.6 feet/hour. The hole washout was computed to be 11%. This figure was determined approximately 500 feet above the production zone. The percentage was 3rd best in this area with 8.3% washout being the best. The drilling engineer stated that the use of this system resulted in lower well costs, less rotating hours and a good cement job (normally a problem in this area.)

Case History #3 Well Summary Matagorda Island – February 1990

Mud-up was at 3,100'. All working pits were jetted and cleaned and 1187 barrels of Low pH Desco® Deflocculant system with Drispac® Plus Polymer was built. Solids control equipment consisted of 2 Brant shale shakers with 20/40 and 20/60 mesh screens, 2 Derrick flow-line shakers with 3 x 110 mesh screens, a mud cleaner with 120 mesh screen, a desander, and a desilter. The final mud bill was $83,000 at list price. This was a 16 degree deviated well and hole washout was 12.5% calculated from 500 feet above the production zone. The average ROP was approximately 60 ft. /hour. The operator was satisfied with the large reduction in hole enlargement (compared to as high as 33% with lignosulfonate muds), less rotating hours and good cement jobs. They went one step further to assure themselves that the Low pH Desco® Deflocculant/Drispac® Plus Polymer was the system for their wells and had a return permeability study done on core samples from the well. Return permeability using mud filtrate from this well was 85% and considered very good.

Case History #4 Well summary Brazos Block – February 1990

Mud-up was at 3,200' and TD was 9,500'. All working pits were jetted and cleaned and a 11.5 ppg Low pH Desco® Deflocculant system with Drispac® Plus Polymer was built to drill out with. This well drilled the best compared to the previous two wells using a Low pH Desco® Deflocculant system with Drispac® Plus Polymer system. A rate of penetration of 65' per hour was averaged which resulted in a reduction in overall rotating hours. Solids control equipment consisted of two Derrick flowline cleaners, a desander, a desilter and a mud cleaner. At the end of this well, the mud weight had to be increased 1.5 ppg to 14.8 ppg – which made the ending mud bill approximately $100,000. The hole was only 1" out of gauge after the caliper logs were run. This is what the operator wanted to accomplish. The reduced hole washout allowed the operator to obtain excellent primary cement jobs, and excellent bond logs. In prior wells, not utilizing the Low pH Desco® Deflocculant/Drispac® Plus Polymer fluid system, a good cement job included one or two squeezes. The Low pH Desco® Deflocculant/Drispac® Plus Polymer fluid system was the key factor in getting a good cement job the first time.

Case History #5 Well Summary Matagorda Island Block – June 1990

Mud-up was at 5,500' and TD was 9,200'. All working pits were jetted and cleaned and 1,100 barrels of Low pH Desco® Deflocculant/Drispac® Plus Polymer mud was built to drill out with. Solids control equipment consisted of a Premier Unit (unable to keep up with the high rate of penetration in a 12¼' inch hole), a desander, a desilter, a mud cleaner, and a decanting centrifuge (which was only used the last three days of the hole.) Although this well was plugged and abandoned at TD after logs were run, the hole remained very stable due to the use of the Low pH Desco® Deflocculant/Drispac® Plus Polymer mud. The mud on this well was overwhelmed with a high influx of drill solids due to ineffective solids control equipment. Also, the mud weight was increased approximately 4 ppg to 14.8 ppg over a 24-hour period which resulted in high flowline viscosities. Everything was working against this drilling mud system; however, it was able to maintain a stable well bore. Although the mud bill ran high at approximately $194,000; 59% of this cost was Barite and only about 18% of the cost was the Low pH Desco® Deflocculant/Drispac® Plus Polymer drilling fluid.

Drilling Specialties' Technical Note #3

USE OF SODIUM SULFATE (Na_2SO_4) TO REDUCE CALCIUM ION IN DRILLING MUD

Mud analysts normally test the filtrate from water-based muds for total hardness. They report the results as "ppm calcium". Total hardness even though reported as calcium (Ca^{2+}) is, in fact, both (Ca^{2+}) and magnesium (Mg^{2+}). For most water base systems this is all right because Ca^{2+} and Mg^{2+} affect clays similarly. Normally, the same chemicals are used for treating out both Ca^{2+} and Mg^{2+} ions.

Clays are flocculated in salty muds; they give less viscosity and less water loss control than they do in fresh water muds. Drispac® Polymer is used to control water loss and viscosity in both fresh water and salty muds. Mg^{2+} and Ca^{2+} ions affect Drispac® Polymer differently. Drispac® Polymer performs well when Mg^{2+} is high; it does not perform as well with high Ca^{2+}. To get the most from your mud dollars both Ca^{2+} as well as total hardness levels should be determined.

