



CORROSION INHIBITORS FOR PIPELINES CARRYING OIL WELL WATER

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ABSTRACT

The corrosion resisting property of an aqueous extract of Brown Indian Hemp Leaves and Asafoetida in controlling corrosion of mild steel and SS316L alloy in presence of simulated oil well water has been evaluated by AC impedance Spectra. Corrosion parameters such as charge transfer resistance double layer capacitance and impedance value have been calculated. This study reveals that the two aqueous extracts have corrosion resisting property. It is observed that Asafoetida is more corrosion resistant than Brown Indian Hemp Leaves extract. Further it is found that SS316L is more corrosion resistant than mild steel. This finding will be useful in petroleum technology where oil well water is carried by pipelines made of mild steel and SS316L.

KEYWORDS: Oil well water, corrosion prevention, Green inhibitors, Electrochemical Studies, Brown Indian Hemp Leaves, Asafoetida.

INTRODUCTION

Corrosion is a common problem in petroleum industries. Corrosion of carbon steel in the presence of saline water from oil. Source wells is a common problem across many petroleum industries.^[1] Saline water from oil source wells contain corrosive species.

Such as chlorides and also high levels of dissolved solids.^[2-3] Corrosion is devised by inhibitors which are injected continuously or periodically depending on the well corrosivity. The corrosion inhibitor is one of the well known methods of corrosion protection and one of the most useful in the petroleum industry.^[4-6]

The mechanism of the corrosion inhibitor can occur by (a) adsorption on the surface of the metal and forms a protective thin film; (b) a formation of a protective film by oxide protection of the base metal; and (c) reacting with apotential corrosive component present in aqueous media and the product is a complex.^[7]

Unfortunately, most organic inhibitors are inherently toxic and potential health hazards, such as the carcinogenic effect of aromatic heterocyclic compounds on humans.^[8] The use of inorganic inhibitors as an alternative to organic compounds is based on the possibility of degradation of organic compounds with time and temperature.^[9] This tempted many researchers to investigate the feasibility of application of new

synthetics inorganic compounds (phosphites) as inhibitors in corrosive solution. A phosphite in inorganic chemistry is a salt of phosphorous acid. Historically, Phosphate has referred to salts containing HPO_3^{2-} .^[10] Also natural products can also be used as corrosion inhibitors. These extracts are non toxic and easily available. The present work in undertaken to investigate the corrosion resistance of mild steel in simulated oil well water in the absence and presence of aqueous extract of Brown Indian Hemp leaves and Asafoetida by AC impedance spectra.

MATERIALS AND METHODS

1. Simulated oil well water

Simulated oil well water was prepared by the following method. 3.5g of NaCl 0.305g of CaCl_2 and 0.186g of MgCl were dissolved in 100 ml of water. Just before the experiment, 0.067g of Sodium sulphide and 0.4ml of Con. HCl were added. Thus H_2S gas was generated (100 ppm of H_2S). Then AC impedance spectrum study was carried out with their solution.

2. Preparation of Extract

2.1 Brown Indian Hemp Leaves extract

Brown Indian Hemp Leaves were dried in the air shade. 100 g of the Brown Indian Hemp Leaves were boiled with DD water. The suspended impurities were removed. The extract was made upto 100 ml. This solution was used as inhibitor.

2.2 Asafoetida extract

1 g of Asafoetida power was added to 100 ml of oil well water.

