IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 8.021 ⁜ Vol. 11, Issue 4, April 2023

DOI: 10.17148/IJIREEICE.2023.11406

CORROSION MEASUREMENT INSIDE PIPE USING AIML

Nishikant Ashok Warghude[1], Gaurav Vilas Thakar[2],

Prof. Dr. Manish Attal[3]

Student, of Mechanical Engineering, SKN Sinhagad Institute of Technology and Science,

Lonavala Maharashtra, India[1,2]

Assistant Professor, Dept. of Mechanical Engineering, SKN Sinhagad Institute of Technology and Science,

Lonavala Maharashtra, India[3]

Abstract: The purpose of the experimental investigation is to look into how bitumen's properties are affected by the addition of polythene trash. Due to its inability to degrade naturally and its long-lasting negative effects on the environment, polythene trash is a significant environmental hazard. In order to dispose of polythene trash sustainably, the study suggests adding it to bitumen, which is frequently used in road building. In this study, different amounts of polythene trash were added to bitumen (2%, 4%, 6%, 8%, and 10% by weight of bitumen) and their properties were compared to those of pure bitumen. Standard tests, such as those for penetration, softening point, ductility, and viscosity, were used to assess the bitumen's qualities. The study's findings demonstrated that bitumen's characteristics were enhanced by the addition of polythene trash. As polythene concentration rose, the penetration value dropped, suggesting that bitumen stiffness had increased. The modified bitumen's softening point grew, showing that its high-temperature characteristics had improved. The modified bitumen's ductility also increased, indicating a rise in its capacity to deform without breaking. Finally, the modified bitumen's viscosity increased, showing that its workability had improved. Overall, the study finds that mixing polythene trash with bitumen is a viable way to improve bitumen's qualities while lowering polythene waste's environmental impact. Due to the low cost and easy availability of polythene trash.

Keywords: Experimental study, bitumen properties, polythene waste, sustainable solution, environmental impact, road construction, penetration, softening point, ductility, viscosity, high-temperature properties, workability, cost savings.

I. INTRODUCTION

This project is aimed to determine the rate of corrosion inside the metal pipe where the human is not able to determine approximate percentage of corrosion. The corrosion measurement with this project will have a corroded pipe, graphical representation for insight readings and ultrasonic technique. The pipeline transportation is the fifth transportation modes besides highway, railway, waterway and aviation. It is widely used because of low operating costs, high transport efficiency and being used across a variety of regions. In petrochemical pipeline transportation, because of its geographical distance or other restriction, most pipeline led underground. Corrosion is one of the main causes of destruction and failure of buried pipelines, because of the complexity of medium and environment. The inner and outer walls of pipeline are easily corroded and they can cause a series of irreversible harm. Therefore, it is very important to protect pipeline away from corrosion. This paper mainly introduced the main detection technology and the protective measure for corrosion of internal corrosion.

1.1 Objective

1. To determine the rate of corrosion inside the metal pipe where the human is not able to determine approximate percentage of corrosion.
2. To determine corrosion in the form of graphical representation by which we can take insights regarding the pipe weather it is suitable for the further uses or not.

II. LITERATURE SURVEY

1. Hagarová M., Cervová J., Jaš F, explained in his project named "Selected types of corrosion degradation of pipelines" The paper deals with corrosion degradation of gas pipeline. Pipelines play very important role as means transporting gas media over long distances from producers to end-users. Gas pipelines present a risk of potential corrosion

DOI: 10.17148/IJIREEICE.2023.11406

degradation that can result in their failure. Corrosion on internal surfaces of steel pipes takes place in CO2, H2S, H2O and chloride environment. Degradation of steel results in loss of mechanical properties, reduction in thickness and ultimate perforation and failure. Corrosion is the electrochemical process that involves the flow of electrical currents on a micro or macro scale. For corroding steel, the anodic and the cathodic reactions produces the electrochemical cell. Corrosion protection of internal pipeline surface is based mainly on chemical composition of gas and the use of inhibitors. Corrosion protection of the external steel surface of the product line involves coatings and cathodic protection

