MEMORIAL UNIVERSITY

MSc Departmental Seminar

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Tuesday, July 30, 2024 at 1:00 p.m. (via Webex)

Meeting Link: https://mun.webex.com/mun/j.php?MTID=m220f5b4b199d2089e9c6ac60b821b796

Title: Understanding oil refinery corrosion by Naphthenic Acid: A chemical approach

Abstract:
Corrosion causes a significant financial loss for the petrochemical industry. Many components in crude oil, such as sulphur, moisture, salts, and naphthenic acid (NA), causes corrosion damage. Among these, NA plays a significant role in corrosion activities. The structure of the carboxylic acids, the composition of the steel, temperature, pressure, phase of NA, and flow affect the corrosion rate.

In petrochemical manufacturing, infrastructure is commonly made up of carbon steel and 316L steel. Corrosion manifests as changes in the steel's structural morphology, lattice structure, and the development of corrosion products. This study observes the corrosion behavior of these steel materials by immersing steel plates in NA and operating reactions at five different temperatures. The corrosion activity was monitored visually, as well as through microscopic and XRD examinations. ATR-FTIR spectroscopy was utilized to research the chemical products of NA corrosion (metal naphthenates) and find the thermal effects on the chemical structure of NAs themselves.

To further comprehend the chemical aspects of NA corrosion, The reactions were performed at room temperature to maintain NA structure stability. In addition to corrosion of carbon steel and 316L steel, NA reactions were conducted with Fe powder, Ni powder, and Cr powder to determine the individual impacts of these components on the corrosion process. Changes to the NA C=O peak and the emergence of metal-carbonate peaks were examined, using ATR- FTIR.

The corrosion rate of carbon steel and Fe powder by NA was researched using a 1:2 weight ratio of Fe content to NA at room temperature. ATR-FTIR spectroscopy was used to study molecular changes in NA through the corrosion process over time. The progression of corrosion was examined by analyzing the area under the curve of impacted CO peak, at intervals over time at

room temperature. In addition, the corrosion behavior of carbon steel and Fe powder with NA exposed changes in the binding modes between metal and NA over time.

This study presents new insights into the processes of NA corrosion, emphasizing the critical factors that affect the corrosion rate and cause physical and chemical changes. The findings also recommend potential applications for monitoring NA corrosion in the petrochemical industry.