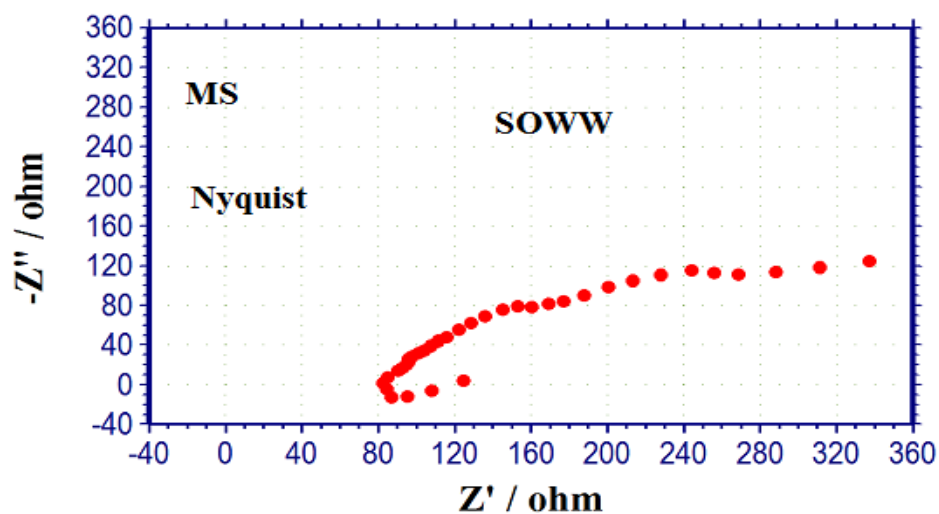


FIGURE 1: AC impedance spectra (Nyquist plot) of mild steel immersed in SOWW

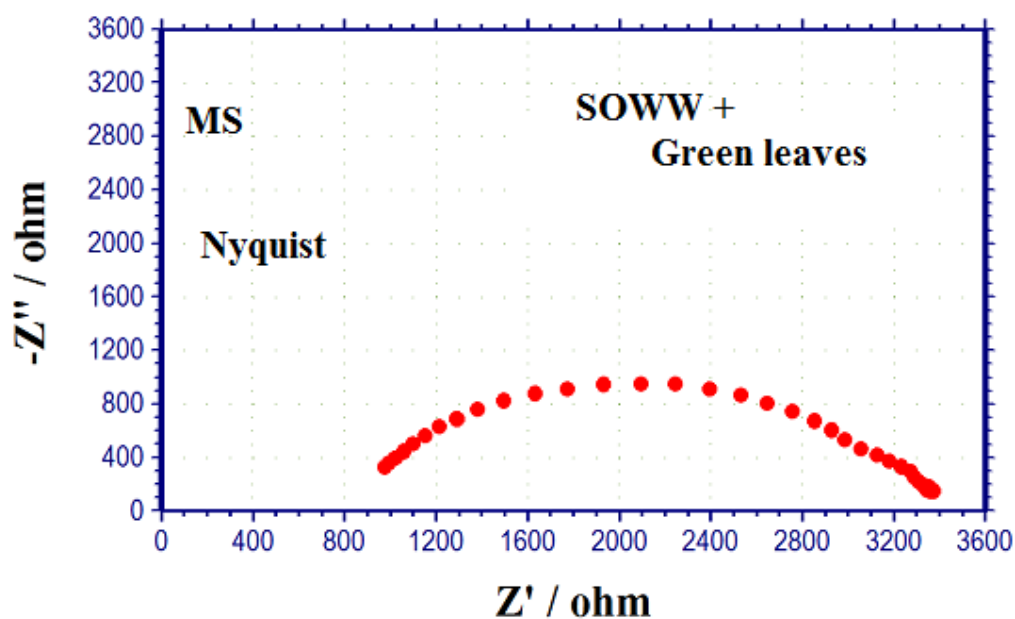


Figure 2: AC impedance spectrum (Nyquist plot) of mild steel immersed in Simulated oil well water and 20 ml of green extract.