2. Michael Baker Jr., Inc., his project named "pipeline corrosion". Corrosion is one of the leading causes of failures in onshore transmission pipelines (both gas and hazardous liquids) in the United States. It also is a threat to gas distribution mains and services, as well as oil and gas gathering systems. PHMSA uses specific criteria to identify the incidents that are significant from a pipeline safety viewpoint. An incident is defined as significant if it meets any of the following conditions: ƒ Fatality, or injury requiring in-patient hospitalization ƒ $50,000 or more in total costs, measured in 1984 dollars ƒ Highly volatile liquid releases of five barrels or more, or other liquid releases of 50 barrels or more ƒ Liquid releases resulting in an unintentional fire or explosion. Corrosion has been responsible for 18 percent of the significant incidents (both on shore and offshore) in the 20-year period from 1988 through 2008. By comparison, during this same period, excavation damage accounted for 26 percent of significant incidents.

3. Hyundong Lee, Usman Rasheed and Myeongsik Kong, The journal gives us a brief introduction of corrosion measurement and its effect. In his journal he explains in his journel named. "a study on the comparision of corrosion in water supply pipes due to tap water (TW) and reclaimed water (RW)". Among a wide variety of alternative water resources, reclaimed water from waste-water has drawn much attention, as it is considered a stable water resource to be substituted for agricultural, industrial, recreational, and public water. This study aimed to compare and evaluate the effects of tap water and reclaimed water on the corrosion of the inner surface of pipes. The investigated pipes included GSP (Galvanized Steel Pipe), CIP (Cast Iron Pipe), STSP (Stainless Steel Pipe), and PVCP (Polyvinyl Chloride Pipe). Assessment of corrosion impact on the different materials of pipes was conducted by analyzing the corrosion accelerators and inhibitors related to the characteristics of reclaimed water. Reclaimed water with higher ionic content showed a faster corrosion rate than tap water because corrosion accelerators have more of an effect on pipe corrosion than do corrosion inhibitors. In terms of pipe materials, the corrosion rate was fastest in CIP, followed by GSP, and STSP; PVCP exhibited no electrochemical corrosion.

4. Alexey Andrianov and Dmitry spitsov, Introduced the corrosion of his work. The journal, "Corrosion of galvanized pipes in the hot water supply system" has despite increased use of plastic and ductile iron pipes for construction of water supply system, steel pupes production volume in Russia remains high due to technological advantages in laying external water supply system, as well as high fire safety when installing internal systems. The main advantages of steel pipes are their strength, low coefficient of linear expansion, possibility to use several types of pipes connection in one network. However, low corrosion resistance of steel pipes, both ferrous and galvanized, significantly reduces the above advantages. Galvanized steel pipes are often used without taking into account quality of tap water, as well as ignoring the requirements of standards on stabilization treatment before water is fed into the water supply network. Sometimes these mistakes lead to intense corrosion of the steel and iron pipes that has a great impact on water quality and lifetime of pipelines in water distribution systems. Corrosion in the presence of oxygen is the main reason of destruction of equipment and steel pipes in water supply systems.

5. H.Shafeek, H.A. Soltan , M.H. Abdel-Aziz, introduced the corrosion of his work. The journel "Corrosion monitoring in pipeline with a computerized system". This software measures general internal pipeline corrosion forms to identify locations with potential corrosion features and predict corrosion conditions in the future. Computer-aided corrosion management program (CACM) examined maximum corroded depth of internal corrosion, maximum allowable axial corrosion defect length, failure pressure, the corrosion rate, and the remaining pipeline life. This work introduces a wide- ranging review of computer-aided corrosion management programs. The proposed method of assisting and detecting corrosion internal defects and defects data should be available. This software is easy to use without complicated analysis. It helps to reduce unplanned shutdowns in the oil and gas production industry.

