



Drilling Fluid Properties and Testing

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Drilling Fluid Properties

What are Fluid properties? And why do we test them?



- Drilling Fluid properties tell us if the fluid is working for us or against us
 - They tell us if the fluid is performing its functions
- Testing Fluid properties allows us to;
 - Build desirable fluid properties
 - Maintain desirable fluid properties
- You can't see them!
 - The only way to know what they are is to test them!



Drilling Fluid

Properties

- Viscosity
- Rheology
- Filtration
- Density
- Sand content
- Calcium Hardness
- pH





Make-up water test

The language of drilling fluids



Make-up water

Testing

- Drilling Fluid consists for +/- 97% out of water
- Why testing water?
 - Increased calcium hardness levels,
 - Lower pH levels,
 - Increased chloride content

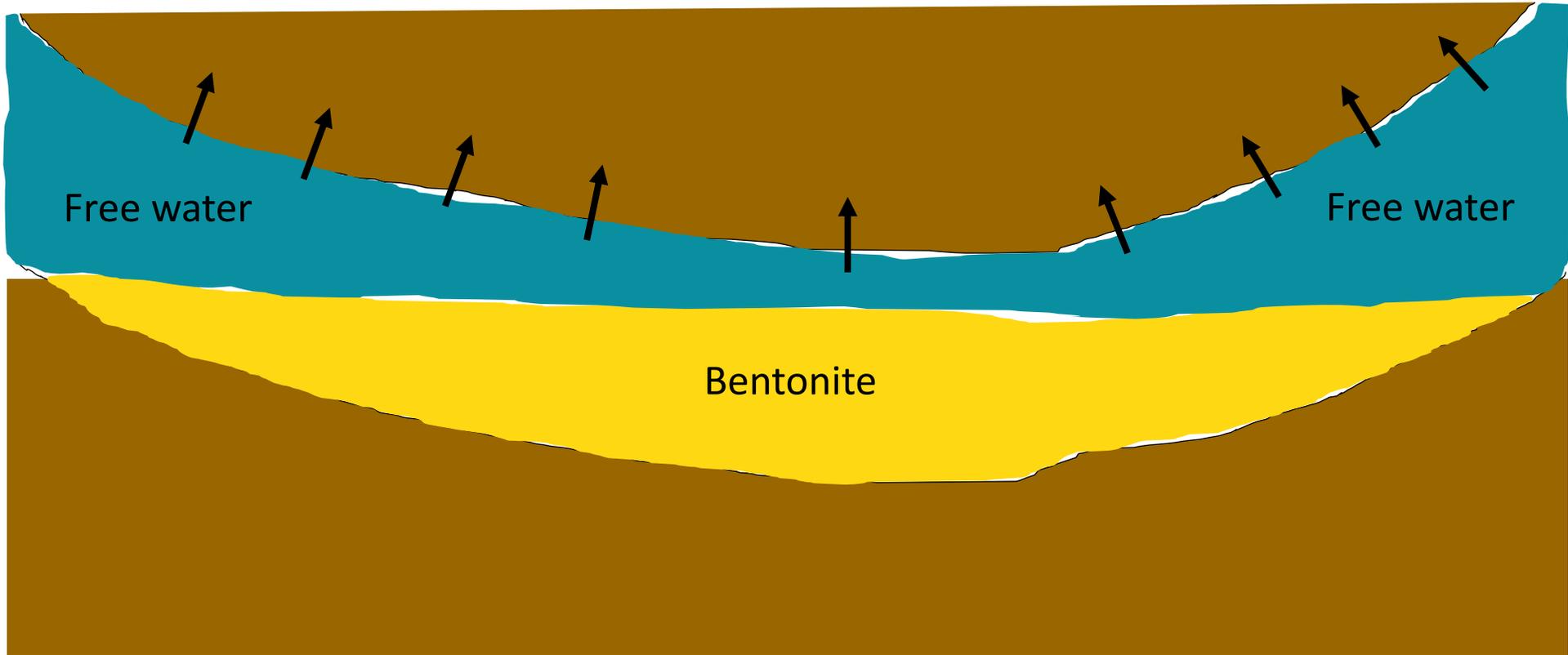
All interfere with the hydration of most drilling fluid additives.





