

6. Hydraulic Fracturing Progress and Challenges Application

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Abstract:

We have done research around 4-vinyl-2,6-Dimethoxyphenol is a dissolvable (canola oil), it was created from seed of a few assortments of the assault plant, those plants, specifically Brassica napus L (or) field mustard, turnip assault it is likewise utilized as a wellspring of Biodiesel. Canola oil is utilized as a dissolvable in direct frac focus. Hostile to settling specialists, killing specialists like sodium hydroxide (or) sodium acetic acid derivation (or) sodium bicarbonate will keep up with the pH, blended framed frac fixation. Thus, this review centres around the method for blending the cracking liquid, organizations of cracking liquid how to direct Straight (gel) and breaker test. These polymers are dry powders that hydrate or swell when blended in with a fluid arrangement and structure a thick gel. Corruption design saw from the breaker test showed that decrease in gel consistency relies upon time, temperature, and Breaker fixation. This straight gel will use in Oil and gas wells during cracking on-shore tasks for (CBM or Coal-Bed Methane gas zones) to improve the oil and gas creation.

Keywords: Degradation, Fracturing fluids, Breaker, Guar polymer gel, Oxidative agents

6.1 Introduction:

In oil gas industry four kinds of fracturing are there, Pressurized-water frac, gel fluid, linear-gel, crosslinked gels. Instead of fossil diesel I used Vegetable oil as a base fluid (Poe, Cadena, & Kristopher, 2012). [Figure -6.1].