III. METHODOLOGY

Modern CP techniques using to control pipeline corrosion can extend the life of the pipeline by using reliable maintenance methods. The cornerstone of corrosion control is corrosion data day -to -day basis. Monitoring this data must be applicable which leads to an effective corrosion program. This data includes pipeline description (diameter of pipe and pipe thickness, material pipe grade), product type, maximum operation pressure, operation temperature, soil specification, last inspection date, condition of coating and density of population, pipeline age, pressure in the pipeline, corrosion

DOI: 10.17148/IJIREEICE.2023.11406

specification depth, width and length. Control of corrosion means detection and assessment of the level of the corrosion. American Petroleum Institute API introduced effects assessment procedure includes identification of flows, damage mechanisms, the applicability of assessment procedures, data requirements, acceptance level, remaining life estimation, in-service monitoring, and certification results. The common corrosion damage parameters are corrosion type (pit, circumferential weld, spiral, groove), measured max corrosion depth and width, average corrosion rate, stand deviation, and spiral angle. Orazem decided that pitting defects are around ten percent of the underground pipeline wall thickness at eighty percent confidence. Depth of grooves and pits between minus twenty percent and Positive ten percent of pipeline wall thickness at eighty percent confidence. The scope of corrosion inspection in the pipeline includes the correct classification corrosion depth preliminary inspection level to decide whether a detailed assessment is needed. The evaluation vital shape identified major measured feature of specific defect dimensions such as (width, depth, and length) correctly, identified standardized safety and uncertainty elements, to check for uncertainties in the evaluation and thickness sizes. The objective of the CACM program is to identify the present status and future situations of each pipeline with deference to the reliability, at the same conditions.

1. Multi-Technique Pipeline Corrosion Monitoring

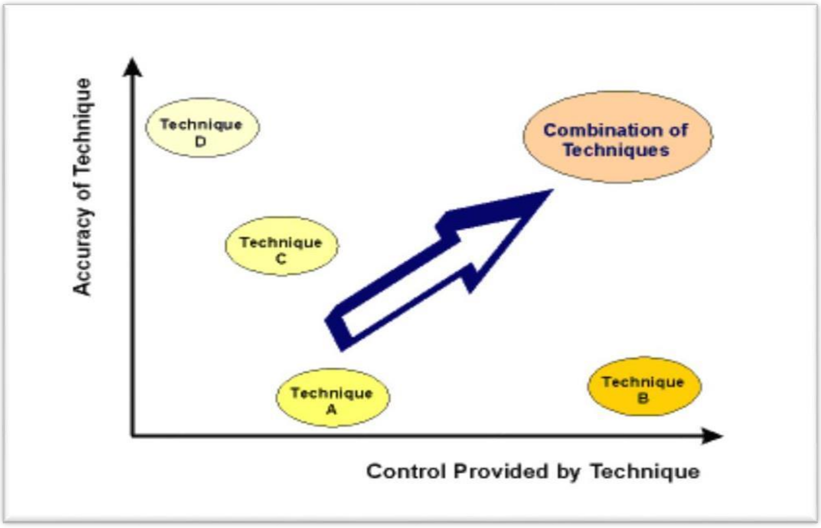
A multi-technique corrosion monitoring system combines two or more techniques to cover a wide base for data gathering and to provide accurate corrosion data as well as differentiate between localized and uniform corrosion. The approach overcomes the limitations of the individual monitoring techniques, and helps in identifying the various complex factors that often lead to corrosion failures again.The corrosion-related failures in pipelines cost billions of dollars in production losses, downtime, environmental contamination, injuries and fatalities. Most of these could be significantly reduced by employing continuous monitoring techniques as a component of comprehensive corrosion control programs.

2. Corrosion Monitoring and Corrosion Control

The monitoring enables the detection of changes in the rate of corrosion as well as the variations in corrosion behavior. This information enables timely remedial action to be applied and hence eliminate the corrosion-related failures. Using more than one type of monitoring system provides more accurate data that can reliably determine the corrosion rates as well as the effectiveness of the control and protection methods in place.

