PRODUCT DATA SHEET

Enviro-Syn® HFR-1000™

Modified Acid™ System

Enviro-Syn® HFR-1000™ is part of the proprietary, eco-friendly Modified Acid™ product portfolio that minimizes the hazardous exposure levels, corrosion rates and negative HSE properties of commonly used acids, while maintaining the positive aspects of solubilizing ability and reactivity rates. Enviro-Syn HFR-1000 is a modified hydrofluoric acid (HF) that is neutralized until activated by the addition of a strong acid *in-situ* where there is no risk to human or environmental exposure.

When coupled with Enviro-Syn HCR® Modified Acid or hydrochloric acid (HCl), the fluoride ion is liberated and yields a high-performance mud acid system. Unlike HF, un-activated Enviro-Syn HFR-1000, is dermally non-toxic, providing a high level of safety to people and the environment for transportation and storage. HCR or HCl can be used as a pre-flush to prevent calcium fluoride (CaF_2) precipitation resulting from the reaction between HF and carbonates.

FEATURES & BENEFITS

- Neutralized until activated downhole by the addition of a strong acid (e.g., HCR or HCl)
- Low viscosity; does not need gelation by a polymer or surfactant, or emulsification by diesel to achieve retarded reaction rate
- Concentration can be adjusted on the fly by regulating the amount of activating acid, enabling operational flexibility
- Minimizes reprecipitation of aluminum compounds compared with conventional mud acid systems
- Ultra-low, long-term corrosion effects
- Compatible with typical elastomers used in oil and gas (e.g., Viton, Nitrile and EPDM)
- High stability in solution
- High thermal stability up to 190°C (375°F)

APPLICATIONS

- High-performance, safe mud acid alternative
- Sandstone and carbonate formation acidizing
- Readily reacts with quartz, silicates and clay to increase formation permeability and remove damage from silicate-based drilling muds

PHYSICAL PROPERTIES

Appearance:	Amber liquid
Specific Gravity:	1.185
Freezing Point:	≈ -27°C (-16°F)
Boiling Point:	> 100°C (212°F)
Thermal Stability:	190°C (375°F)
Un-activated Viscosity:	453 cP at 20°C (68°F)
Activated Viscosity:	< 5 cP at 20°C (68°F)
pH:	9.0
Solubility:	Soluble in water
Shelf Life:	> 1 year

SUPPORT HSE AND ESG GOALS

Non-corrosive to skin

Low-fuming*

Readily Biodegradable (OECD-301E)

Non-regulated for ground transport (USDOT)

Dermally non-toxic

*NOTE: Reduced immediate evolution of hydrogen chloride vapor at ambient temperature

PRODUCT DATA SHEET

Enviro-Syn® HFR-1000™

Modified Acid™ System

SOLUBILITY

Activation of Enviro-Syn HFR-1000 with a strong acid restores the quartz dissolving ability (Table 1). By themselves, HCl and Enviro-Syn HFR-1000 dissolve essentially no quartz; however, in combination they perform on par with a standard mud acid (HF with HCl). In addition, Enviro-Syn HFR-1000 activated with Enviro-Syn HCR blends match or exceed the performance of a standard HCl mud acid.

Table 1. Dissolution of quartz with various mud acid blends. Testing was performed at 75°C (167°F) for 4 hours.

Acid Blend	Free HCl (%)	kg/m³	lb/gal
HCl	12	0.095	0.0008
HFR-1000	–	0.036	0.0003
HF with HCl	12	3.8	0.0317
HFR-1000 with HCl	12	3.95	0.0329
HFR-1000 with Enviro-Syn HCR-7000®	6	4.49	0.0374
HFR-1000 with Enviro-Syn HCR-7000FRAC+®	12	5.76	0.0480

CORROSION RATES

With ultra-low metal corrosion properties, Enviro-Syn HCR/HFR-1000 blends have corrosion rates well below oilfield industry accepted values on typical oilfield alloys.

Table 2. Corrosion rates of various mud acid systems.

Blend	HCR (% HCl equivalent)	HFR (% HF equivalent)	Temp (°C /°F)	Coupon	Time (hr)	Corrosion (mm/yr)	Corrosion (lb/ft²)
HFR-1000 NEAT	–	–	55 / 131	1018CS	168	0.478	0.015
HCR-6000®/HFR-1000	6 (8.2)	1 (2.7)	110 / 230	P-110	6	13.655	0.015
HCR-6000/HFR-1000	6 (8.2)	1 (2.7)	110 / 230	N-80	6	14.343	0.016
HCR-6000/HFR-1000	6 (8.2)	1 (2.7)	110 / 230	J-55	6	10.801	0.012
HCR-7000-WL®/HFR-1000	7 (7.2)	1 (2)	90 / 195	316SS	6	1.037	0.001
HCR-7000FRAC/HFR-1000	5.5 (9.83)	1 (3)	90 / 195	1018CS	6	13.426	0.015
HCR-7000FRAC/HFR-1000	5.5 (9.83)	1 (3)	90 / 195	P-110	6	12.764	0.014
HCR-7000FRAC/HFR-1000	5.5 (9.83)	1 (3)	90 / 195	J-55	6	16.036	0.018
HCR-7000FRAC/HFR-1000	5.5 (9.83)	1 (3)	90 / 195	L-80	6	13.274	0.015

NOTE: Oilfield industry typically accepts a corrosion rate less than 0.050 lb/ft² at 6 hours. Coiled tubing typically accepts a corrosion rate less than 0.020 lb/ft² at 6 hours.

PRODUCT DATA SHEET

Enviro-Syn® HFR-1000™

Modified Acid™ System

SAFETY, STORAGE & HANDLING

- Stored in sealed containers, such as plastic pails, lined drums and HDPE IBC totes
- Fitting and valves should be HDPE, brass or stainless steel
- Do not use containers or fittings made of aluminum, copper, zinc or their alloys
- If heating, use a stainless-steel heat exchanger or tank steam coils, keeping the temperature below 65°C (150°F)
- Recommended shelf life of 1 year
- Consult SDS for additional information and PPE requirements

NOTE: Activated HFR-1000 is acute dermal toxin – exercise caution

Talk to us today about our revolutionary products available globally.
info@fluidenergyltd.com or www.fluidenergyltd.com