ProGel HT

Proprietary, Cross-linked, Liquid Biopolymer
Based on Xanthan Polysaccharide

Description

The base technology of Chemlogic's **ProGel HT** is Xanthan, a natural polymer, generated by the bacteria Xanthamonas Campestris and produced commercially by a fermentation process. It is composed of three monosaccharides – mannose, glucose and glucuronic acid, arranged in a highly branched structure with an estimated molecular weight of 5 million. Xanthan's polar side chains provides sites for extensive hydrogen bonding with water and interactions between polymer chains that give rise to a helical structure in solution. **ProGel HT** liquid biopolymer is a high-purity cross-linked Xanthan suspended in an ultra-clean mineral oil and biodegradable surfactants for ease of mixing. It is not subject to particle settling or fluid separation under normal storage or transport conditions. Starting with an environmentally friendly fluid and utilizing our unique suspension technology, we eliminate settling of the **ProGel HT** while the product remains fully pourable. The long-term stability of the suspension provides for consistent, reliable product properties at your field locations any place in the world

This type of structure allows for a significant increase in solution viscosity especially at low shear rates. The physical properties of **ProGel HT** have led to its use in a variety of drilling and completion applications. It is readily soluble in hot and cold water and brines over a wide pH range. In aqueous solutions, **ProGel HT** is highly pseudoplastic and shows stability to a wide range of temperatures and pH changes. **ProGel HT** has unique resistance to thermal degradation at temperatures up to and over 300°F, but at the same time is susceptible to degradation by enzymatic and oxidizing agents – these properties are ideal for drilling, completions, and fracking.

ProGel HT was cross-linked using a proprietary ionic process yielding an eco-safe, biodegradable, compound with enhanced pseudoplastic properties required to move large amounts of solids. It's unique 'scaffolding' molecular structure makes the product an excellent suspending agent to carry cuttings from drilling and completion operations. **ProGel HT**'s rheological properties are particularly well suited to oilfield applications in that it's pseudoplastic and produces high viscosity while at rest.

Advantages

- Easy to handle and mixes well in low shear environments
- Extremely stable suspension provides reliable properties
- Freeze/thaw cycle does not affect stability or performance of the product
- Optimized bit hydraulics resulting in higher penetration rates (increased ROP)
- Viscous laminar flow in the annulus for improved wellbore stability with maximum hole-cleaning and suspension capacity; minimal drilled solids settle under static conditions
- Performs well in freshwater, seawater, and a variety of brines; both mono and divalent salts and saturated salt environments
- Excellent viscosifier – requires less material than other types of rheology modifiers
- Solution viscosity is stable in varied temperature and pH conditions
- Stable thickener for 15% HCl at temperatures below 200°F; utilized in wellbore stimulation allowing for dissolved/displaced solids removal
- Rapid dispersion without "fisheyes"
- Excellent friction reduction in coil tubing applications
- Demonstrates beneficial synergistic effect with polyacrylic polymers utilized for friction reduction and shale stabilization

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General Guidelines for Maximum Performance

ProGel HT can be used with or without bentonite, i.e. as a secondary or primary viscosifier/suspending agent. Unlike other polymers (cellulosics, polyacrylamides, starches), cross-linked **ProGel HT** develops significant viscosity at low shear rates (LSRV) to provide suspension of weight materials in high-density fluids.

ProGel HT can be used in a wide range of makeup waters, ranging from fresh water to saturated sodium chloride, in formate brines, and near-saturated calcium chloride. The following are some general guidelines to achieve optimum fluid efficiency in the field:

1. As with any polymer-based system, the use of efficient solids control equipment is recommended, including high speed, fine screen shale shakers, hydroclones, and decanting centrifuges. Overall stability is based on maintaining low-density solids in the ≤ 5% by volume range, and using the biopolymers to increase LSRV.
2. Bingham Plastic parameters, the plastic viscosity (PV), yield point (YP) will often be inverted, preferably varying between a PV:YP ratio of 1:2 to 1:3 with a PV in the 10-20 range for unweighted systems. Using **ProGel HT** to improve carrying capacity will automatically maintain a low PV while increasing viscosity at low shear rates (≤5.1 sec^{-1}), as measured with the Fann 35 and Brookfield viscometers.
3. Using the Power Law model, "n" values, as calculated between 3 and 300 rpm, should be maintained between 0.25 and 0.35 for optimum shear thinning characteristics and hydraulic efficiency. "K" values >10 $dynes.sec^{n}/cm^{2}$ are recommended to assure sufficient LSRV for suspension. Hole conditions should dictate the need for increasing "K". Fill on trips, settling, barite sag, and trouble making connections are all symptomatic of hole cleaning problems brought about by inadequate LSRV, and indicate the need to add **ProGel HT** biopolymers.
4. For optimum stability, pH of xanthan systems should be maintained between 8.0 and 9.0. Monitor and treat the high pH (above 10.0). Watch systems with soluble calcium such as in drilling cement solids due to rapid pH increases and the potential for reduction in performance. Pre-treat with Pro-Pyrophos to minimize the effect.
5. In low pH, fresh water and low salinity brines (<10% salt) a biocide/biostat (Glutaraldehyde) is highly recommended if the fluid is to be stored.
6. Various additives, including glycols, polymeric blends, resins, and salts have been developed for shale inhibition. While most are compatible with ProGel HT and other Chemlogic polymers (FR's), pilot testing is highly recommended if cationic inhibitors are used (Halliburton Clay Stay & other similar technologies). For optimum stability, ProGel HT should be pre-hydrated in the makeup fluid prior to adding cationic shale inhibitors.