3. Why Consider a Multi – Technique Approach

Individual corrosion monitoring techniques used in isolation will only give an indication of one type of corrosion and may not show another form even if it exists. This can be misleading and may indicate that there is no corrosion when, in fact, another type of corrosion process is taking place. The multi-technique approach combines various complimentary technologies to provide maximum coverage and to overcome the limitations of relying solely on data from an individual technique. In addition, some of these additional techniques allow the systems to differentiate between general and localized corrosion processes. The data from such a combined system is more reliable in identifying a suitable inhibitor for the localized corrosion, thereby helping in the fight against corrosion and providing economic benefits to businesses and the users.



- Sensitivity
- Alloy system

IJIREEICE

ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

ISO 3297:2007 Certified ⁒ Impact Factor 8.021 ⁒ Vol. 11, Issue 4, April 2023

DOI: 10.17148/IJIREEICE.2023.11406

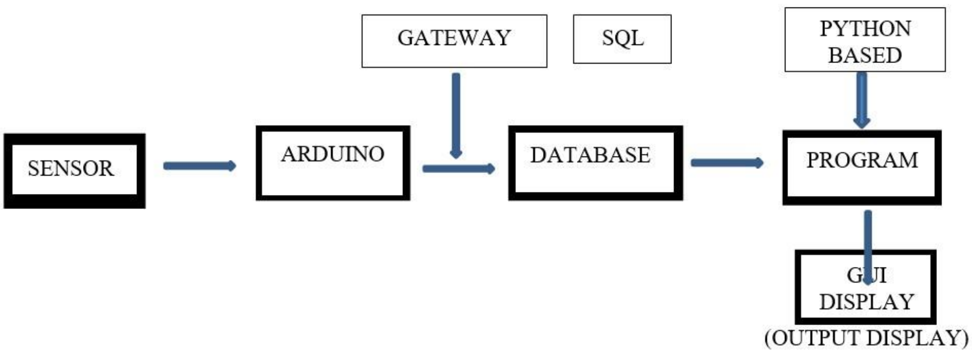
- Type of measurement
- Operating parameters
- Environment
- Media conductivity, i.e. linear polarization resistance (LPR) is only applicable in aqueous systems
- Degree of accuracy and control that the technique provides
- Speed of response:

4. Training Module

In this data testing module sensor is a device that detects the change in the environment and responds to some output on the other system. The sensor is usually the beginning of a measurement chain in the modern data acquisition system. The ease with which an Arduino can obtain sensor values is one of the features that makes it so useful.

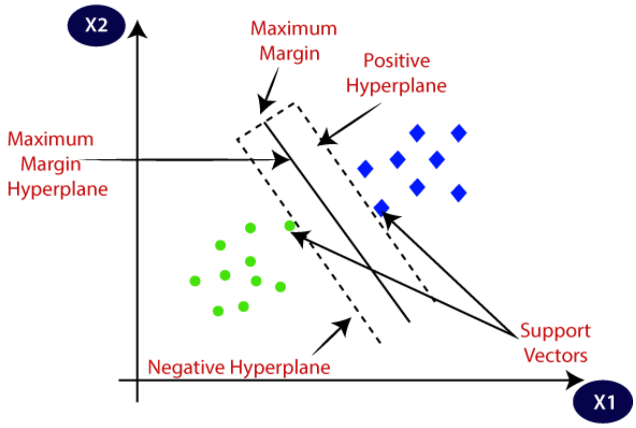
In this project, I have interfaced senor with Arduino and then I am sending data to sensor which is database. So here we are just reading the serial data coming from Arduino and then pushing to python based program, and the end output will display on a display screen.