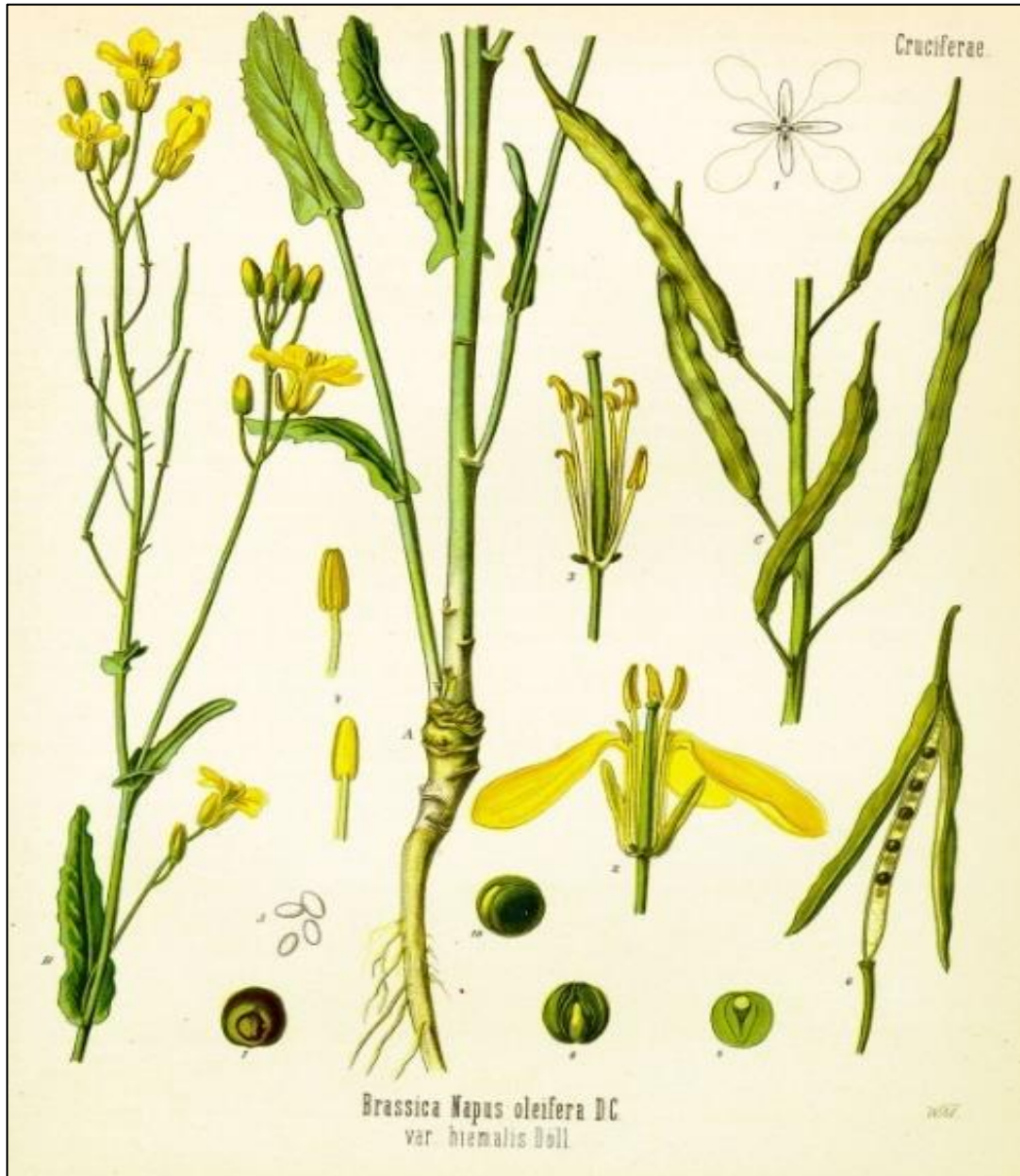


Figure 6.1: Rapeseed

Rapeseed classification- Kingdom: Plantae. Clade: Angiosperms. Clade: Eudicots. Clade: Rosids. Order: Brassicales. Family: Brassicaceae. Genus: Brassica. Species: B. napus. The term “rape” derives from the Latin word for turnip, rape or rapum. The species Brassica napus belong to the Brassicaceae family of flowering plants.

The phenolic compound indicating prevention for anti-oxidation agent nature and less corrosive are observed in a vegetable oil [Figure-6.2].

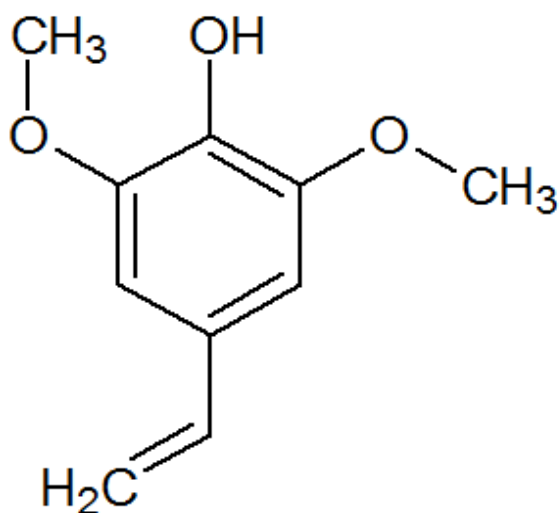


Figure 6.2: Chemical Structure of 4-vinyl-2,6-dimethoxy Phenol

Synthesis of frac concentration made with base fluid canola oil blended the polymer settling powder and Emulsifiers agent and the focus ought to be in essential nature. The agro material gelling agent is guar gum powder and its derivatives hydroxyl propyl guar and carboxymethyl hydroxyl propyl guar, cellulose, carboxyl methyl guar, hydroxyl ethyl cellulose, hydroxypropyl cellulose [figure-6.3]. (Xu, Hill, Zhu, & Wang, 2011).