Make-up water

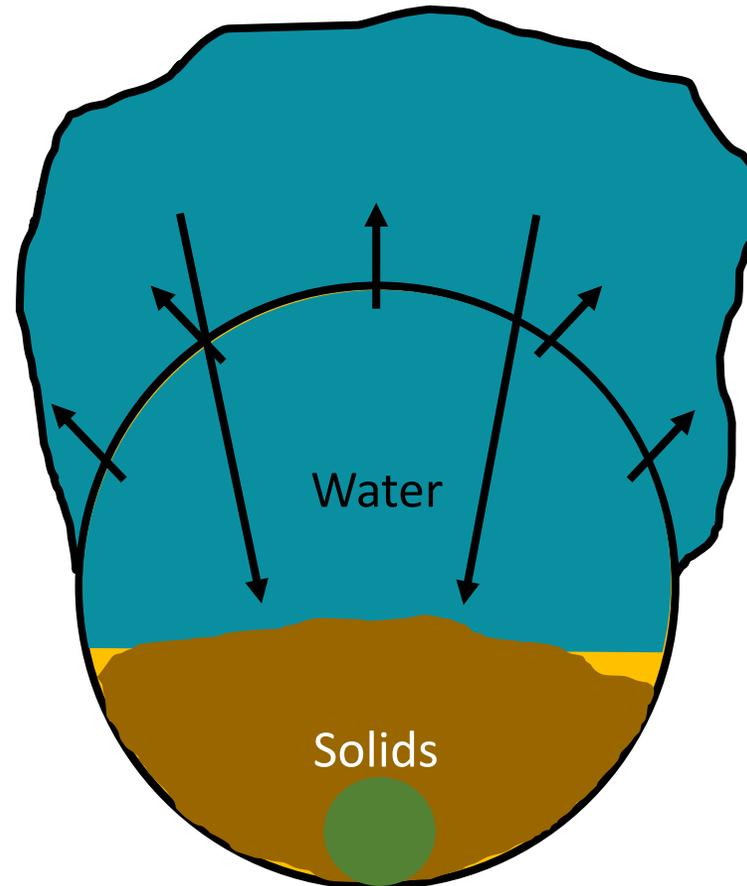
Testing

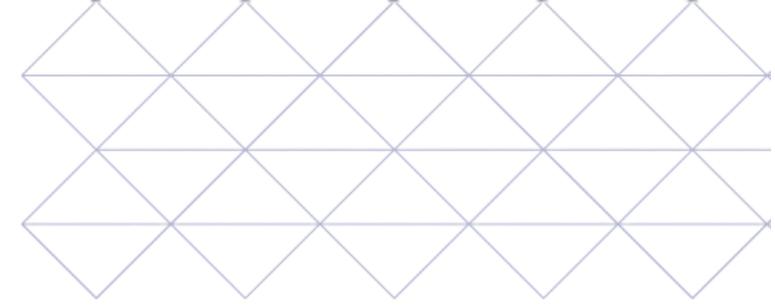




Make-up water

Testing





Total Hardness (calcium)

The language of drilling fluids



Total hardness (calcium)

Testing

- Measures the concentration of cations contributing to total hardness
- Measured with Total Hardness indicator strips
- Reported in parts per million (ppm or mg/l)
- Check the hardness of the make-up water

- Why?
 - Retards hydration of bentonite and polymers



Total hardness (calcium)

Testing

- Dip indicator strip into make-up water
- Compare colour on the strip to colour chart on container after 15 seconds

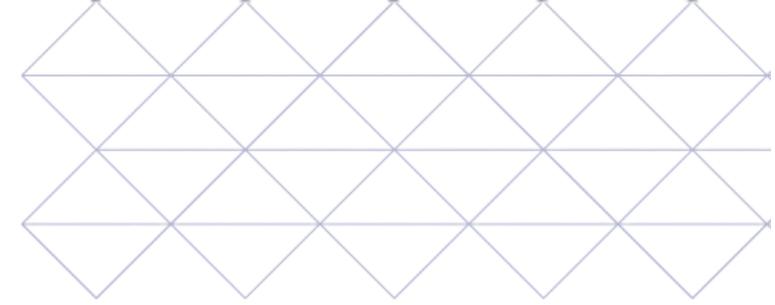


Total hardness (calcium)

Testing

- Calcium levels as low as possible are desirable
 - Less than 100 ppm is recommended
- Higher calcium content can cause
 - Bad hydration, water separation, Uncontrolled filtration and difficult viscosity build-up
- Calcium contamination can be treated using Soda Ash
 - 0,5 – 1,5 kg/m³





pH

The language of drilling fluids

pH

Testing

- Indicates the Acidity or Alkalinity of a fluid
 - A pH of 7 is neutral
 - Acidic environments range from 0 to less than 7
 - Alkaline environments range from greater than 7 to 14
- Check the pH of the make-up water
- Measured with pH strips or pH meter

