MicrobialControl

Dantogard® 2000: A New Environmentally Responsible Chemistry for Biocide Applications in Fracturing Fluids

3rd UNECE Gas Center Industry Forum 2012 - Lausanne

A. Hurtado / Lonza Microbial Control, Basel / 2 October 2012

Lonza

Disclaimer

The following presentation is not relevant for the European Union as the active substance contained in the Dantogard® 2000 is not supported under the Biocide Product Directive 98/8/CE (BPD) for applications defined in product types PT11 and PT12 and therefore cannot be used for hydraulic fracturing operations.

Hydraulic Fracturing Facts

- The use of horizontal drilling and multi-stage fracturing technique has become very popular in the Oil & Gas industry by making unconventional resources economically viable.
- This technique has been extensively used in North America in the past decade and is now slowly developing in Europe.
- As a result of its expanding use, hydraulic fracturing has become a very controversial topic in the public domain raising many concerns about:
  - Potential environmental impact
  - Water safety

Chemicals Under the Spot Light

The chemicals used in hydraulic fracturing fluids have been one of the major concerns due to associated risks and related HSE issues.

- Risks
  - Potential groundwater and aquifers contamination due to chemical injection during fracturing operations
  - Potential surface water contamination due to the spill of the impoundments of the treated flowback fluids
  - Transport and handling of chemicals
- HSE Issues
  - Human and animal exposure
  - Environmental toxicity (Aquatic organisms)
- Carcinogens and biocides have been a particular concern

Increasing Regulatory Environment

Concerns have led to increased governmental awareness and calls for regulatory oversight:

- US
  - New federal regulation: U.S. – H.R. 1084 (“Frac Act”)
  - State disclosure requirements for chemicals used
  - Additional state bans and moratoriums: New York
- Europe
  - France and Bulgaria have put a ban on hydraulic fracturing
  - Czech Republic is preparing a moratorium on prospecting for new shale gas
  - Romania is willing to lift its moratorium if environmental concerns can be resolved

→ Need to develop more environmentally friendly techniques and chemical solutions to answer the public concerns and comply with new regulatory requirements.

The Ideal Biocide

The biocide choice is a consideration of health, safety, environmental, and performance criteria.

- Low toxicity
- Readily biodegradable
- Reduced handling risks, low hazard
- Maintained fracturing fluid integrity and quality
- Prevented reservoir souring and reduced the risk of MIC
- Prevented biofilm growth which can plug the formation

MIC: Microbiologically Induced Corrosion

Dantogard® 2000–Environmentally Responsible Biocide for Hydraulic Fracturing Applications

- Dantogard® 2000 is an EPA approved, readily biodegradable biocide for oil and gas applications that meets and exceeds both biocide performance criterion and HSE standards.

Readily biodegradable, non-hazardous product	– Meets or exceeds corporate HSE standards
Excellent friction reducer compatibility	– Saves money by allowing for equal or lower operating pressures than other biocides
Broad spectrum efficacy in brines	– Ideal for applications with high TDS – Effective on problematic organisms such as SRB and APB
Acts as a biocide and a preservative	– Single chemical treatment can preserve flowback with less frequent treatment vs. competitive biocides for use in multiple fracturing jobs

Dantogard® 2000
Labeled as Non-Hazardous

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Warning

Form: liquid, Colour: colourless, Odour: odourless

Hazard Summary	:	Handle in accordance with good industrial hygiene and safety practice.
OSHA Hazards	:	MILD EYE IRRITANT

Potential Health Effects

Primary Routes of Entry	:	Inhalation Eyes Skin Ingestion
Inhalation	:	No hazards to be specially mentioned.
Skin	:	No hazards to be specially mentioned.
Eyes	:	May cause eye irritation.
Ingestion	:	May be harmful if swallowed.

SECTION 7. HANDLING AND STORAGE

Handling

Handling	:	No special precautions required.
Advice on protection against fire and explosion	:	Take precautionary measures against static discharges.

Storage

Requirements for storage areas and containers	:	Keep container tightly closed. To maintain product quality, do not store in heat or direct sunlight. Keep in a dry, cool and well-ventilated place.