FOR DATA TESTING



5. Support Vector Machine Algorithm

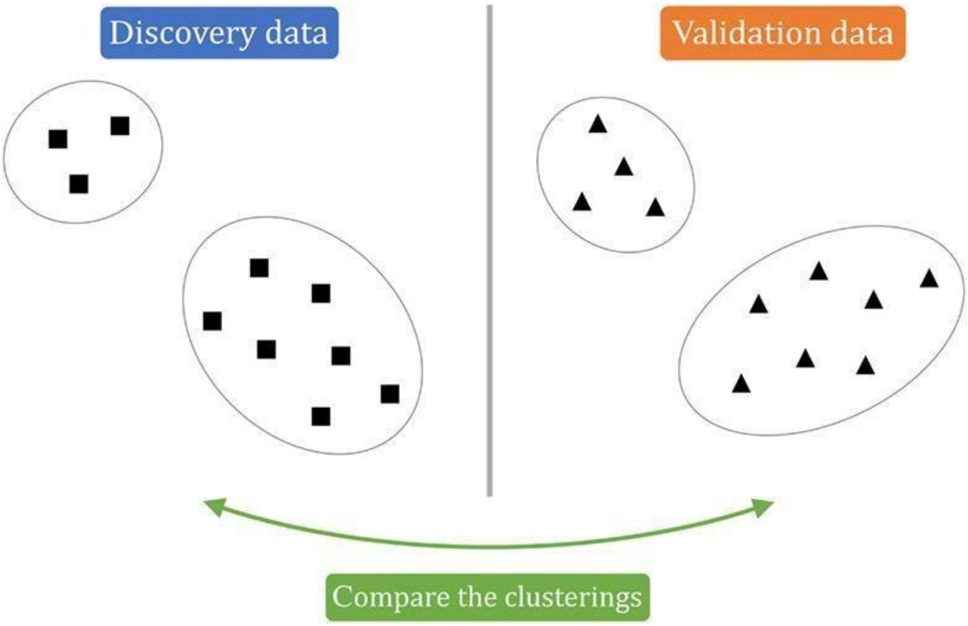
Support Vector Machine or SVM is one of the most popular Supervised Learning algorithms, which is used for Classification as well as Regression problems. However, primarily, it is used for Classification problems in Machine Learning. The goal of the SVM algorithm is to create the best line or decision boundary that can segregate n-dimensional space into classes so that we can easily put the new data point in the correct category in the future. This best decision boundary is called a hyperplane. SVM chooses the extreme points/vectors that help in creating the hyperplane. These extreme cases are called as support vectors, and hence algorithm is termed as Support Vector Machine. Consider the below diagram in which there are two different categories that are classified using a decision boundary or hyperplane:



International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering
ISO 3297:2007 Certified ⁜ Impact Factor 8.021 ⁜ Vol. 11, Issue 4, April 2023
DOI: 10.17148/IJIREEICE.2023.11406

6. Clustering

Cluster analysis refers to a wide range of data analytic techniques for class discovery and is popular in many application fields. To assess the quality of a clustering result, different cluster validation procedures have been proposed in the literature. While there is extensive work on classical validation techniques, such as internal and external validation, less attention has been given to validating and replicating a clustering result using a validation dataset. Such a dataset may be part of the original dataset, which is separated before analysis begins, or it could be an independently collected dataset. We present a systematic, structured review of the existing literature about this topic. For this purpose, we outline a formal framework that covers most existing approaches for validating clustering results on validation data. In particular, we review classical validation techniques such as internal and external validation, stability analysis, and visual validation, and show how they can be interpreted in terms of our framework. We define and formalize different types of validation of clustering results on a validation dataset, and give examples of how clustering studies from the applied literature that used a validation dataset can be seen as instances of our framework.



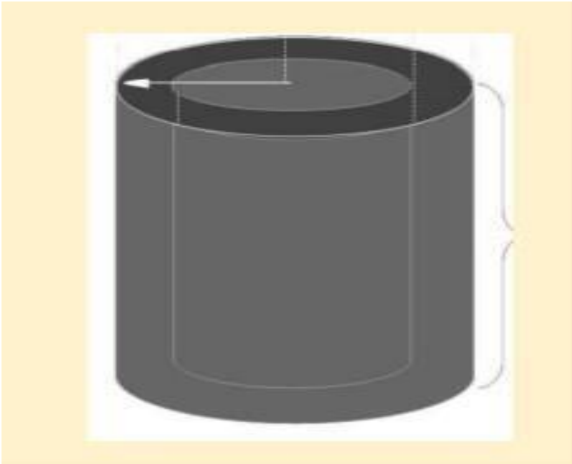
IV. CALCULATIONS

$$\text{Corrosion rate (LT)} = \frac{t_{initial} - t_{actual}}{\text{Times between } t_{initial} \text{ and } t_{actual} \text{ (years)}}$$