Application

ProGel HT mixes easily with oilfield waters. Add 0.5 to 3 quarts/bbl (0.50 - 4.0 lb/bbl) to drilling fluids depending on the application and viscosity required. Allow more time for complete hydration in cold fluid temperature or high salt content (monovalent – KCl/NaCl and divalent – $CaCl_2$/$CaBr_2$) content waters.

ProGel HT has unique a unique 'scaffolding' molecular which allows other polyacrylic polymers to be mixed with the system to enhance carrying capacities, increase friction reduction, drag reduction, or prevent fluid loss**.** Chemlogic's **ProPoly FR-821 – 823** have been developed to be used alone or in combination with **ProGel HT's** positive system benefits. Combining the technologies can reduce use of both compounds while maintaining the highest possible performance available in the industry.

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Table 1

ProGel HT demonstrates outstanding performance which is readily seen in field conditions – tested at 3 gals/10 bbls and 5 gals/10 bbls in Seawater, Saturated NaCl (9.9 lbs/gal), and 11.0 lb/gal $CaCl_2$ brine. Tested at 100°F - Fann 35, f1.0 measurement. Results show **ProGel HT** is broad-spectrum and the one polymer that the drilling and completion system should not be without.

					Viscosity, cP	
	PV	YP	"n"	"K"	5.1 sec^{-1}	0.0636 sec^{-1}
Seawater						
3 gals/10 bbl	4.5	17.5	0.2	32.0	890	28,000
5 gals/10 bbl	7.0	24.0	0.19	49.0	1,300	59,000
Saturated NaCl						
3 gals/10 bbl	9	19	0.26	28.0	840	33,000
5 gals/10 bbl	11	27	0.24	43.0	1,280	62,000
$CaCl_2$, 11.0 ppg						
3 gals/10 bbl	16	19	0.42	13.0	500	9,000
5 gals/10 bbl	20	26	0.41	18.5	700	19,000

"n" and "K" between 3 and 300 rpm; "K" in dynes - sec^n/cm^2 or Poise

Table 2

ProGel HT exhibits high calcium stability – tested at 3 gals/10 bbls in 11.0 lb/gal $CaCl_2$ brine weighted to 12.0 lb/gal with 90 lbs/bbl of Calcium Carbonate. Aged at 150°F for 24 hours and cooled to 75°F for Fann 35, f1.0 measurement. These lab results indicate why **ProGel HT** users in cement plug drillouts swear by its outstanding solids carrying capacity.

	Before Aging	After Aging
Temp., °F	75°F	75°F
Fann 35, f1.0		
600 rpm	85	75
300 rpm	57	49
PV, cP	28	26
YP, lb/100 ft^2	29	23
Gels, 10sec/10min.	8/11	6.5/9
Brookfield LV		
cP@0.12 sec^{-1}		10,000
cP@0.06 sec^{-1}		15,600

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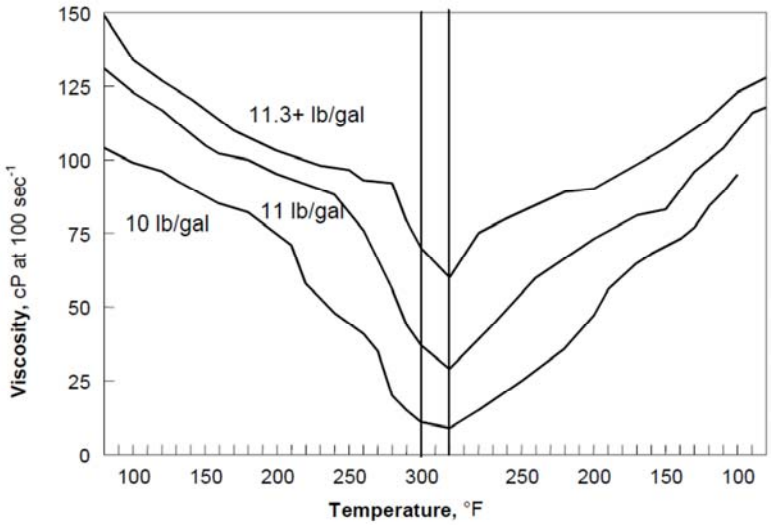
Table 3

ProGel HT exhibits improved thermal stability with increased brine density – tests at 5 gallons/10 bbls in $CaCl_2$; Fann Model 50 @100 sec^{-1}. These lab results back up field-use results demonstrated on a daily basis by users.



Health and Safety

Before handling, storage or use, please refer to the Material Safety Data Sheet (MSDS) for details.
Chemlogic's 24 Hour Emergency Hotline: (800) 424-9300 (CHEMTREC), USA
Chemlogic's Customer Service Line: (337) 334-8100 or (888) OIL-CHEM (645-2436), 24/7 – 365

Handling and Storage

Recommended materials of construction include mild steel, stainless steel, fiberglass, plastic and glass or epoxy-lined vessels. The shelf life of the product is a minimum of 12 months when stored at temperatures between 10 - 30°C. For best results avoid freezing. If the product freezes, thaw completely and mix prior to use.

Shipping

Standard packaging includes:

- Bulk
- Non-returnable 275 gal. semi-bulk containers
- Poly 55 gal. non-returnable drums
- Poly Pails or Carboys

Supplementary Information

Test data, samples, and field case histories on **ProGel HT** are available upon request.