Automated Corrosion Inhibitor System for Water Pipeline

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Senior Project Design

Term: 231

Team: 9

Introduction

Objective

To develop an automated system that manage corrosion in water pipelines by corrosion inhibitor (CI).

Constrains

- Temperature (25 °C)
- Flow rate (40 liters/min)
- Low Pressure (10 BAR)

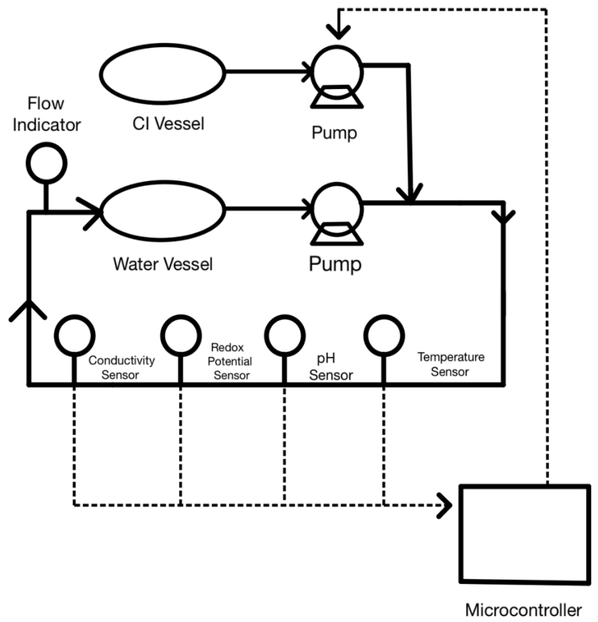
Specifications

- Concentration (7-9.5 pH)
- Time (1 reading/min)
- Conductivity (6000 µs/cm)
- Redox Potential (-1.2 ~ -0.6 V)

Material Used

- The physical prototype is build from mild steel (1018 carbon steel)
- Basics media flow in the pipe
- Anodic inhibitor Sodium molybdate (Na_2MoO_4)

System design



Dosage Rate

$$Q_{inh} = \left(\frac{V_{Fluid}}{1 \times 10^6}\right) C_{inh}$$

$$V_{Fluid} = \pi r^2 L_{pipe} = \pi\,(3.175)^2\ 0.146 = 4.62\text{L}$$

$$C_{inh} = 50\ \text{ppm}$$

$$Q_{inh} = \left(\frac{4.62}{1 \times 10^6}\right) * 50 = 0.231\ \text{g}$$

Q_{inh} = quantity of inhibitor, g
V_{Fluid} = volume of fluid to be inhibited, L
C_{inh} = inhibitor concentration, ppm
L_{pipe} = Length of the pipe, cm

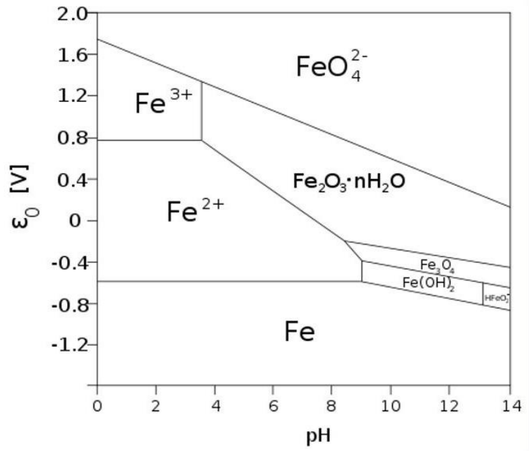
Operation

The System detect the corrosion using sensors

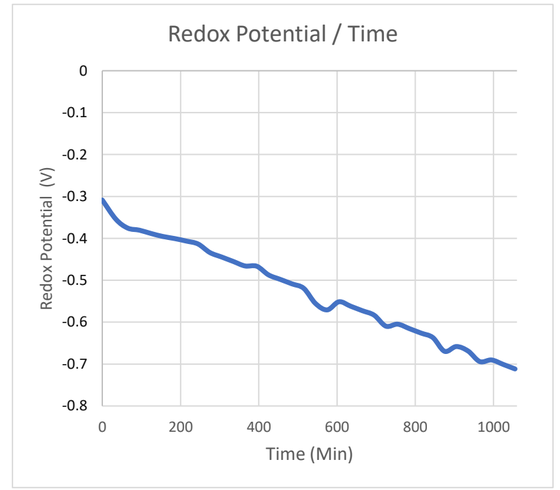
The Microcontroller send a signal to the pump to inject CI

The System hold for specific time to measure and store data

Testing & Validation



Pourbaix diagram From Zaki.Ahmad. (August 14, 2006). Principles of Corrosion and Corrosion Control.



The diagram shows the data gathered after the injection of corrosion inhibitor.

Conclusion

The project has effectively managed the corrosion in the pipe by maintaining the material in the immune region.

Future development

Enhance the project to support internet of things, so the collected data could be processed using AI.