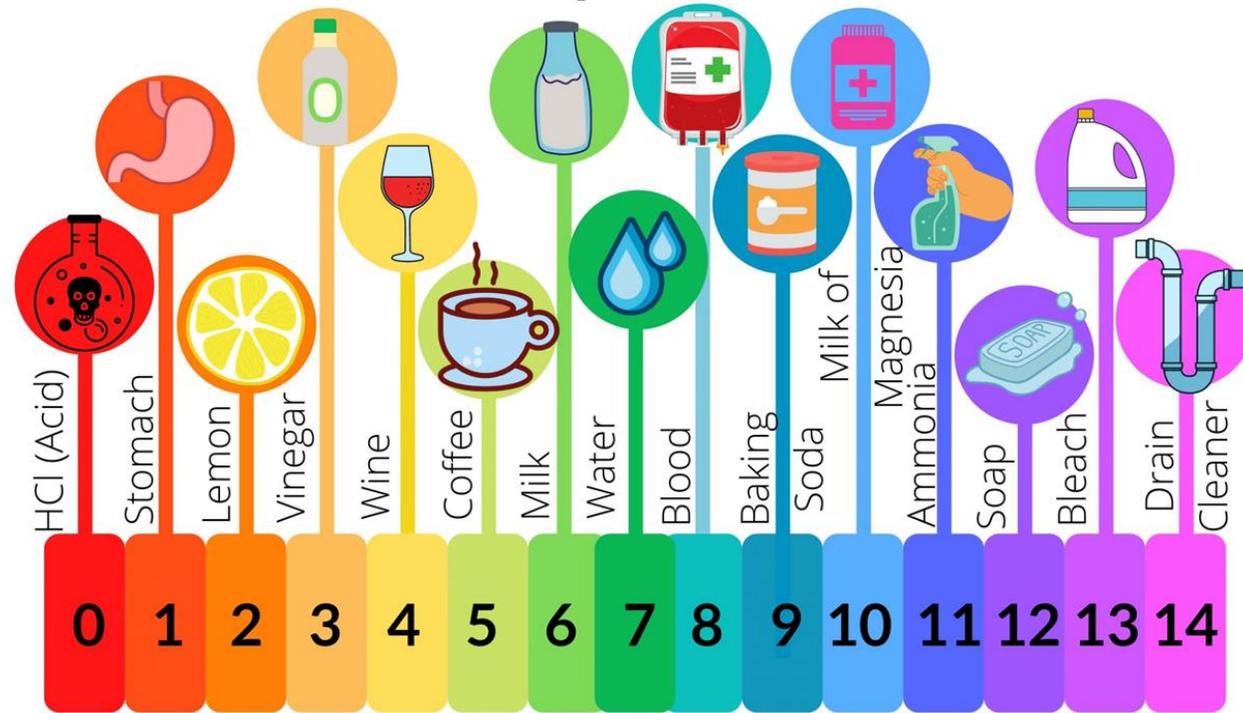
- Why?
 - Slightly alkaline is optimal for hydration of bentonite and polymers



pH

Testing

The pH Scale



$$\text{pH} = -\log [\text{H}^+]$$



pH Testing

- Dip pH strip into make-up water or filtrate
- Compare colour on strip to colour on chart to determine pH value



pH

Testing

- pH 8,5 – 9,5 is optimal for hydration of bentonite and polymers
- Lower pH can cause:
 - Bad hydration, water separation and a difficult viscosity build-up
- pH can be increased to 8,5 – 9,5 by addition of Soda Ash
 - 0,5 – 1,5 kg/m³





Chlorides (salt)

The language of drilling fluids



Chlorides (salt)

Testing



- Indicates the concentration of chlorides in the make-up water
- Measured with a conductivity tester or by tasting
- Why?
 - Retards the hydration of bentonites

Chlorides (salt)

Testing

- Chloride levels as low as possible are desirable
 - Less than 500 mg/l is recommended (1000 μ s)
- Higher chloride contents can cause:
 - No viscosity build-up, uncontrolled filtration, water separation and no hydration
- Chlorides cannot be treated out with an additive
 - Find a new source of make-up water
 - Use a salt tolerant additive



