

QuantArray[®]-MIC

A Key Line of Evidence for Investigating MIC



PROJECT SUMMARY



- QuantArray[®]-MIC was performed on swab samples from internally pitted and adjacent non-pitted areas of pipeline components as part of a multiple lines of evidence approach to evaluate microbiologically influenced corrosion (MIC).
- Concentrations of Total Bacteria, Total Archaea, sulfate reducing bacteria (SRB), methanogens, and other microorganisms commonly implicated in MIC were orders of magnitude greater in the pit samples compared to the non-pitted sample.
- In conjunction with a review of chemical conditions and corrosion products, the QuantArray-MIC results added a key line of evidence indicating a threat of MIC.

PROJECT CHALLENGE



Correct diagnosis of MIC is critical for making the best chemical treatment and corrosion control decisions. Molecular microbiological methods (MMM) offer more accurate quantification and comprehensive assessment of microbial communities than traditional methods. In the current study, operators needed to conclusively determine whether MIC was a contributing factor to observed localized corrosion.

SAMPLING AND ANALYSIS

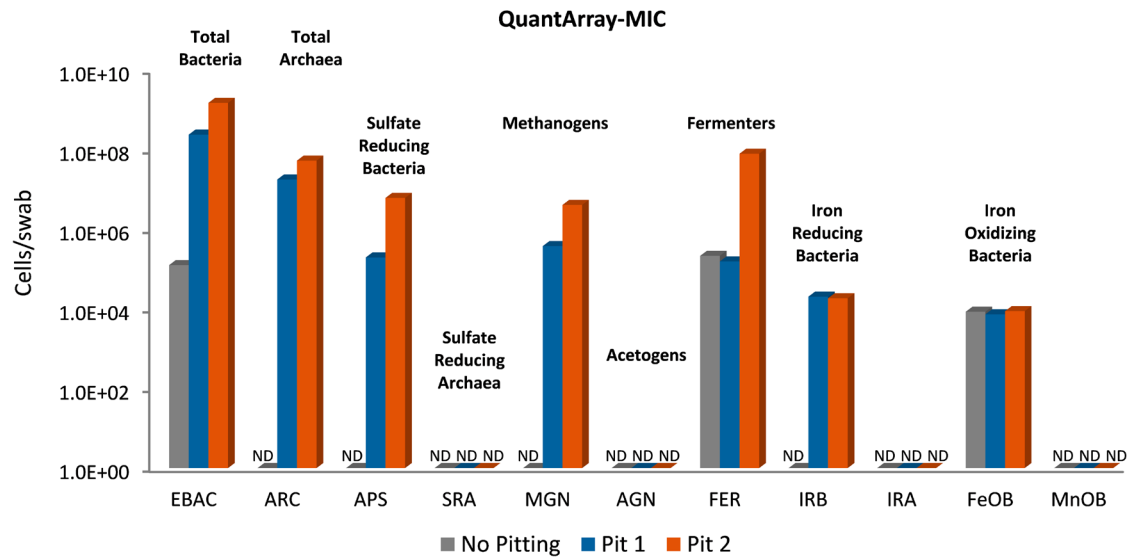


QuantArray[®], an advanced qPCR method, detects and quantifies a broad spectrum of key microorganisms and functional genes responsible for MIC and souring in a single analysis. With direct analysis of sample DNA, QuantArray-MIC eliminates the biases of culture methods and provides much more accurate quantification of target microorganisms including SRB and methanogens. In the current study, QuantArray-MIC was performed on swab samples of internally pitted and adjacent non-pitted areas of pipeline components. For easy-to-follow sampling protocols, please visit www.microbe.com.

QUANTARRAY-MIC RESULTS



As part of a multiple lines of evidence approach, QuantArray-MIC was used to quantify Total Bacteria, Total Archaea, and a suite of key microorganisms commonly implicated in MIC. A portion of the results is shown in the figure below.



- Concentrations of Total Bacteria (EBAC) in swabs from Pit 1 (blue bars) and Pit 2 (orange bars) were more than three orders of magnitude greater than in the swab of the area with No Pitting (gray bars). Furthermore, Total Archaea (ARC) were detected on the order of 10⁷ cells/swab in Pit 1 and Pit 2 but were below the detection limit in the area with No Pitting.
- Concentrations of sulfate reducing bacteria (APS) and methanogens (MGN) were on the order of 10⁵ to 10⁶ in Pit 1 and Pit 2 swabs. Neither SRB nor methanogens were detected in the sample from the area with No Pitting.
- Another important group of anaerobes, iron reducing bacteria (IRB), were also detected in Pit samples but not in the area with No Pitting. Fermenters were also detected at a high concentration in Pit 2. Fermenters are known to produce organic acids, including acetate, and support growth of other anaerobes, such as SRB.

Overall, concentrations of not just of Total Bacteria and Archaea but also SRB, methanogens, and other microorganisms commonly contributing to MIC were substantially greater in the Pit samples.

Decision: Combined with review of operating conditions, chemistry, corrosion products and morphology, QuantArray-MIC results demonstrating high concentrations of Total Bacteria, SRB, and methanogens indicated a substantial MIC threat.

KEY BENEFITS



- **Quantitative:** Comparing concentrations of total and specific microbial groups like SRB between pits and non-pitted areas quantitatively demonstrated growth of MIC associated microorganisms.
- **Accurate:** Direct analysis of sample DNA removed biases associated with culture methods and other traditional approaches.
- **Cost-Effective:** QuantArray analysis provided simultaneous quantification of Total Bacteria, Total Archaea, and a broad spectrum of specific microbial groups most commonly implicated in MIC.
- **Conclusive:** Since the damage mechanism was confirmed to be MIC, the mitigation program can be optimized to address that specific threat, for example by pigging and biocide for MIC rather than corrosion inhibitor that would provide no real benefit, savings thousands of dollars.

LAB LOCATIONS



Microbial Insights, Inc. USA

10515 Research Drive, Knoxville, TN 37932 USA

Microbial Insights Canada, c/o EBPI

735 Griffith Court, Burlington Ontario, L7L 5R9

Microbial Insights (Australia) Pty Ltd, c/o AGRF Ltd

Plant Genomics Centre, Hartley Grove, Urrbrae SA 5064, Australia

Microbial Insights Europe, c/o Avecom

Industrieweg 122P, B-9032 Wondelgem, Belgium

Microbial Insights Europe (Germany), c/o Sensatec

Tempelhofer Weg 8, 12099 Berlin Germany

Microbial Insights China, Xiuying Li (cell# 13204027102)

Institute of Applied Ecology, Chinese Academy of Sciences

72 Yunong Road, Shenyang, Liaoning, 110164 China