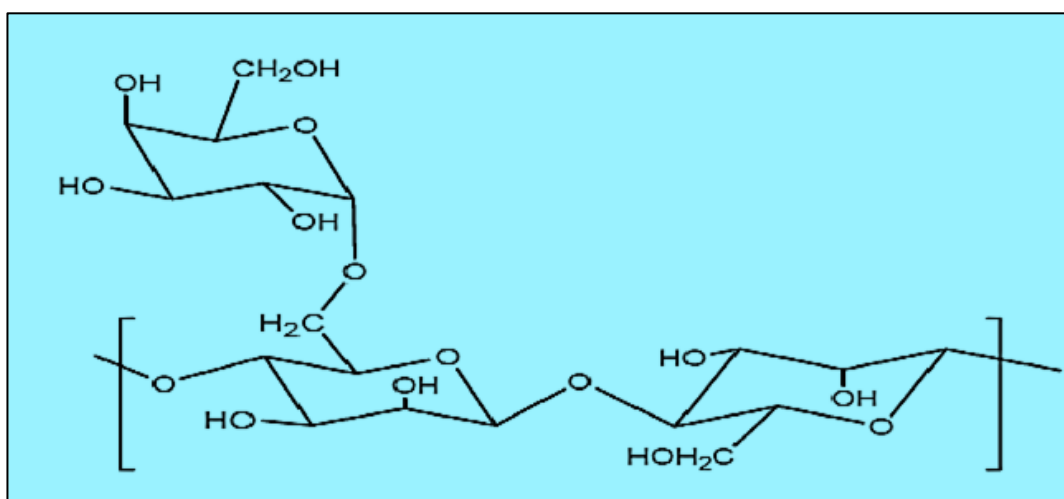


Figure 6.3: The Basic chemical structure of Guar gum

Guar gum is polymer material, which is along the chain, the high sub-atomic weight made from mannose and Galactose Sugars, this polymer has a high fondness for water. At the point when the guar Powder added to water, the guar particles swell and hydrate, which implies the polymer atom related with many water atoms unfurl and reach out into an

answer which will in general cover and impede movement, which lifts the consistency of the arrangement. Guar gum derivatives are better suited for use in high temperature more than 150°C formations. This is more effective Friction reducing agent that reduces leak-off (Srivastava & Kapoor, 2005).

Sodium Bicarbonate and sodium acetate are used as a buffering agent, maintain the pH (Kekacs, Drollette, Brooker, Plata, & Mouser, 2015) Inorganic salts are more powerful oxidizing agents obtained good results initiate fragmentation. Pure organic compound 2,2-dibromo-3-nitrilopropionamide very powerful enzyme to breaks linear gel that easily hydrolyses in acid & base nature. (Sarwar, Cawiezel, & Nasr-El-Din, 2011).

6.2 Materials and Methods:

6.2.1 Vegetable (canola-oil):

Vegetable canola-oil is 4-vinyl -2,6- dimethoxyphenol.

6.2.2 Anti-settling Agent:

Iso tri decanol ethoxylated is in liquid form.

6.2.3 Buffering Agent:

Buffering agent is a base used to maintain the acidity of a fluid. Buffering agents used in this research work, they are sodium bicarbonate, sodium acetate. It prevents a rapid change in pH when sodium acetate added to the fluid.

6.2.4 Gumming Agent:

Guar gum seed is from the vegetable plant, this seed is powdered having a gumming nature and non-toxic powder. If it combines with water it shows polymeric nature. Guar gum powder can use in bakery items, cosmetics, manufacturing of soaps, Multani Matti compositions, industrial use. It was used for increasing viscosity in any industrial use. Guar gum has many derivatives such as hydroxyl propyl guar and cellulose derivatives like carboxyl methyl guar and xanthan gum. This guar gum gel is more able to transport the proppant to the formation area. This powder is very low cost and easily availability for industries.

6.2.5 Linear gel Breakers:

There are two types of breakers are there, one is solids oxidizers ammonium persulfate, ammonium sulphate, copper compounds. Also, liquids are enzymes hemicellulase. These breakers are degraded the linear gel viscosity during pumping into the down hole at bottom hole circulating temperature. It reduces the molecular weight of linear gel viscosity. It facilitates the flow back of residual polymer which allows for clean-up of the proppant pack. The two general types of breakers are Oxidizers and Enzymes.

6.2.6 Oxidizing Agent:

Ammonium persulfate [(NH₄)₂S₂O₈] is very strong oxidizer it will form free oxygen radical at temperature 125°F. It was acting on cleaving the acetyl linkages in the polymer. Also, Sodium persulfate (Na₂S₂O₈) is very strong oxidizer it will form free oxygen radical at temperature 130°F. It was acting on cleaving the acetyl linkages in the polymer.

Calcium peroxides and magnesium peroxides act as a mild oxidizer are break it down its constitutive sugars, it releases oxygen when it contacts with water. So, the flow back after well fracturing collects in the pit.

Here peroxides convert into flow backwater, its rate depending on peroxide concentration. These free radical acceptors are like gel stabilizer. So, these are very strong oxidising agents and very active when contact with organic materials.