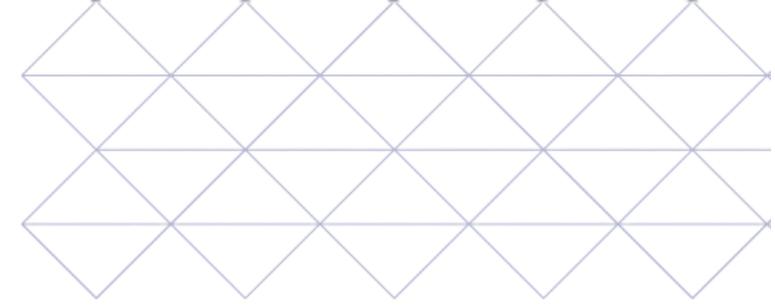




Properties and testing

The language of drilling fluids





Viscosity

The language of drilling fluids

Viscosity

The language of drilling fluids

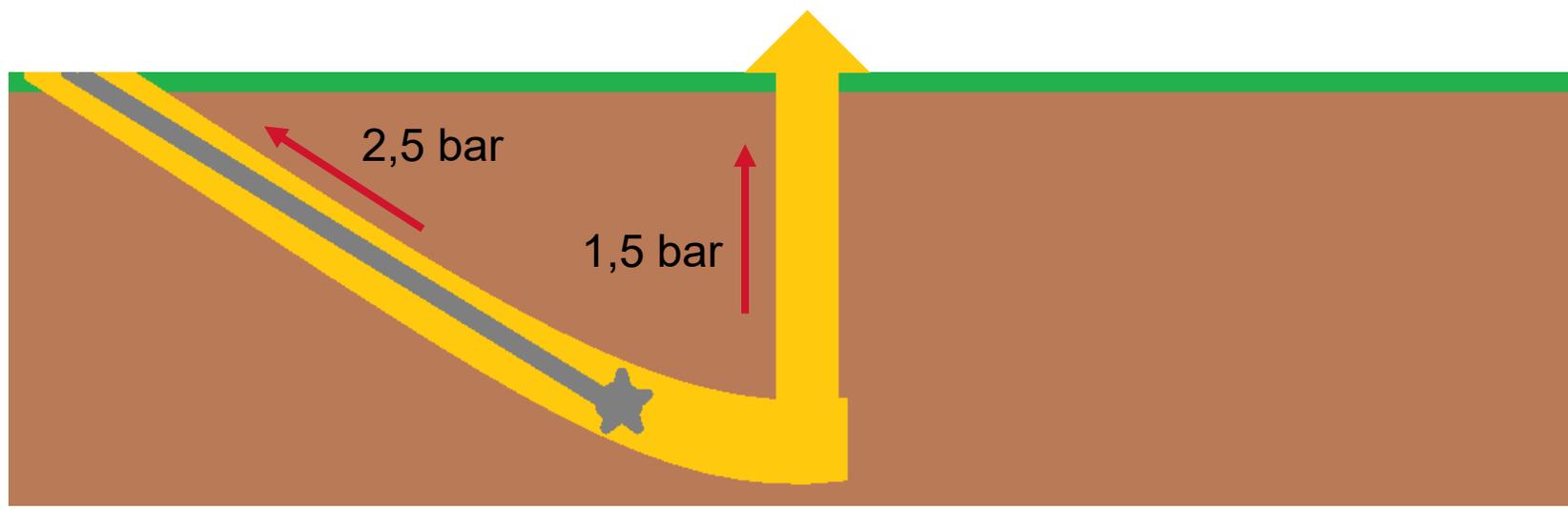
- Defined as the fluids “Resistance to flow”
- Thickness of the fluid
 - Only visible property when mixing fluids
- Measured with a Marsh Funnel Viscometer
- Why?
 - Relates to hole cleaning, cuttings settling, borehole stability and pumping pressures





Viscosity

Drilling fluid properties and testing



Viscosity

Marsh Funnel Viscometer

- Field measurement of the viscosity of a fluid
- Reported in seconds per liter



Marsh Funnel Viscometer

- With finger over the bottom of funnel, fill the fluid through screen to the bottom of the screen
 - Same as scribed line in funnel (1500 ml)



Viscosity

Marsh Funnel Viscometer

- Using a stopwatch, time the number of seconds for one-liter of fluid to run out of the funnel

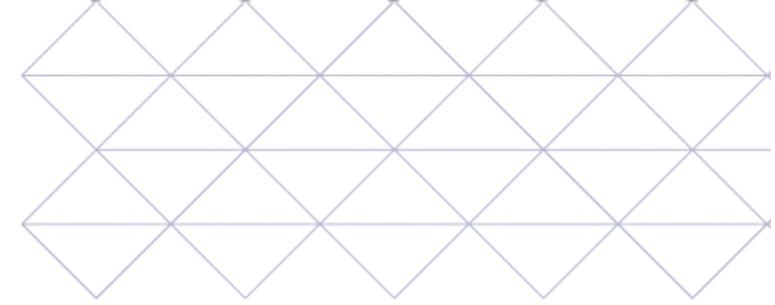


Viscosity

Marsh Funnel Viscometer

- Viscosity of water
 - 27 seconds per liter
- “Normal” drilling fluid viscosity
 - Varies greatly, from 50 – 75 seconds per liter
 - Significant change in viscosity $\pm 5\%$
- Low(er) viscosity is desirable while maintaining other drilling fluid properties
 - Higher viscosities contribute to higher pumping pressures





Drilling Fluid Properties and Testing

Questions

