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In-Situ Analysis of Corrosion Inhibitors using a Portable Mass Spectrometer with Paper Spray Ionization

A rapid, handheld mass spectrometry method allows for inexpensive, in situ monitoring and quantification of corrosion inhibitors and other chemicals in oil pipelines, optimizing treatment.

Corrosion of oil transmission pipelines is of concern to the oil industry as it results in leakage and large-scale oil spills that are destructive to the ecosystem and pollute drinking water supplies. Corrosion of such pipelines is inhibited through the addition of oil-soluble compounds, such as salts and ionic liquids, to the crude petroleum. Successful inhibition depends on the amount of inhibitor present; thus, measurement of inhibitor levels in crude oil is of great interest. Inhibitor measurements are especially valuable in long-distance transfer pipelines where it is highly desirable to make the measurement directly at the location of the pipeline. While the idea of corrosion inhibitor detection and quantification using mass spectrometry is not a new subject, currently, there is no method for field monitoring of residual levels of corrosion inhibitors using mass spectrometry in the oil field industry.

Using paper spray (PS) ambient ionization, researchers at Purdue University have implemented a portable mass spectrometer and applied it to the detection of key salts at relevant concentration levels in a complex oil matrix. These salts are commonly used as active components in the formulation of corrosion inhibitors. Using a rapid, high throughput, miniature, handheld mass spectrometer, the active components of the corrosion inhibitors were identified and confirmed. When using this method, the detection limits are approximately 10 times higher than values obtained by commercial instruments. This method can provide almost instantaneous data while minimizing sample preparation and will allow quantification of corrosion inhibitors in oil at the pipeline, and hence, the optimization of corrosion inhibitor treatment through rapid and inexpensive monitoring even at very low concentrations.

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Category
Buildings, Infrastructure, & Construction/Structural Health Monitoring
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Biotechnology & Life Sciences/Analytical & Diagnostic Instrumentation

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Advantages:

-In situ measurement of corrosion inhibitors or any other oil field-related chemical at very low absolute concentration (1 ng)

-No sample preparation prior to MS analysis

-Because no prior sample treatment is required, both cost savings and simplicity of analysis are considerably increased

Potential Applications:

-Oil industry

-Chemical analysis

TRL: 5

Intellectual Property:

Provisional-Patent, 2013-01-31, United States | PCT-Patent, 2014-01-23, WO | NATL-Patent, 2014-01-23, Canada | NATL-Patent, 2014-01-23, China | NATL-Patent, 2014-01-23, Brazil | NATL-Patent, 2015-03-09, United States | CON-Patent, 2017-08-15, United States | DIV-Patent, 2018-03-02, China | CON-Patent, 2018-12-26, United States | CON-Gov. Funding, 2020-01-17, United States

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