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Poster [ ] Oral [X]
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Validation between the evaluation of corrosion inhibitors in the laboratory using LPR and EIS with results obtained from well monitoring.

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Extended Abstract

Introdution:

In laboratory, corrosion inhibitors were evaluated prior to their application in crude oil production wells under ASTM G 285-06 [1] and NACE 2D282 [2] standards by the Rotating Cylinder Electrode (RCE) method, with the use of Linear Polarization Resistance (LPR) and Electrochemical Impedance Spectroscopy (EIS).

Methodology:

The evaluation was developed as indicated in Figure 1 under turbulent flow conditions (1000 - rpm) in deaerated environments acidified with CO_2 or H_2S. The methodology applied was under ISO 17025 accreditation. Using the LPR technique, the corrosion rates of the inhibitors were determined; with the use of the EIS technique, the electrochemical behavior of the corrosion inhibitor on the metal surface was obtained.

Results:

The efficiency of 2 inhibitors (25 ppm) was determined with respect to their blanck, as shown in Figure 2. H_2S environment shows to be more harmful to the metal surface with respect to the CO_2 environment, inhibitor A demonstrated greater efficiency in the CO_2 environment and inhibitor B in the H_2S environment. For CO_2 environments during hour 18 h, the Nyquist diagram in figure 3 of inhibitor A with respect to the blank shows an increase in the resistance of the solution (RS), greater resistance to charge transfer (RCT) and the formation of a second time constant at high frequencies associated with diffusion processes, inhibitor B indicates an increase in RCT by hour 18, inhibitor A maintains a higher RCT compared to inhibitor B. For environments in H_2S during hour 1 in the Nyquist diagram of figure 4, inhibitor A with respect to the blank shows a reduction in the RS and greater RCT Inhibitor B indicates a significant increase in RS and diffusion processes at high frequencies. For hour 18, it was observed that inhibitor B showed greater diffusion than that shown by inhibitor A. This behavior is observed in the corrosion rates in the diagram in Figure 2. Based on the results obtained in the electrochemical test, the application of corrosion inhibitors to facilities was carried out. Figure 5 shows that of a total of 24 coupons, during the first quarter of evaluation, the corrosion rates obtained of just three wells where the inhibitor was not supplied were higher than 3 mpy.

Conclusions:

Electrochemical evaluations carried out in the laboratory under controlled conditions with norms and standards allowed increasing the probability of the correct performance of the injected chemical. The determination of the efficiency of the inhibitor chemical and the knowledge of its behavior on the metal surface allowed us to reduce the probability of failure during the application of the treatment.

[a] Master, Chemical Engineer – CORROSION Y PROTECCION
[b] PHD Mechanical Engineer - CORROSION Y PROTECCION
[c] PHD, Chemical Engineer - CORROSION Y PROTECCION