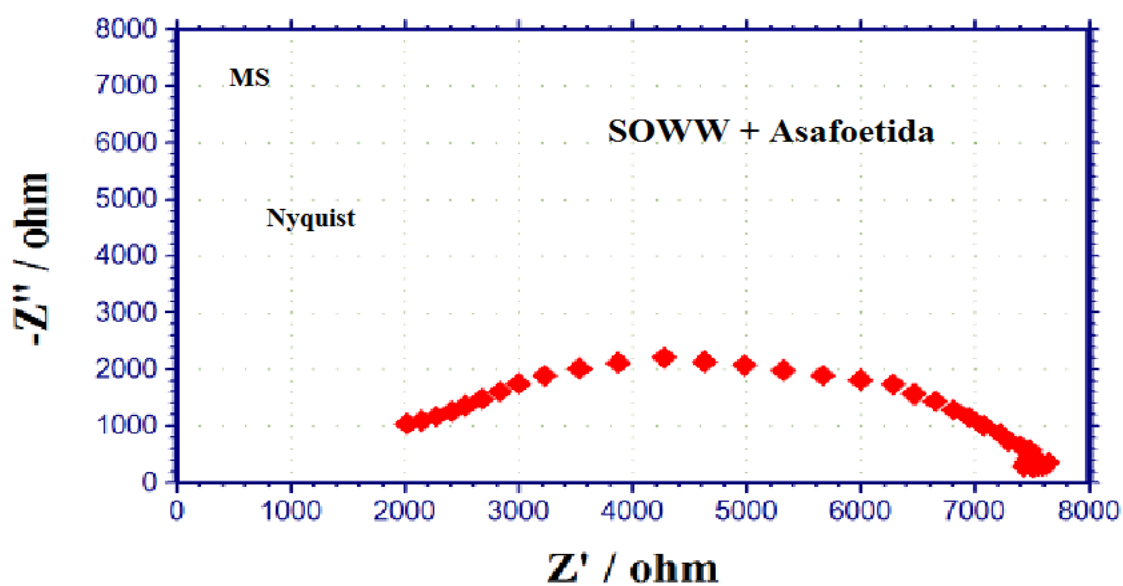


Figure 3: AC impedance spectrum of mild steel immersed in Simulated oil well water and Asafoetida extract.

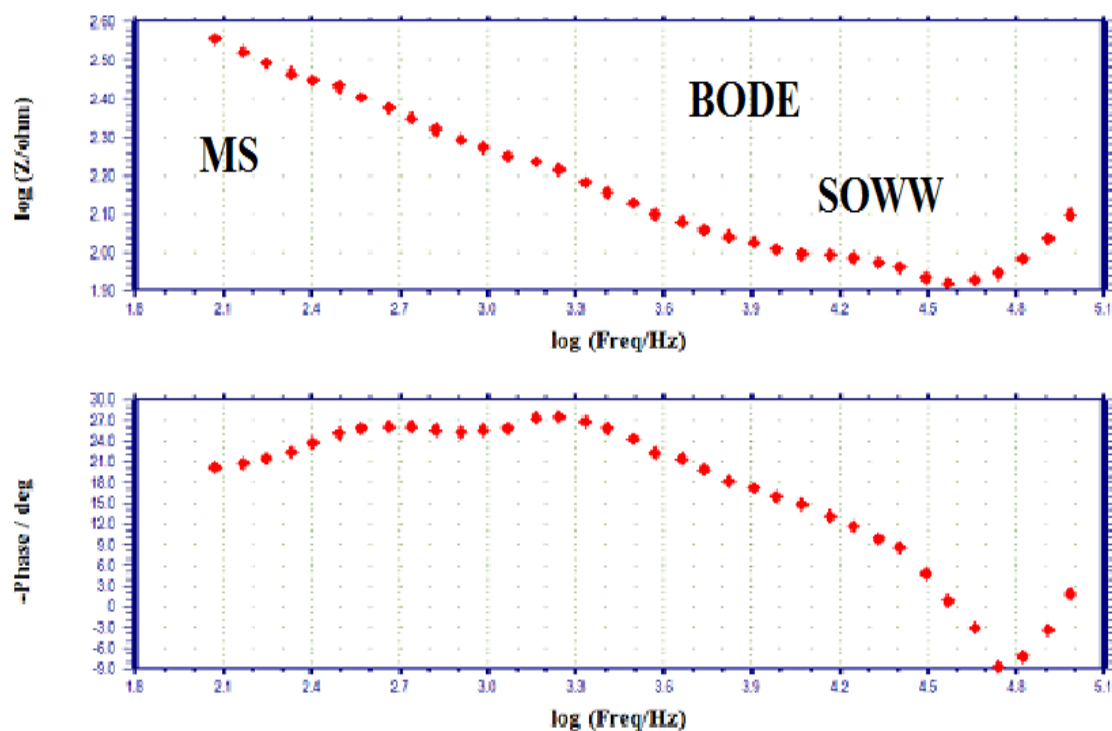


FIGURE 4: AC impedance spectrum of mild steel immersed in Simulated oil well water