The relative amounts of Mg^{2+} and Ca^{2+} vary widely in natural brines that are sometimes used for drill mud. The following table shows how brine from five sources varies:

Brine Source	**Total Harness ppm**	**Calcium ppm**
West Texas Brine	2,800	1,100
Sea Water	2,500	400
Salt Lake in New Mexico	10,400	400
Produced Brine from North Dakota	16,000	15,000
Middle East Make-up Water	30,000	4,000

For economic as well as technical reasons only Ca^{2+} ion should be treated from these brines when using Drispac® Polymer but only in those brines where Ca^{2+} exceeds 800 ppm. For better results treat Ca^{2+} ion to below 600 ppm.

Sodium sulfate (salt cake) can control Ca^{2+} harness but it should be used only in special cases. Used properly it can help you; used improperly it can become a part of the problem. This note will guide you in using salt cake to treat out Ca^{2+} ion.

Why Reduce Calcium?

The reason for treating out Ca^{2+} is because it reduces the effectiveness of Drispac® Polymer. Fortunately Mg^{2+} does not interfere with the performance of Drispac® Polymer. A chemical that removes only Ca^{2+} is desirable because less will be required than if both Ca^{2+} and Mg^{2+} ion are precipitated. Also, fewer precipitated solids will be added to the mud. Therefore, maintain Ca^{2+} ion to 800 ppm or less to improve the effectiveness of Drispac® Polymer and for better results treat Ca^{2+} ion to below 600 ppm.

How Sodium Sulfate (Na_2SO_4) Salt Cake Works

Salt cake reacts with Ca^{2+} to form calcium sulfate (gyp). Gyp is slightly soluble in water, hence, salt cake reduces Ca^{2+} ion only to about 500 to 800 ppm, sufficiently low to assure good performance of Drispac® Polymer.

Sodium Sulfate does not reduce the Mg^{2+} ion because Mg sulfate is very soluble in water. Below 500 to 800 ppm, Na_2SO_4 reduces Ca^{2+} through the common ion effect. Larger reductions in Ca^{2+} are obtained per pound of Na_2SO_4 used when Ca^{2+} is above 800 ppm than when Ca^{2+} is less than 800 ppm. One lb/bbl of salt cake reduces Ca^{2+} by about 800 ppm when Ca is high. By adding an excess amount of Na_2SO_4 to treat the Ca^{2+} down to 500 – 800 ppm, a reserve of salt cake can be built up to treat out additional Ca^{2+} as it is added with brine, by water flows, or by drilling Ca^{2+} containing evaporates.

Restricted Use of Salt Cake

The use of salt cake to reduce hardness is restricted to salt muds of high total hardness when both Ca^{2+} and Mg^{2+} are high. If Ca^{2+} is low, no treatment is needed. As a general practice, it is uneconomical to treat out more than about 5,000 ppm calcium.

Sulfate ion flocculates fresh water muds and causes high viscosities and gel strengths in these systems. Normal hardness treatments are preferred in fresh water muds. Salty muds are naturally flocculated systems; hence, salt cake has little or no effect on their rheology.

Why Not Soda Ash instead of Salt Cake?

Soda ash reacts with both Ca^{2+} and Mg^{2+} ion to form insoluble carbonates. A bi-product of this reaction is sodium hydroxide which reacts with the remaining Mg^{2+}. The Mg^{2+} hydroxide so formed is a gelatinous precipitate and carries with it organic colloids such as Drispac® Polymer present in the drilling mud. This increases the water loss, requiring additional Drispac® Polymer. For this reason other alkaline materials should not be used in muds high in Mg^{2+} ion. (Alkaline materials can be added to muds containing Mg^{2+} before adding Drispac® Polymer without causing precipitation of Drispac® Polymer.)

Lignosulfonates should not be used in salty muds high in Mg. The caustic soda needed to solubilize the lignosulfonate will precipitate MgOH. This will treat out polymers, including lignosulfonate, thus, it will give high mud costs. Salty muds, high in Mg ion, should be non-dispersed or semi-dispersed with one of Drilling Specialties tannate thinners. If Ca^{2+} is 1,000 ppm or higher, reduce it with salt cake.