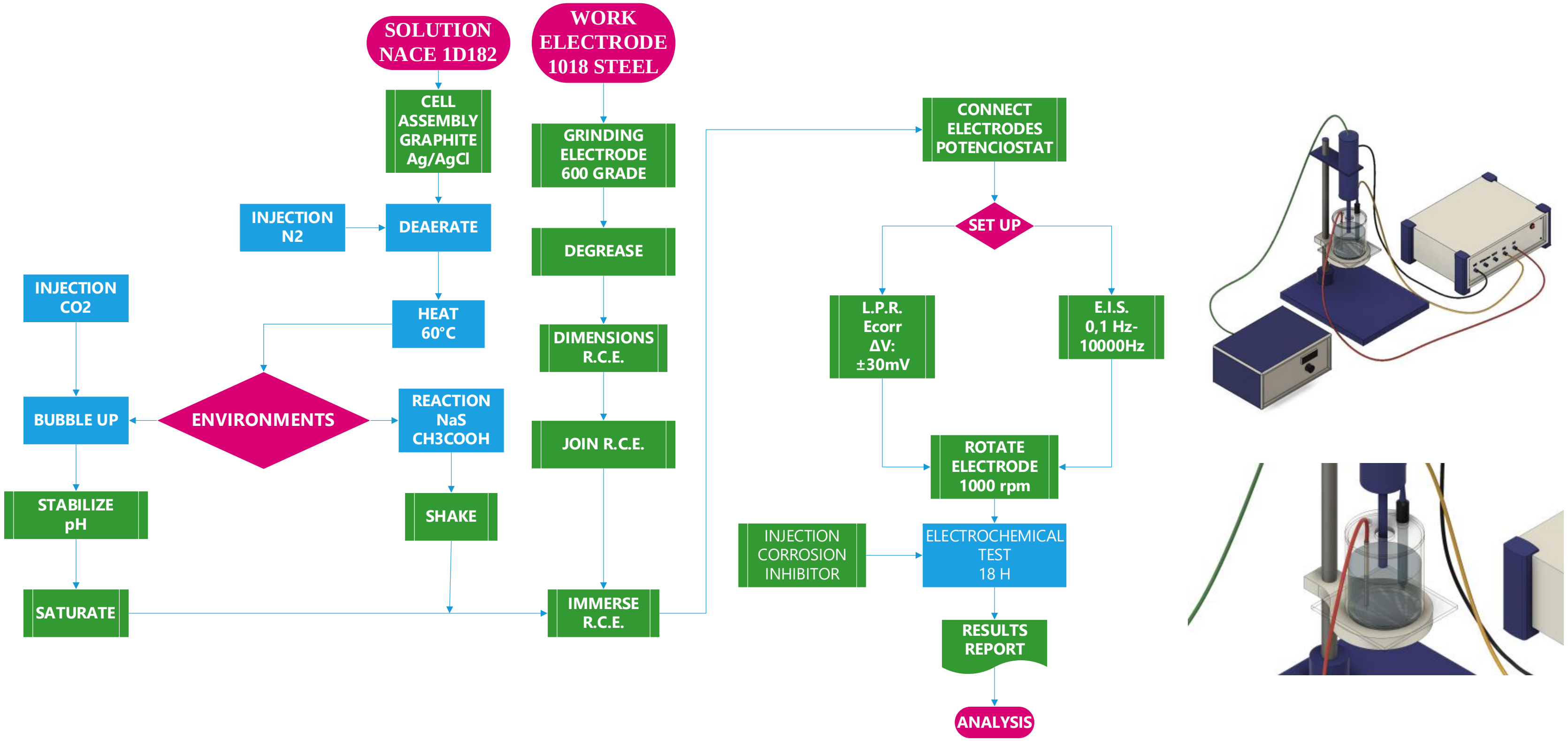

Figure 1 – Experimental development of the electrochemical test with R.C.E.