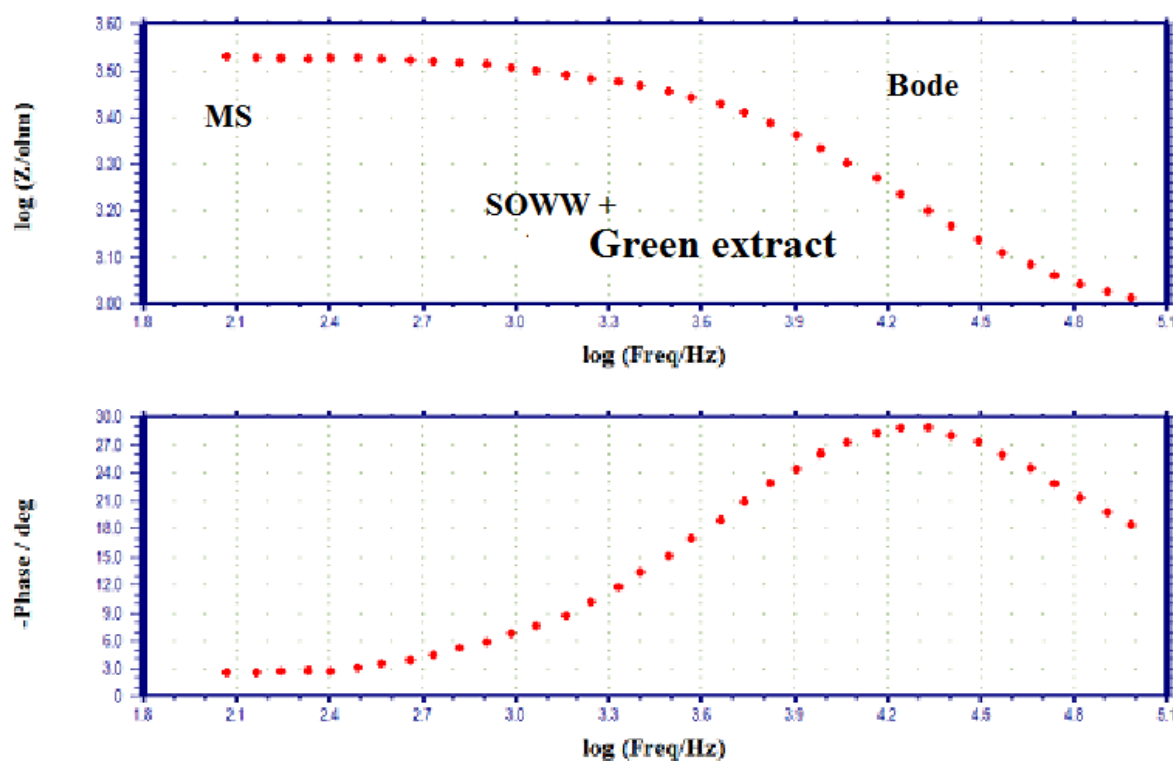


Figure 5: AC impedance spectrum of (Bode plot) mild steel immersed in SOWW and 20 ml of green extract.

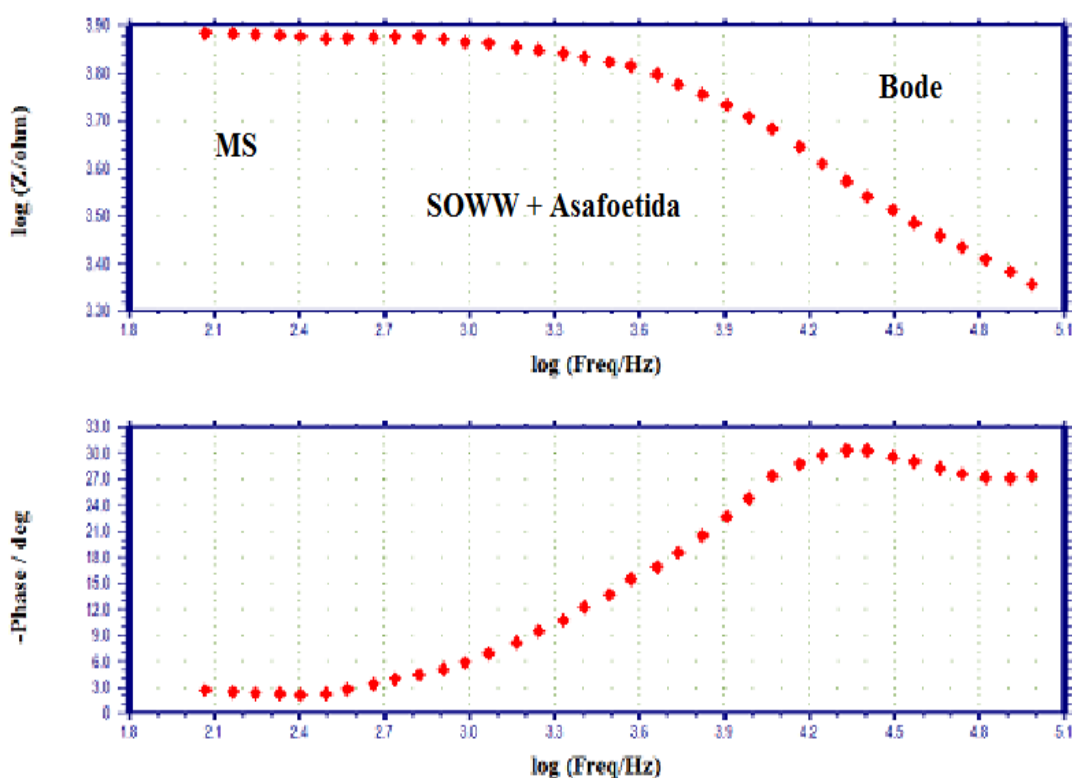


Figure 6: ac impedance spectrum of (bode plot) mild steel immersed in soww and asafetida extract.