Where,

$t_{initial}$ = Thickness of Pipe before corrosion process
t_{actual} = Thickness of Pipe after corrosion process
$t_{initial}$ = Time period when corrosion process initiated
t_{actual} = Time period when corrosion going to measured

DOI: 10.17148/IJIREEICE.2023.11406



Here it is we are selected a Mild steel pipes for taking all data required for calculations. Here we are explaining each step of the calculation as per below.

V. CONCLUSION

Corrosion Detection system using AI and ML is design to solve the issues regarding the corrosion inside the pipes like pipes using for Water distribution, Boiler tube, Milk processing, Food industries, chemical plants etc. Because in this application human is not able to inspect corrosion without damaging the pipeline it so we try to give data to user regarding its application without cutting the line NDT (Non Destructive technology). The main pipelines corrosion monitoring device have been carried out; the studies confirmed the possibility of detecting local and extensive pipe defects, including the inside of a pipe, in a wide range of experimental conditions.

VI. REFERENCES

[1] H. Shafeek a,b , H.A. Soltan c , M.H. Abdel-Aziz, Chemical Engineering Department, Faculty of Engineering, Alexandria University, Alexandria, Egypt, Alexandria Engineering Journal (2021) 60, 5771–5778.

[2] Shree Minakshee K., Senior research fellow, Anna university, PARIPEX - INDIAN JOURNAL F RESEARCH | O Volume - 10 | Issue - 07 | 1 | PRINT ISSN No. 2250 – 1991.

[3] Xin Wei , Dongmei Fu , Mindong Chen , Wei Wu , Dequan Wu , Chao Liu, Data mining toeffect of key alloying elements on corrosion resistance of low alloy steels in Sanya seawater environment Alloying Elements, Journal of Materials Science & Technology Volume 64, 20 February 2021, Pages 222-232.

[4] Yupeng Diao , Luchun Yan , Kewei Gao, Improvement of the machine learning-based corrosion rate prediction model through the optimization of input features, Materials & Design Volume 198, 15 January 2021, 109326.

[5] Sahar Foorginezhad , Masoud Mohseni-Dargah , Khadijeh Firoozirad , Vahid Aryai , AmirRazmjou , Rouzbeh Abbassi , Vikram Garaniya , Amin Beheshti , Mohsen Asadnia, Recent Advances in Sensing and Assessment of Corrosion in Sewage Pipelines, Process Safety and Environmental Protection Volume 147, March 2021, Pages 192-213.

[6] Di Wang , Jialin Liu , Ru Jia , Wenwen Dou , Sith Kumseranee , Suchada Punpruk , Xiaogang Li , Tingyue Gu, Distinguishing two different microbiologically influenced corrosion (MIC) mechanisms using an electron mediator and hydrogen evolution detection, Corrosion Science Volume 177, December 2020, 108993.

[7] Hyundong Lee 1,2,*, Usman Rasheed 1,2 and Myeongsik Kong, A Study on the Comparison of Corrosion in Water Supply Pipes Due to Tap Water (TW) and Reclaimed Water (RW), Published: 17 April 2018.

[8] Safieh Almahmoud 1,†, Oleg Shiryayev 1,* ,† ID , Nader Vahdati 1,† and Paul Rostron," Detection of Internal Metal Loss in Steel Pipes and Storage Tanks via Magnetic-Based Fiber Optic Sensor", Published: 8 March 2018.

[9] Alexey Andrianov1, and Dmitry Spitsov1 1 Moscow State University of Civil Engineering, Yaroslavskoye shosse, 26, Moscow, 129337, Russia, "Corrosion of galvanized pipes in the hot water supply system" Article in MATEC Web of Conferences · January 2017.