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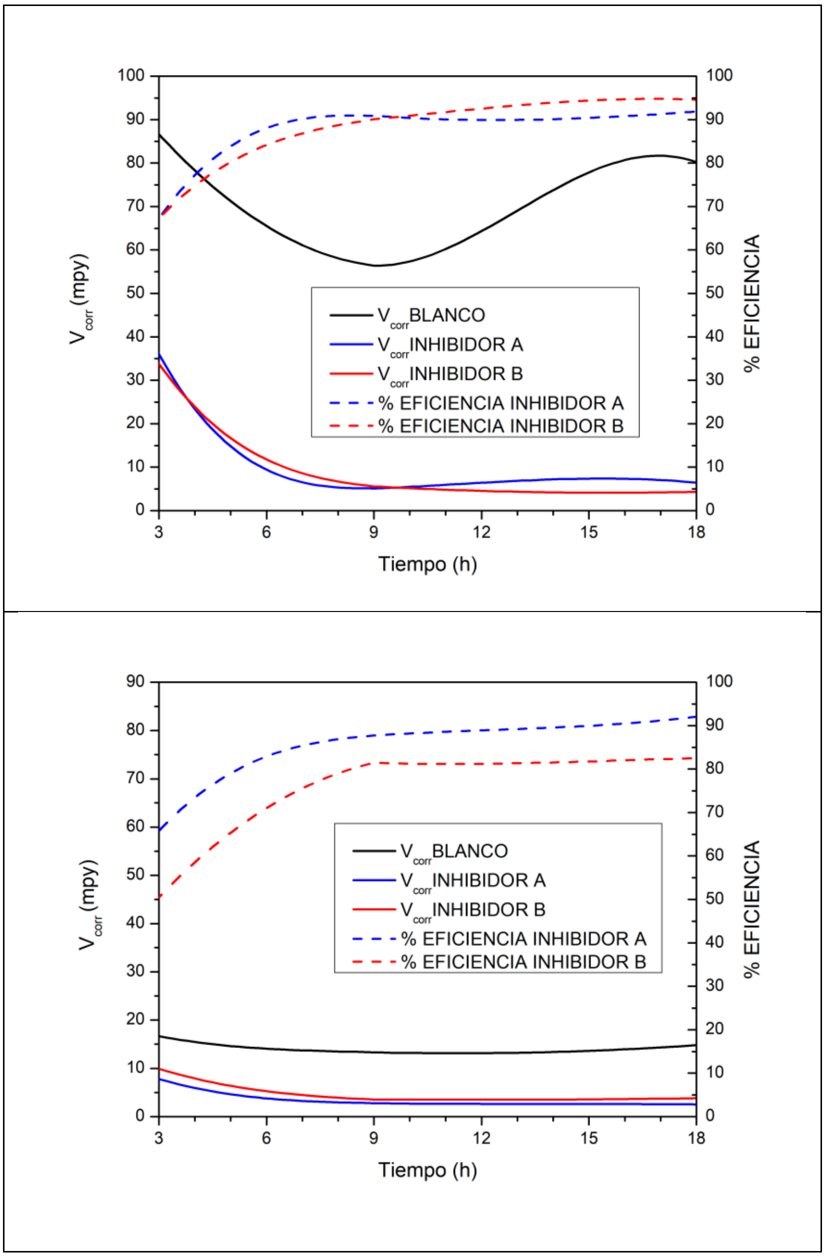

Figure 2 – Corrosion rate and efficiency over time