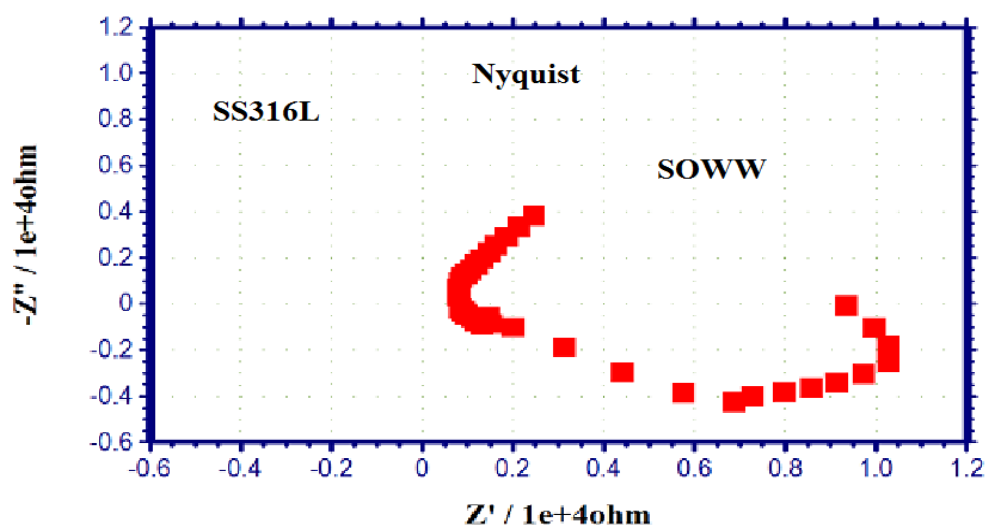


Figure 7: AC impedance spectrum (Nyquist plot) of SS316L immersed in SOWW.

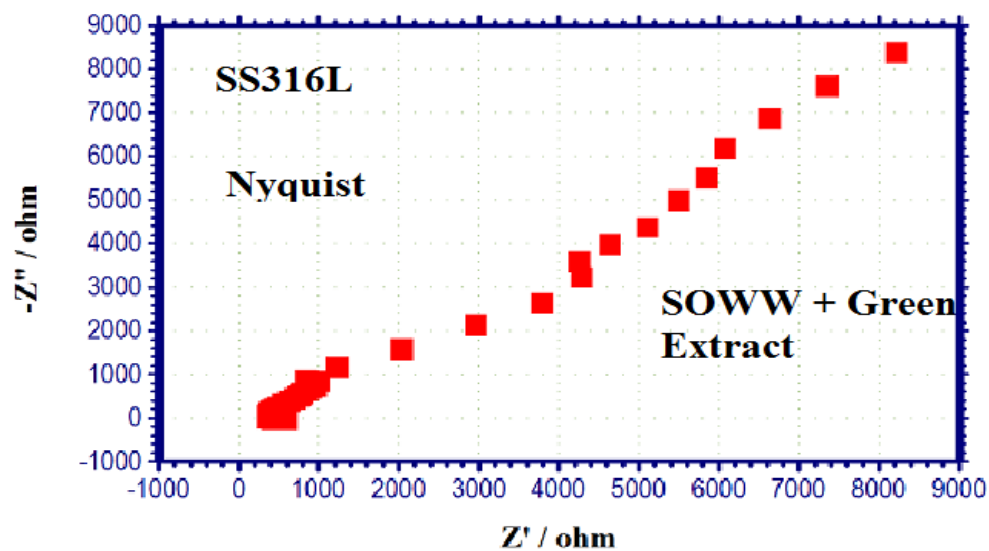


Figure 8: AC impedance spectrum (Nyquist plot) of SS316L immersed in SOWW and 20 ml of green extract.

