

FRACTURING FLUIDS



What are Fracturing Fluids?

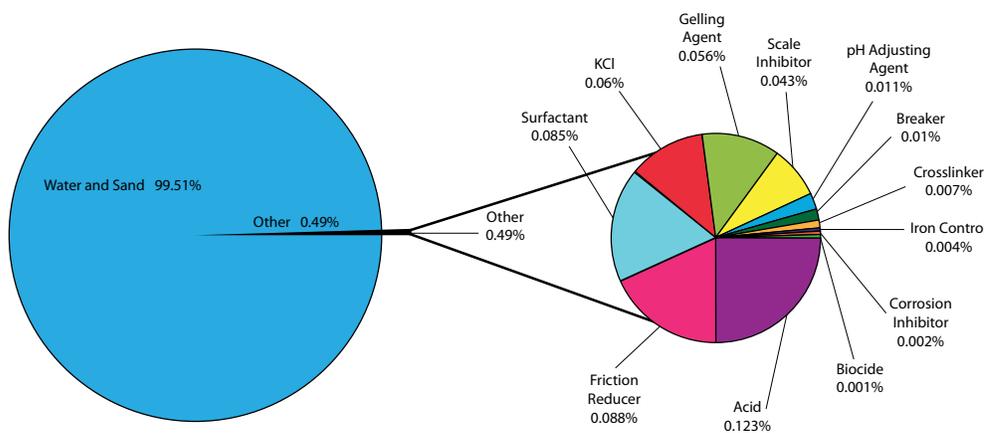
Fracturing fluids are liquids or gases that convey pressure from the surface into the reservoir to enable fractures to be created. Fracturing fluid allows transportation of proppant and chemicals into the reservoir.

Types of hydraulic fracturing fluid

The choice of hydraulic fracturing fluid is dependent on the properties within the reservoir. Some reservoir rock types contain **hydrophilic** clays which are sensitive to water and, in this circumstance, other base fluids are used instead. Types of fracture fluids commonly used are water, liquids/gases such as carbon dioxide, nitrogen, propane and oil based fluids. Water is the most common base fluid used in hydraulic fracturing due primarily to the low cost and availability.

Chemicals Used in Hydraulic Fracturing Fluids

To make fluids suitable for hydraulic fracturing, chemicals are commonly added to create a highly viscous low friction fluid that will withstand the rigors of traveling to the zone of interest, readily carry the proppant material into the fractures and ultimately return to surface. All chemicals used in the process must comply with Provincial and/or Federal regulations. The number of chemicals and concentrations added to the fluid/proppant mixture is highly variable and dependent on the specific properties of the reservoir.



Source: www.fracfocus.org

TERMINOLOGY

Hydrophilic: compounds which have an affinity to water and a structure that will attract water.

There are generally seven types of additives and each serves a different purpose.

1. Gellants/Gelling agents increase viscosity, suspend proppant material and provide lubrication.

Type	Source	Purpose
Guar Gum is the most common gellant in use	Guar bean, grown in India and Pakistan. Used as animal feed and a food additive.	Creates a natural polymer chain. Can be refined multiple times to improve its qualities such as methanol tolerance, decreased hydration time, and increased viscosity.
Polyacrylamide	Chemically produced long-chain molecule, known as a polymer. Commonly used in water treatment as a flocculent, or for products such as soft contact lenses.	Used to make water slippery for slick water fracturing.

2. Cross linkers are used to join polymers in a three-dimensional shape.

Boron, zirconium, titanium, or iron	Naturally occurring elements, mined at various locations.	Increases the viscosity of the liquid by linking the polymers.
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3. Clay Controllers are used in water sensitive rock formations to prevent clays from swelling.

Potassium Chloride	Potash, used in the preparation of many types of fertilizer, also used occasionally as a table salt substitute.	Reduces damage to reservoirs by inhibiting the reaction of certain clay minerals with water.
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4. Breakers, as the name suggests, break the polymer chain created by the gelling agent. This is particularly important when flowing the fracturing fluid back to the surface while, at the same time, ensuring that the proppant material remains in the newly created or enhanced fractures.

Oxidizers	Manufactured substances that release oxygen such as bleach.	Reduces viscosity of polymers and allows the fluid to flow back to surface.
Enzymes	A naturally occurring agricultural by-product.	Consumes Guar Gum polymers.

5. Surfactants lower the surface tension on the fracturing fluid.

Flow back additives	Akin to soap, these additives enhance the ability of water to flow back to surface following treatment.	Allows easier flow back of the fluid after the treatment is complete.
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6. Biocides prevent the introduction of sulphate reducing bacteria into wells.

Natural and manufactured biocides	Can be derived from bacteria or plants, or prepared from chemicals.	Prevents introduction of bacteria that can produce hydrogen sulphide (H ₂ S) or other corrosive or fouling chemicals in the reservoir. Pumped in small quantities.
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7. Energizers are gases used to energize (or foam) fluids for fracturing treatments.

Carbon Dioxide (CO₂)	Common compound found in the atmosphere. Carbon Dioxide can exist as a liquid, gas or solid, (known as 'dry ice').	Odourless and non-toxic. Improves the recovery of fluid, while reducing the potential of formation damage. Carbon Dioxide is moderately soluble in water and highly soluble in oil, particularly under pressure.
Nitrogen (N₂)	A naturally occurring element, nitrogen is stored, transported and pumped as a cryogenic liquid, then heated and injected into the wellbore as a gas.	Improves recovery of stimulation or well fluids.

Chemicals & Public Disclosure

Different jurisdictions mandate certain disclosure requirements for the oil and gas industry depending on local, provincial and federal regulations. Disclosure provisions help increase the public's knowledge and access to information on chemicals, along with their uses and potential environmental impacts. Although the content of disclosure rules will differ throughout Canada, the intent of each is to provide the public with information about the chemicals being used to fracture wells.



ADDITIONAL RESOURCES

www.fracfocus.org

www.fracfocus.ca

www.csur.com