for H_2S (upper) and CO_2 (lower) environments

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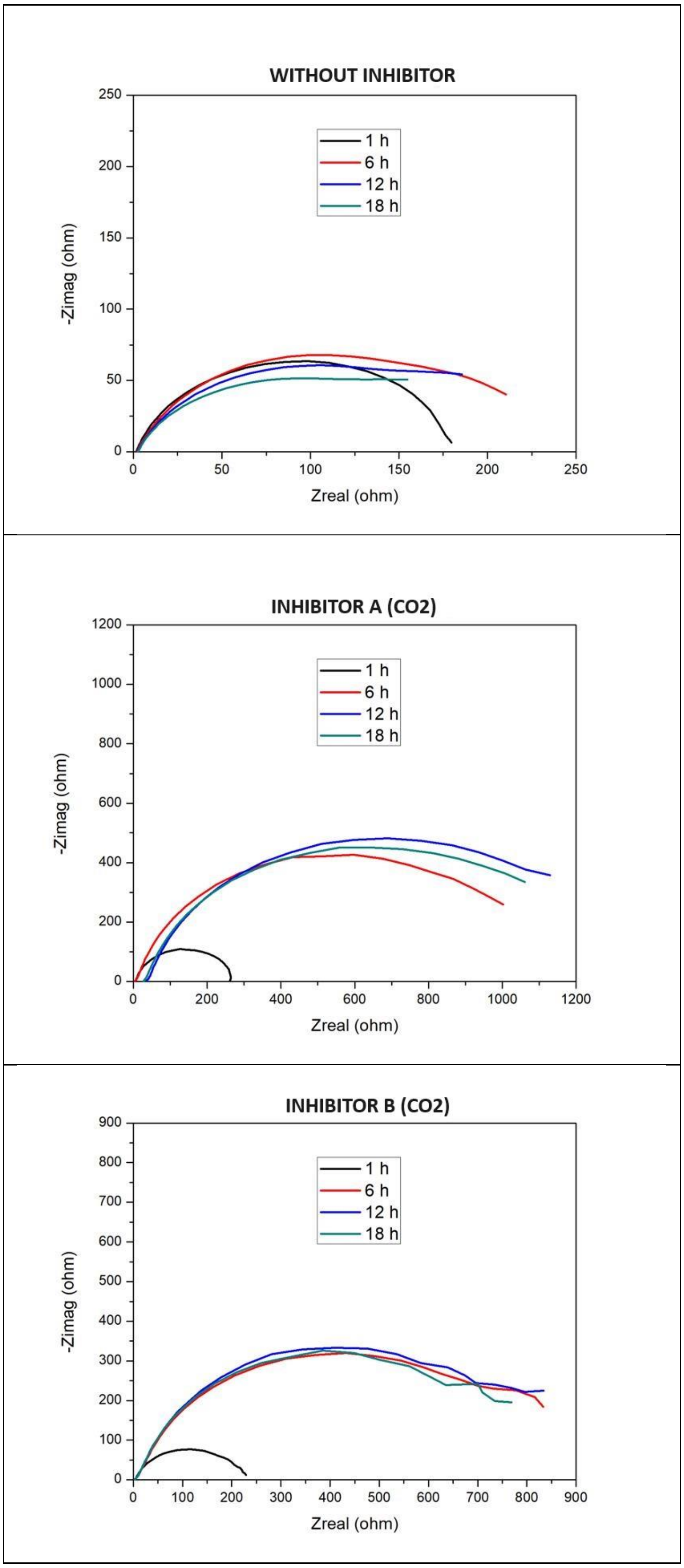