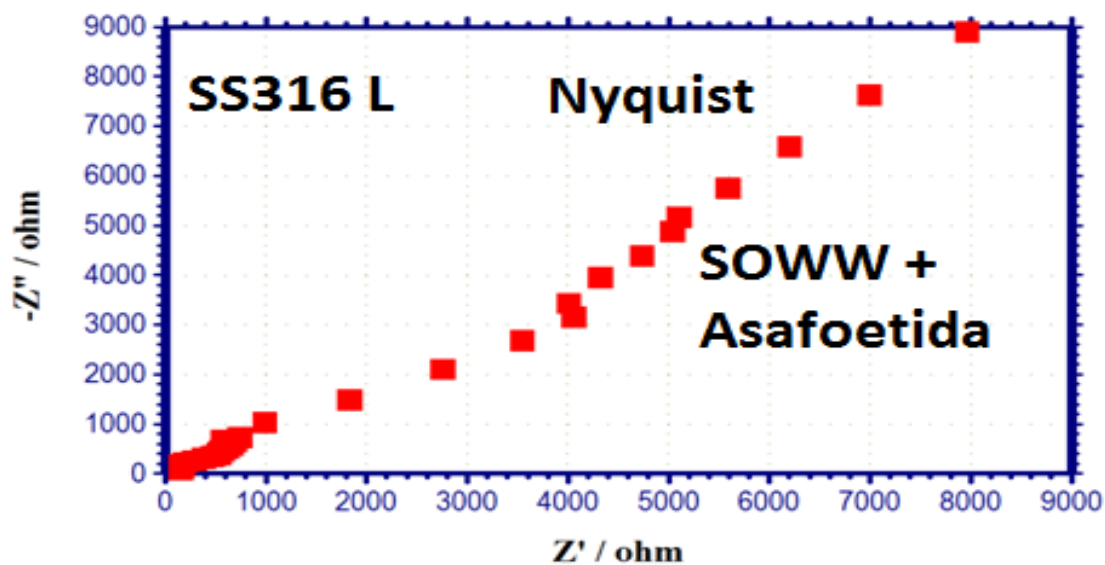


Figure 9: AC impedance spectrum (Nyquist plot) of SS316L immersed in SOWW and Asafoetida extract.

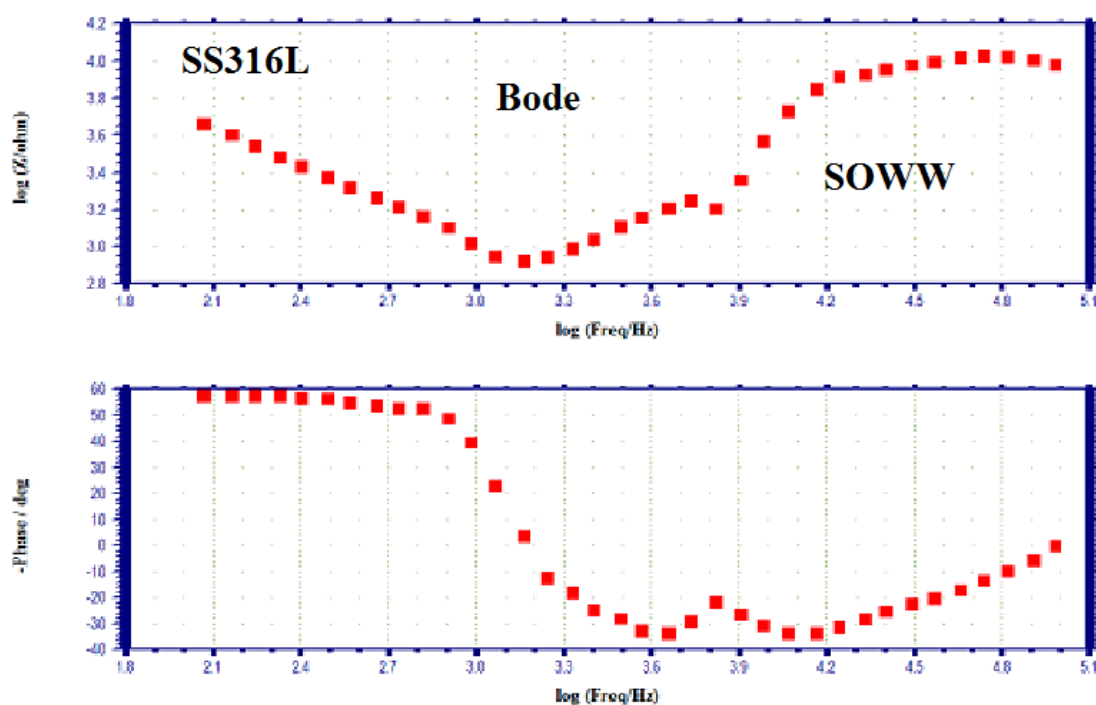


Figure 10: Ac Impedance Spectrum (Bode Plot) Of Ss316l Immersed In Soww.