SECTION 14. TRANSPORT INFORMATION

DOT
Not dangerous goods

TDG
Not dangerous goods

IATA
Not dangerous goods

IMDG-CODE
Not dangerous goods

RID
Not dangerous goods

Less Hazardous Handling and Environmental Characteristics than Other Biocides

- Dantogard® 2000 is 1.5 – 100x less toxic to aquatic species than other biocides

Product	Category (EPA)	Corrosive	Dermal Toxicity	Skin Sensitizer	Aquatic Toxicity
Dantogard® 2000	**Caution (III)**	**No**	**Category IV**	**No**	**29.1 ppm (Daphnia)**
Glutaraldehyde (50%)	Danger (I)	Yes	Category III	Yes	5.0 ppm (Daphnia)
Glutaraldehyde + Quat	Danger (I)	Yes	Category II	Yes	5.0 ppm (Daphnia)
THPS (75%)	Danger (I)	Yes	Category III	Yes	19.4 ppm (Daphnia)
Dazomet (20%)	Caution (III)	No	Category III	No	0.31 ppm (Daphnia)
DBNPA (20%)	Danger (I)	Yes	Category III	Yes	2.5 ppm (Daphnia)

Advantages vs. Glutaraldehyde

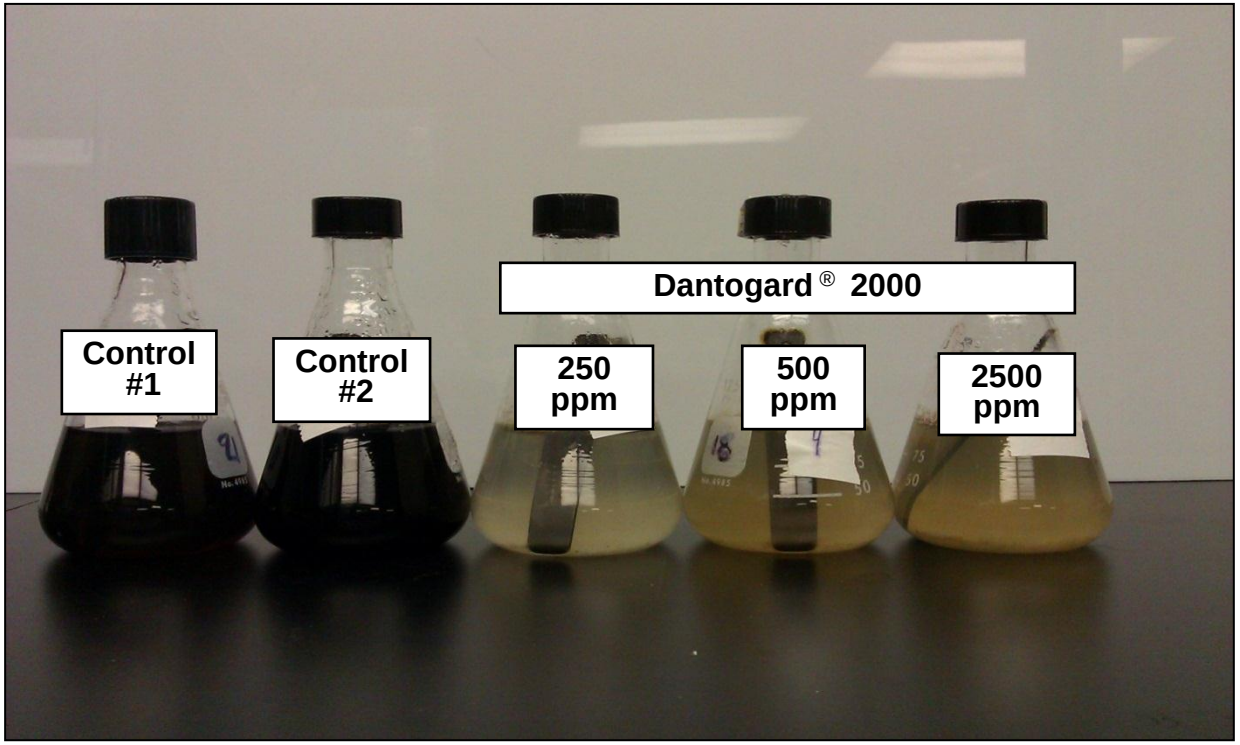
Performance Characteristic	Dantogard® 2000	Glutaraldehyde (50%)
GHB Efficacy	4	4
APB Efficacy	5	4
SRB Efficacy	4	5
Speed of Bacterial Kill	3	5
Preservation	5	2
Fracturing Fluid Compatibility	5	3
Safety and Handling	5	1

GHB = General Heterotrophic Bacteria
SRB = Sulfate Reducing Bacteria
APB = Acid Producing Bacteria

5 = superior performance / optimal characteristic
1 = poor performance / characteristic

Extended Preservation on SRBs in Gel Based Fracturing Fluids

- No growth observed down to 250 ppm after 35 d



Testing conducted in an anaerobic chamber and deoxygenated fluids (use of oxygen scavenger and a specialty oxygen scavenging enzyme to prevent O_2 contamination).