Figure 3 – Nyquist diagram of Blanck, inhibitor A and inhibitor B for CO_2 environments for 18 h.

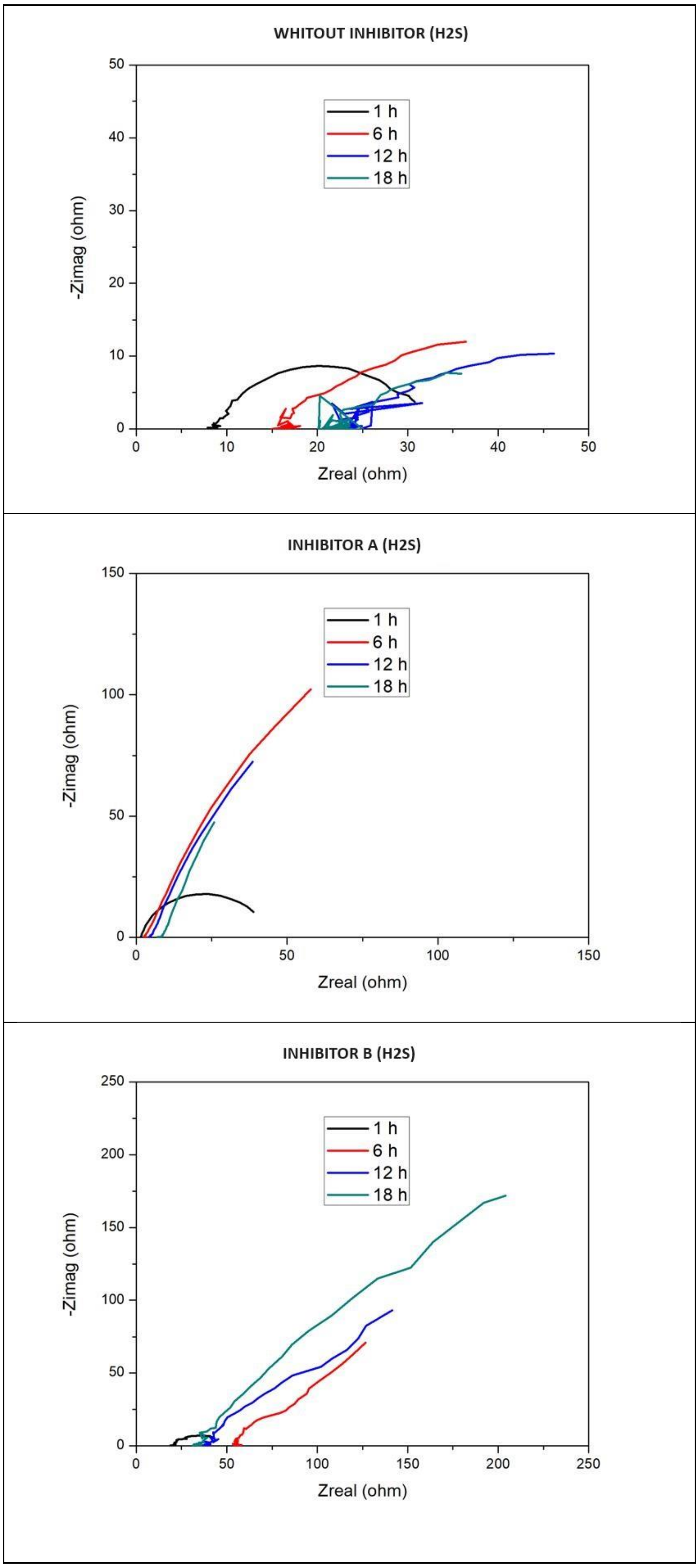

Figure 4 – Nyquist diagram of Blanck, inhibitor A and inhibitor B for H_2S environments for 18 h.

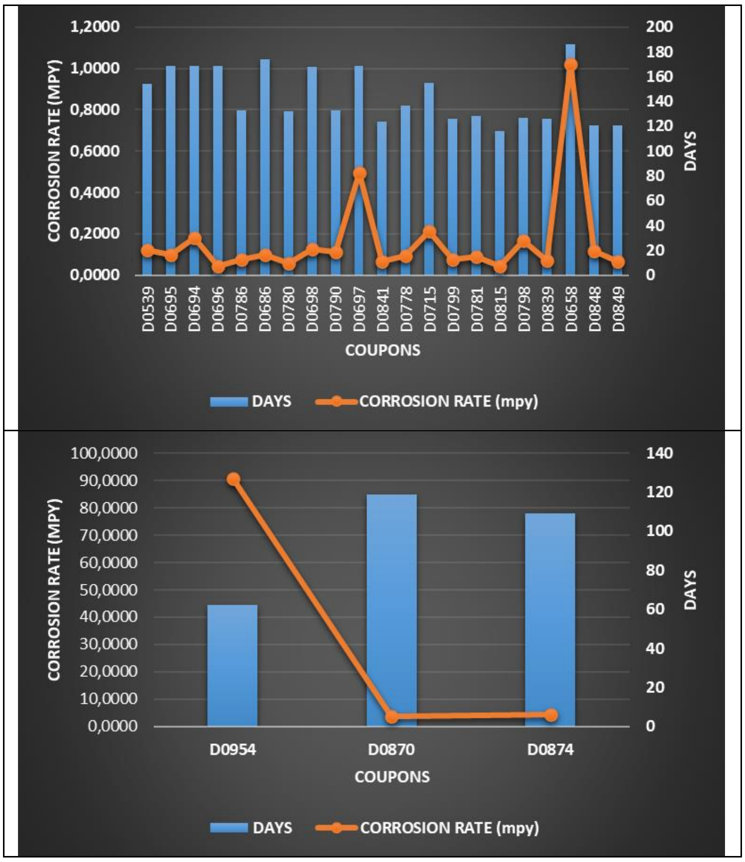

Figure 5 – Corrosion rate (mpy) and days of exposure of installed coupons for the first evaluation period. Wells with chemical injection (upper) and without chemical injection (lower).

Bibliographical references

1. Standard Practice for Evaluating and Qualifying Oil Field and Refinery Corrosion Inhibitors Using the Rotating Cylinder Electrode ASTM G285-06 (2020) E2.

2. Wheel Test Method Used for Evaluation of Film-Persistent Corrosion Inhibitors for Oilfield Applications NACE 2D282 (2027).