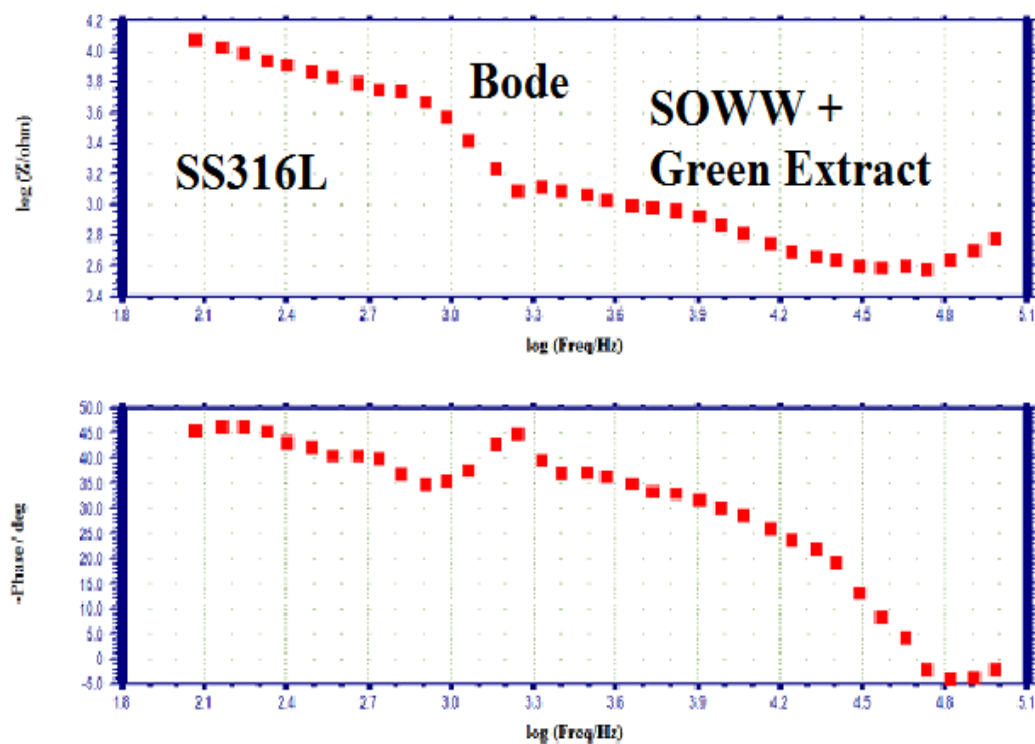


Figure 11: AC impedance spectrum (Bode plot) of SS316L immersed in SOWW and 20 ml of green extract.