Thank You!

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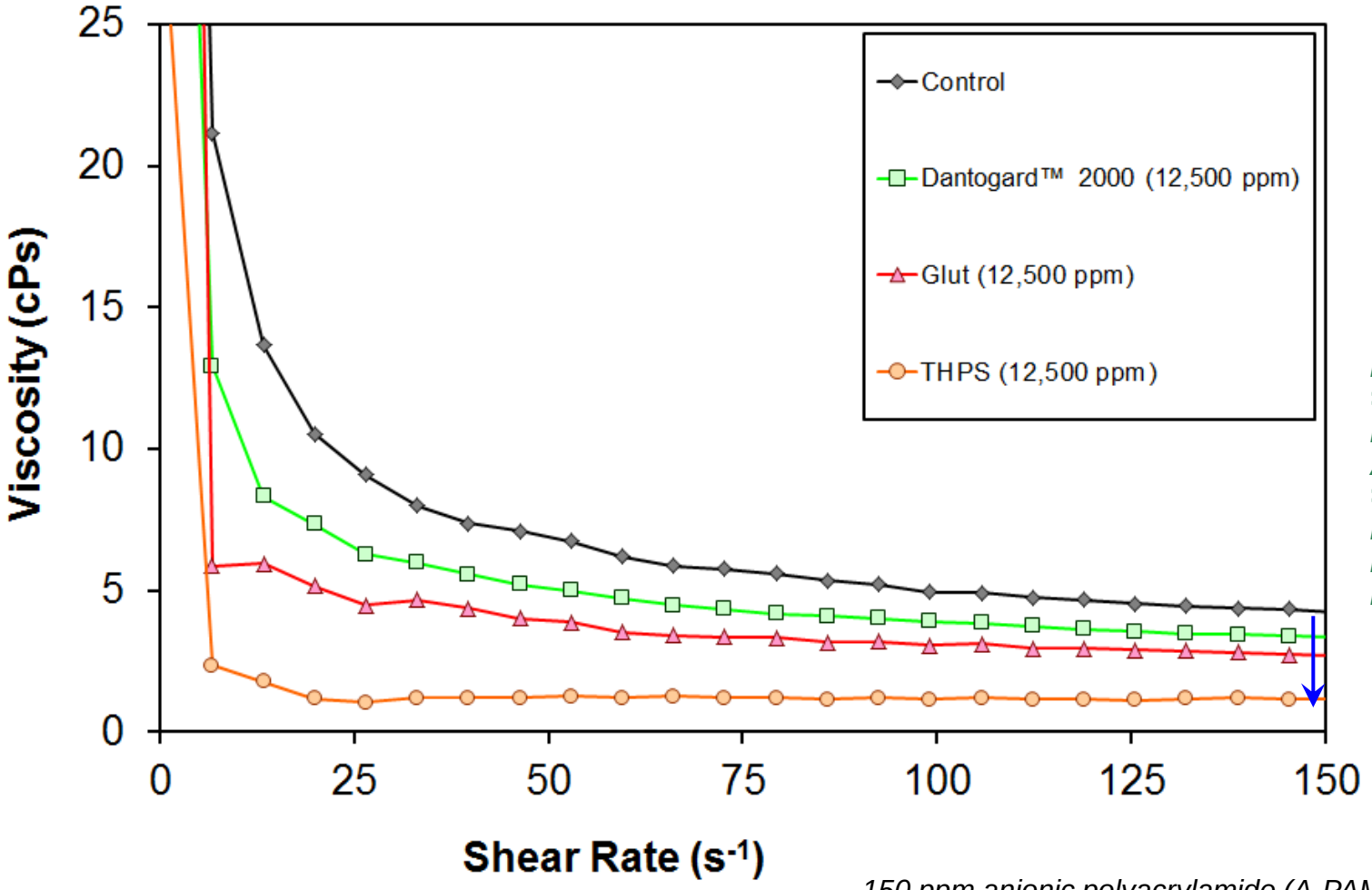
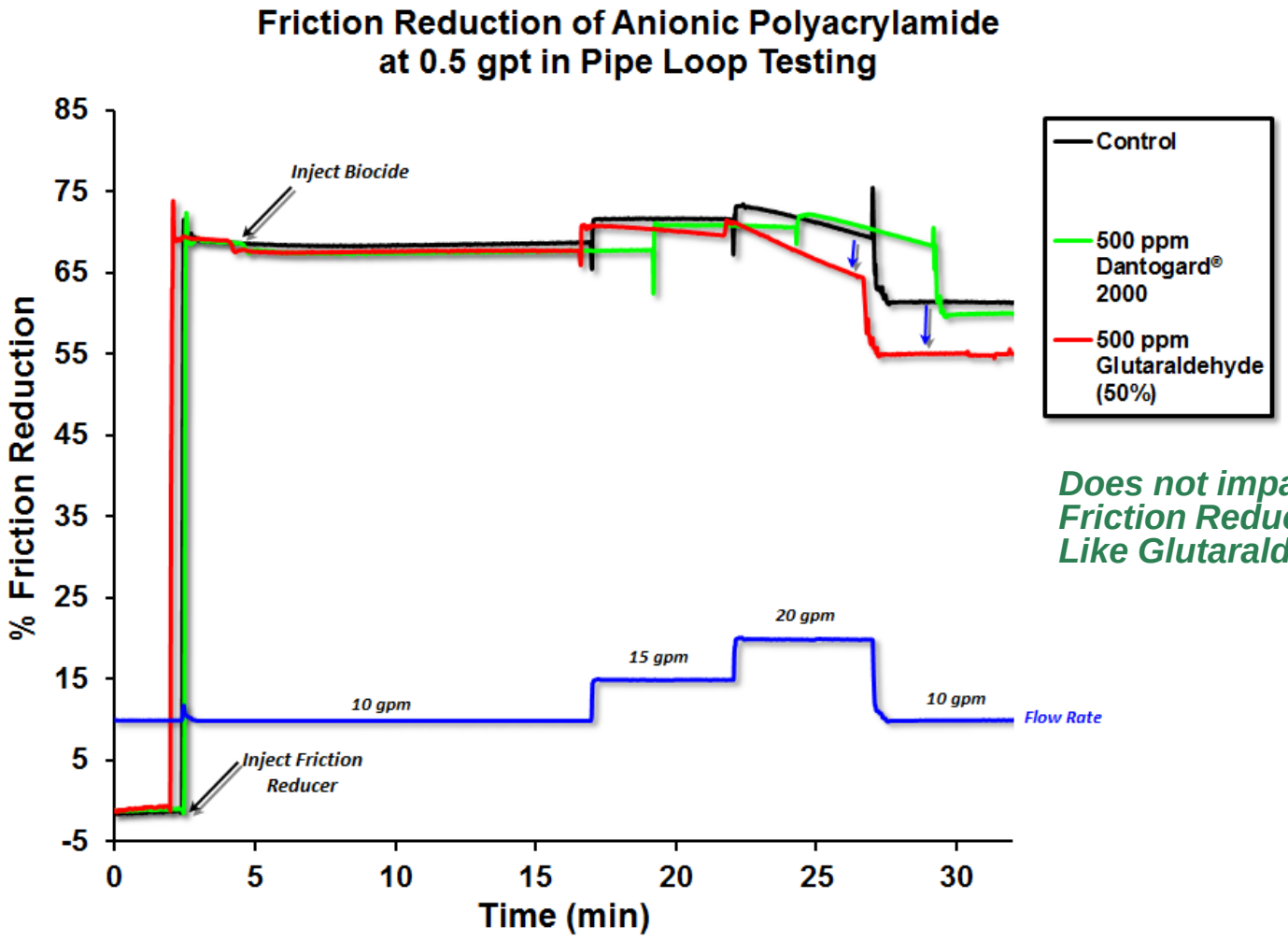
Better Compatibility with Friction Reducers



Lower Viscosity = Interaction with A-PAM = Lower Friction Reducer Performance

150 ppm anionic polyacrylamide (A-PAM)

Better Compatibility with Friction Reducers than Glutaraldehyde



Does not impact Friction Reducer Performance Like Glutaraldehyde

Thank You!