6.2.7 Enzymes:

Hemicellulase, cellulose, pectinase and amylase are used for hydraulic fracturing. These all belong to protein molecules acts like an organic catalyst and digest the polymer at specific sites along the polymer backbone. Enzymes are working at above 60°C to 66°C temperature, degradation takes place at high pH to low pH. So ultimately the degradation takes place due to hemicellulase.

6.2.8 Flow-back (gas-flow):

Gas flow, which is a liquid, it will flow back after completion of the hydrofracturing process. Methanol 2-butoxyethanol ethylene Oxide Nonylphenolpolymer Alcohols, C12-16, ethoxylated Tridecyl alcohol Nonylphenol Ethoxylated non-ionic surfactant.

6.2.9 Anti-Bacterial Agent:

Anti-bacterial agent is purely organic materials to kill microorganisms in any field water tanks. It seems like polymeric gelling agents. These materials are inhibiting growth and deleterious enzyme production.

6.3 20/40 Sand:

Proppants are so many types and with different sizes are using in fracturing operations. 20/40 size proppant was familiar to open hydrofracturing. It gives the maximum permeability, and this proppant has some specification standard like proppant roundness, proppant purity, proppant acid solubility capability test should pass, and crush strength.

In some cases, frac formation is wider and they have many stages to fill the proppant, in that case, they will use larger proppant volumes allow too wide fractures. Normally proppant can transport and placed 11,000 lbs into the good fracture.

6.3.1 Viscosity Measurement:

This equipment is from Chandler Engineering Company using for determination of viscosity, it is also called as Rheometer. The Chandler Engineering Rheometer is shown in [figure 6.4].



Figure 6.4: Viscometer CHANDLER

Viscometer has two important parts spring and bob. They are two types of bobs are bob-1 and bob-5. Bob-1 will use for low-density slurries and bob-5 will use for high-density hematite slurries. Basically, viscometer readings from 0 to 600 rpm will display, direct viscosity readings in centipoise (cp).

6.4 Results and Discussion:

6.4.1 Preparation of XLFC (Cross linked Linear Fracturing Concentration) Slurry:

Consider 309 ml of 4-vinyl -2,6-dimethoxy phenol pours into a mixer jar. Add 4.5 grams of Organophilic clay powder (suspending agents) which is an oil-dispersible powder added to the mix for 20 minutes. It will be allowed to disperse and yield.

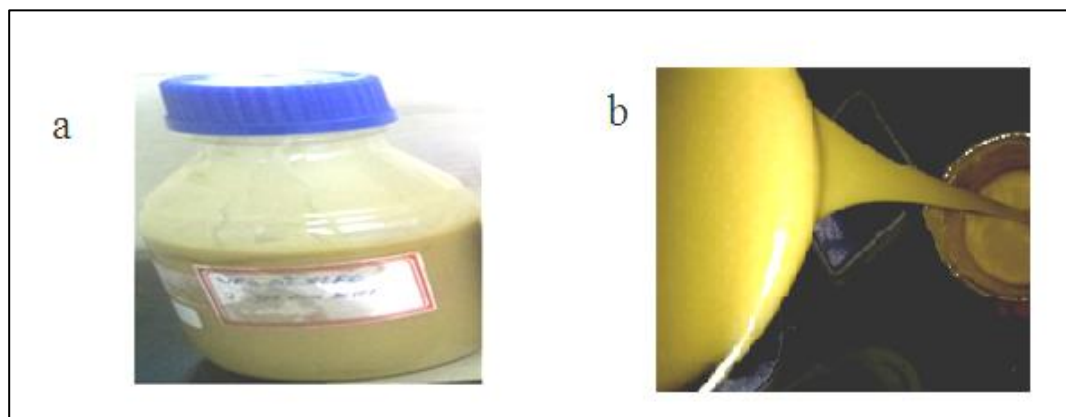


Figure 6.5: (a) 500 ml of XLFC (b) 4-Vinyl-2,6-dimethoxyphenol XLFC-1B flow

Add 3 ml of isotridecanol ethoxylated is a liquid which helps as a suspending agent. It forms like emulsifier to whole the slurry biodegradable and eco-friendly compound; it is agitated for 20 minutes.