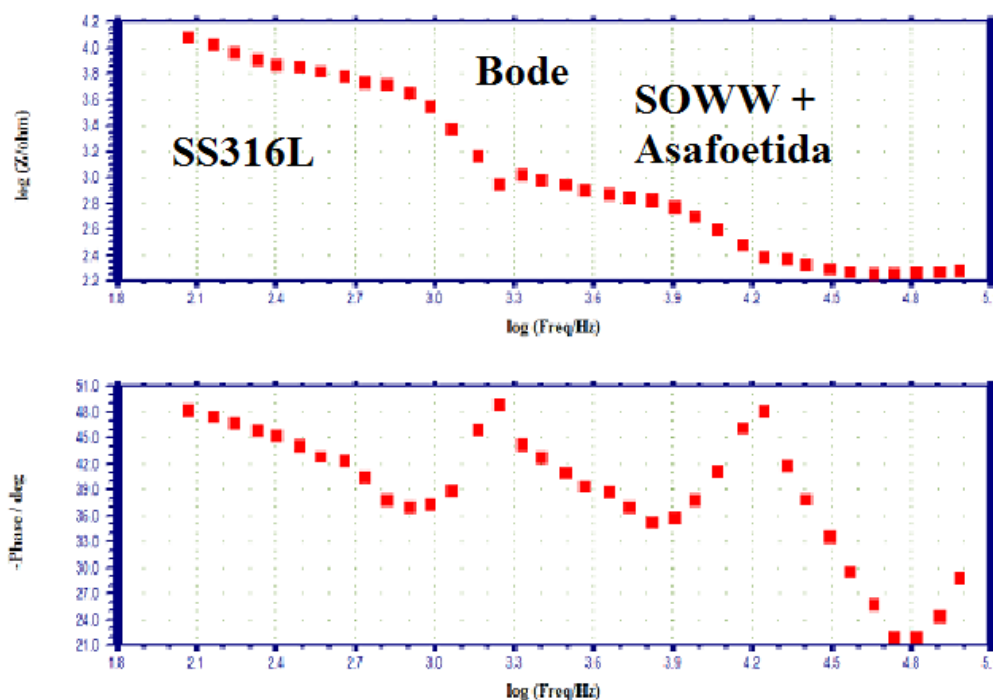


Figure 12: AC impedance spectrum (Bode plot) of SS316L immersed in SOWW and Asafoetida extract.

RESULTS AND DISCUSSION

The corrosion resistance of mild steel and SS316L alloy immersed in simulated oil well water (SOWW) in the absence and presence of corrosion inhibitors such as aqueous extract of Brown Indian Hemp Leaves (Green leaves) and Asafoetida powder has been evaluated by AC impedance spectra.

The AC impedance spectra are shown in Figures. The corrosion parameters such as charge transfer resistance (R_t) and double layer capacitance (C_{dl}) derived from Nyquist plots, and impedance value derived from Bode plots are given in Tables 1 and 2.

Tables 1: AC impedance parameters of mild steel immersed in various test solutions.

Systems	R_t Ohmcm ²	C_{dl} F/cm ²	Impedance Log (Z/ohm)
SOWW	253	201.84×10^{-10}	2.558
SOWW + Green leaves 20 ml	2389	21.34×10^{-10}	3.528
SOWW + Asafoetida (1g)	5494	9.282×10^{-10}	3.884

Mild Steel System

It is observed from Table 1 that when Green leaves extract is added to simulated oil well water, the corrosion resistance of mild steel increases. This is revealed by the fact, that when green leaves extract is added, R_t value increases, C_{dl} value decreases and impedance value increases.

Similarly, when Asafoetida extract is added, the corrosion resistance of mild steel increases. This is revealed by the fact, that when green leaves extract is

added, R_t value increases, C_{dl} value decreases and impedance value increases.

Thus, it is inferred from AC impedance spectra that in presence of Green leaves extract and Asafoetida extract the corrosion resistance of mild steel in simulated oil well water increases.

It is also inferred that Asafoetida offers better corrosion inhibition than green leaves to mild steel as revealed by the fact that for Asafoetida system, the R_t value is higher than that of green leaves system.

Table 2: AC impedance parameters of SS316L immersed in various test solutions.

Systems	R_t Ohmcm ²	C_{dl} F/cm ²	Impedance log(Z/ohm)
SOWW	6965	7.3223×10^{-10}	3.656
SOWW+ Green leaves (20 ml)	7590	6.7191×10^{-10}	4.074
SOWW+ Asafoetida (1g)	7879	6.4729×10^{-10}	4.081

SS316L System

It is observed from Table 2 that when green leaves extract is added to simulated oil well water, the corrosion resistance of mild steel increases. This is revealed by the fact, that when green leaves extract is added, R_t value increases, C_{dl} value decreases and impedance value increases.

Similarly, when Asafoetida extract is added, the corrosion resistance of SS316L increases. This is revealed by the fact, that when green leaves extract is added, R_t value increases, C_{dl} value decreases and impedance value increases.

Thus, it is inferred from AC impedance spectra that in presence of green leaves extract and Asafoetida extract the corrosion resistance of SS316L in simulated oil well water increases.

It is also inferred that Asafoetida offers better corrosion inhibition than green leaves to SS316L as revealed by the fact that for Asafoetida system, the R_t value is higher than that of green leaves system.

CONCLUSION

The corrosion resistance of mild steel and SS316L alloy immersed in simulated oil well water (SOWW) in the absence and presence of corrosion inhibitors such as aqueous extract of Brown Indian Hemp Leaves (Green leaves) and Asafoetida powder has been evaluated by AC impedance spectra.

It is observed that both green leaves extract and Asafoetida extract offer corrosion protection to mild steel and SS316L in simulated oil well water.

SS316L offer better corrosion inhibition than mild steel. This finding will be useful in petroleum industry.

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