In summary, Na_2SO_4 should be used to reduce Ca^{2+} ion in salty muds having high total hardness consisting of Ca^{2+} and Mg^{2+} when Drispac® Polymer is used. Na_2SO_4 is likely to be effective when the following conditions exist:

- When chloride is above 5,000 ppm
- When Ca^{2+} ion is above 1,000 ppm
- When using any Drispac® Polymers
- When Mg^{2+} ion is above 500 ppm
- When mud is non-dispersed or semi-dispersed with Desco® Deflocculant (neutral pH) or any of the other tannate thinners such as CF Desco® Deflocculant, CF Desco® II Deflocculant, and Drill-Thin® Thinner

The use of Na_2SO_4 under the above conditions will result in a minimum of material required to reduce and buffer the Ca^{2+} ion level and a minimum amount of precipitate will be formed.

Adding alkaline material such as soda ash or caustic soda to a salty Drispac® Polymer-treated mud containing Mg^{2+} ion is not recommended.

Deflocculants/Thinners

Certain chemicals added to drilling muds neutralize the edge charge, with the result that particles no longer associate edge-to-edge or edge-to-face, the mud has deflocculated. See Figure 1. Examples of the deflocculating chemicals are lignosulfonates, tannates and polyphosphates all of which are called mud thinners. DSCo sells thinners of the tannates group but they have been modified to enhance their performance. The DSCo thinners are Desco® Deflocculant, CF Desco® II Deflocculant, and Drill-Thin® Thinner. In the Eastern Hemisphere we also sell CF Desco® Deflocculant. Only small amounts of these chemicals are needed to fully deflocculate a suspension as there is a relatively small surface area on the edges of the platelets where they are adsorbed.

The thinner is the layer surrounding the clay platelet→

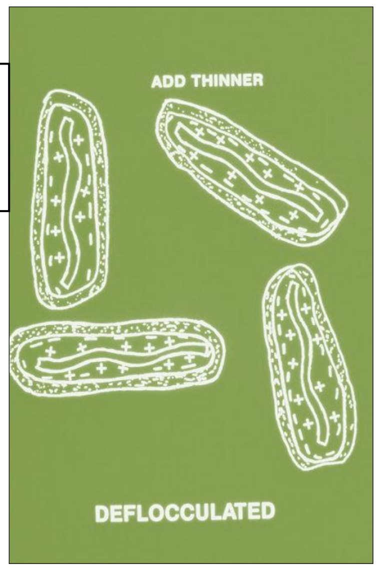


Figure 1 *showing thinner satisfies the electro static charge on the clay particles*

The reason we refer to the DSCo thinners as deflocculants is that they work on the edge of the clay platelets and not on the face of the clay platelet as the lignosulfonates do. This makes it more difficult to over treat with them allowing for deflocculation without dispersion. This is an important feature of our products in that they may be used at low concentrations to treat low solids non-dispersed muds without dispersing them. The DSCo Deflocculants work in amounts as low as 1/8 lb/bbl in the upper hole to as much as 4-6 lb/bbl in the deep hot section. This compares to lignosulfonates (dispersants) which range from 2 lb/bbl in the upper hole to 30 lb/bbl in deep holes. The modified tannins that we sell act on the YP and shear strengths of a drilling mud. Shear strength is a measurement on the undisturbed mud or gel and is the force required to break the gel structure. Gel muds treated with Drilling Specialties tannate thinners re-disperse more quickly than muds treated with lignosulfonates reducing the likely hood of excess surge and swab pressures and the loss of circulation associated with it. Reference: "The Effect of Thinners on the Fabric of Clay Muds and Gels" by R.L. Borst, Phillips Pet. Co. and Frank J. Shell, DSCo SPE-AIME October 1971.

Summary:

The Low pH Desco® Deflocculant drilling fluid system consists of only a few high performance products and is easy to formulate and engineer. Unlike lignosulfonate muds, which will perform only at high pH, the Low pH Desco® Deflocculant drilling fluid system does not contain a high concentration of dispersive hydroxyl ions. A low pH and exceptional inhibiting properties of Drispac® Polymer and Soltex® Additive make the Low pH Desco® Deflocculant system the perfect choice for drilling the most difficult wells or shale sections.

In thousands of wells this simple but efficient water base drilling fluid has increased penetration rates while eliminating hole problems and reducing the incidence of stuck pipe. Further, return permeability studies show the Low pH Desco® Deflocculant drilling fluid systems to be a significantly less damaging fluid than other systems previously used. From drilling to completion and production, the Low pH Desco® Deflocculant system delivers proven, high quality performance.

Products used in Low pH Desco® Deflocculant drilling fluid systems

For more information on Products and Services that work see our web site at www.drillingspecialties.com

DSG/WPR/CES/revised 2013