



# Polyaspartates for the Oil & Gas Market



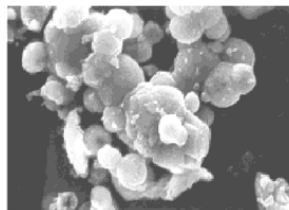
NanoChem Solutions, Inc. (NCS) manufactures proprietary polyaspartates for the oil and gas market. With a number of different molecular weights and options (both liquid and dry), NCS has supplied companies in the oil and gas market with biodegradable, non-bioaccumulating products and technologies for over 15 years.

## Product Description

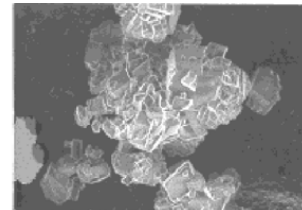
NCS polyaspartates are negatively-charged (anionic), biodegradable amino-acid polymers that are polymerized from L-aspartic acid, an amino acid produced in industrial scale by fermentation. The molecular weight of the polymer can vary depending on the specific application. The polymers are small enough to remain highly water soluble, but large enough to act effectively as biodegradable carbonate- and sulfate-scale inhibitors, and as a biodegradable dispersant while also enhancing the efficacy of corrosion inhibitors.

## Product Benefits—Scale Inhibition

To demonstrate the performance of NCS's polyaspartate products in regard to a decrease in the formation of carbonate and sulfate scale, two (2) NCS polyaspartate products were applied at 4 ppm in a dynamic scale tube-blocking test:



CaCO<sub>3</sub> Treated With Polyaspartate (Vaterite), 4000x



CaCO<sub>3</sub>, no treatment (Calcite), 2000x



Helps to treat mineral scale deposit (left)

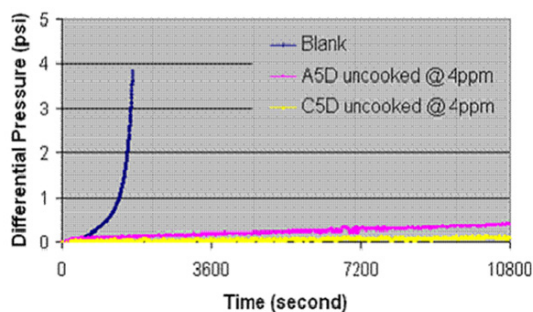
Test Parameters								
<b>Application Rate:</b>				4 ppm NCS A5D or 4 ppm NCS C5D				
<b>Water Parameters (in ppm):</b>								
<b>Na</b>	<b>K</b>	<b>Ca</b>	<b>Mg</b>	<b>Sr</b>	<b>Ba</b>	<b>Cl</b>	<b>HCO<sub>3</sub></b>	<b>SO<sub>4</sub></b>
12384	364	578	731	56	31	22048	388	1325
<b>Time:</b>				10 mL/min for 3 hours (pH: 6.7)				
<b>Temperature:</b>				86° C				
<b>Pressure:</b>				1500 psi				



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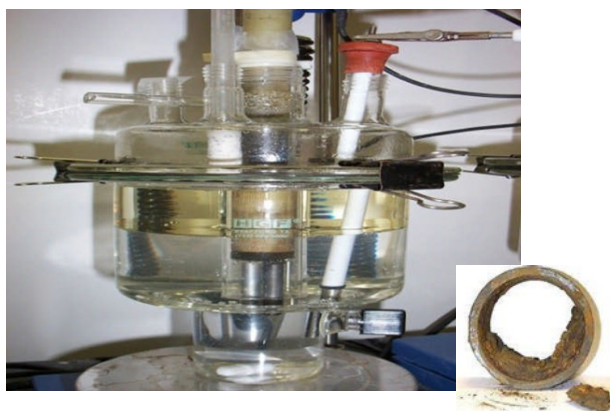
## Dynamic Scale Inhibition Test



Conclusions: At approximately 900 seconds (15 minutes), the untreated tube pressure begins to build—signaling that the tube is becoming blocked with carbonate and sulfate scale. By 1800 seconds (30 minutes), the untreated tube pressure builds dramatically, and is quickly becoming occluded with scale. Alternatively, the two tubes treated with NCS A5D and NCS C5D continue to operate with minimal pressure, and therefore with minimal scale development.

## Corrosion Inhibition

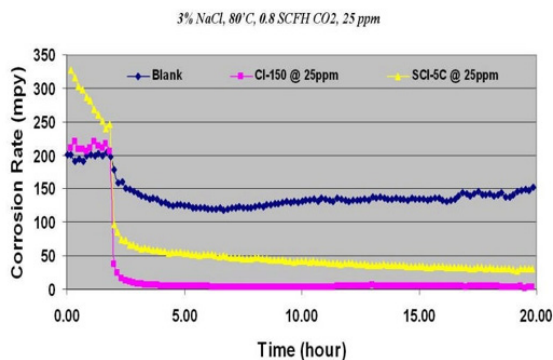
To demonstrate the performance of NCS's polyaspartate products in regard to corrosion inhibition, two (2) NCS products were applied at 25 ppm in an electrochemical corrosion test:



Test Parameters	
<b>Application Rate:</b>	25 ppm NCS CI-150 or 25 ppm NCS SCI-5C
<b>Water Parameters:</b>	3% NaCl, 80° C, 0.8 SCFH CO <sub>2</sub> , 25 ppm
<b>Time:</b>	20 hours
<b>Temperature:</b>	80° C
<b>Carbon Dioxide (CO<sub>2</sub>) Rate:</b>	0.8 SCFH (standard cubic feet per hour)

Helps to treat metal corrosion (bottom left)

## Corrosion Inhibition Test



Conclusions: When comparing the difference between the untreated and the treated, the corrosion rates are reduced around the 2.5-hour mark, with additional corrosion reducing over time with NCS CI-150 and NCS SCI-5C. On the other hand, the untreated iteration continues with steady rates of corrosion that slowly increases over time.