Take 65 gm of sodium acetate into the mixer; continue until the slurry is dispersed for 15 minutes. Check the slurry pH, it is in basic nature.

Then 240 grams of guar gum powder added to mixer for 20 minutes [figure-6.5 (a)]. Measure the density of the slurry [Table-1], [figure-6.5 (b)].

Table 6.1: Concentrated slurry physical properties

Specific Gravity	1.16
Slurry Density	9.6 ppg
Free Diesel	<2% (in 24 hrs)
Polymer Concentration	4.0 ppg
Flash Point	400°F (205°C)
Viscosity @ 300 RPM	< 250 cp

6.4.2 Preparation of Hydraulic Fracturing Linear gel:

7.5 gpt of the concentrated slurry was mixed with water as per below calculation 7.5ml of Concentrated slurry is mixed with 1000 ml water, the gel must be mixed up to 30 minutes after that then stop the agitation. The linear gel is shown in figure 6.6.



Figure 6.6: Hydrated Linear Gel (7.5 gpt)

The gel viscosity is 29 dail reading in viscometer [figure 6.4]

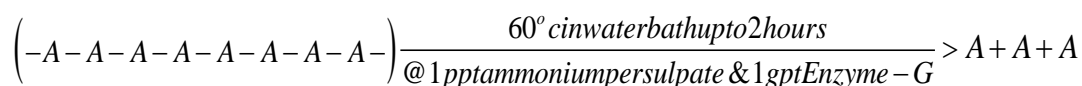
6.4.3 Conversion Factor:

$$1\text{ppt} = \frac{1\text{pound}}{(1000 \times 1\text{gallon})} = \frac{1 \times 453.2}{(1000 \times 1 \times 3.782)} = \frac{453.2}{3782} = 0.12\text{gms / lit}$$

Here 453.2 grams is a factor, 1 gallon=3.782 lit

$$1\text{gpt} = \frac{1\text{gallon}}{1000\text{gallons}} = \frac{1\text{ltr}}{1000\text{ltr}} = \frac{1\text{ml}}{1000\text{ml}}$$

6.4.4 Fragmentation Reaction:



At first, the gel consistency is 29 cp, this gel testing as per formation temperature is 45 °C and 60 °C by utilizing 1ppt ammonium persulphate and 1gpt Enzyme-G breaker dosage then gradually gel breaks at a certain time. it implies the gel thickness will break step by step dependent on these temperatures and breaker focus. On the off chance that we need to break the gel consistency in all respects rapidly, we can expand the breaker concentration.

In fracturing operation, the process of the hydro frac mechanism is that gel conveys 20-40 estimate proppant, oxidizers, enzymes, and gas flow infused into well under high-weight shapes gaps. After slurry pumped (for example following 30 minutes) the fracture response happens, the breakers follow up on gel under base gap circling temperature, 29 cp gel ends up watery bit by bit. Following 180 minutes the gel thoroughly will break become water, the gas stream will return as stream backwater. This stream backwater again we can use for creation water after the turn around the assimilation process. The Linear gel breaking shown in Table 6.2.

Table 6.2: Breaker added to 1ppt oxidizer and 1 gpt Enzyme-G

Test.no	Breaker time, Minutes	linear-gel viscosity (cp)	
		1 ppt & 1 gpt breakers	
		60°C	45°C
1	0	28	28
2	10	25	26
3	20	22	24
4	30	20	22
5	40	15	18
6	50	10	14
7	60	7	10
8	90	4	7
9	120	2	5
10	150	1	3
11	180	0	1

The linear gel was tested under two production casings temperature BHCT at 45 deg c and 60 °C. linear gel gradually decreases, finally gel breaks within 180 minutes.

6.5 Conclusion:

The main aspect is of this exploration was utilizing the canola oil as a dissolvable for the readiness of hydro frac focus watched the great properties.

Our goal was to direct an exhaustive reported that free degradation, so this is the best example of fracturing liquid by utilizing inorganic salts like ammonium persulphate goes about as an oxidizing agents and gel breaking specialist like Enzyme-G at an element of temperature at the rate of base Hole coursing temperature (BHCT) relies on oil and gas well condition. Compounds are steadier in high temperature in all combinations.

6.7 References:

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