



INFLUENCE OF BERMUDA GRASS EXTRACT ON CORROSION RESISTANCE OF SS 316L ALLOY AND SS 18/8 ALLOY IN PRESENCE OF ARTIFICIAL SALIVA

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ABSTRACT

The corrosion resistance of SS 316L alloy and SS 18/8 alloy in artificial saliva, in the absence and presence of Bermuda grass extract has been investigated by impedance study. Corrosion parameters such as charge transfer resistance (R_t), double layer capacitance (C_{dl}) and impedance values have been calculated, from the Nyquist and Bode plots. It is observed that for SS 316L system, the corrosion resistance increases in the presence of Bermuda grass juice extract. So people implanted with orthodontic wire made of SS 316L alloy need not hesitate to take Bermuda grass juice orally. It is also observed for SS 18/8 system, the corrosion resistance decreases in the presence of Bermuda grass juice extract. So people implanted with orthodontic wire made of SS 18/8 alloy should avoid taking Bermuda grass juice orally.

KEYWORDS: Artificial saliva, corrosion resistance, Bermuda grass juice, SS 316L alloy, SS 18/8 alloy.

INTRODUCTION

To regulate the growth of teeth, dentists make use of orthodontic wires made of different metals and alloys. For this purpose orthodontic wires made of several metals and alloys have been used. Vieira et al., have studied the tribo corrosion of Ti in artificial saliva (AS) in presence of citric acid and sodium nitrate.^[1] Mareci et al., have analysed the corrosion resistance of Ni-Co based alloy in AS.^[2] The influence of eugenol of the corrosion resistance of Ti in AS has been studied.^[3] Ziebowicz et al., have evaluated the corrosion resistance of commercial metallic or wires in simulated intra-oral environmental.^[4] Chenglong Liu et al., have studied the corrosion resistance of CrNi, NiTi, CuNiTi wires in AS.^[4] Corrosion behaviors of NiTi orthodontic brackets in AS has been investigated.^[5] Rajendran et al., have studied the corrosion behavior metals in AS in presence of spirulina powder.^[6] Corrosion behavior metals in AS in presence of D-glucose has been investigated.^[7] Corrosion behavior of SS316L in AS in presence of electoral has been studied by Rajendran et al.,^[8] The present work is undertaken to evaluate corrosion resistance of orthodontic wires made of SS 316 L alloy and SS 18/8 alloy in AS in the absence and presence of Bermuda grass extract by Impedance study.

Experimental

Orthodontic wires made of SS 316 L alloy and SS 18/8 alloy are used in the present study. The metal specimens were used as working electrode. They were immersed in Fusayamma Meyer artificial saliva whose composition is.^[8]

Table 1: Composition of Artificial Saliva.

S. No	Name	Wt/lit
1	KCl	0.4 g/l
2	NaCl	0.4 g/l
3	Urea	1 g/l
4	CaCl ₂ .H ₂ O	0.906 g/l
5	Na ₂ S.9H ₂ O	0.005 g/l
6	NaH ₂ PO ₄ .2H ₂ O	0.690 g/l

The pH of the solution was 6.5

Preparation of Bermuda Grass Extract

Bermuda grass was dried in the shade. 50gms of the grass was boiled with well water and the extract was made up to 100ml.

Impedance study

AC impedance studies were carried out in electrochemical impedance work station analyzer model CHI 660A. A three electrode cell assembly was used. The working electrode was SS 316 L alloy and SS 18/8 alloy. A saturated calomel electrode (SCE) was used as

the reference electrode and a rectangular platinum foil was used as the counter electrode.

AC impedance spectra were recorded after doing iR compensation. The real part (Z') and imaginary part (Z'') of the cell impedance were measured in ohms at various frequencies. The corrosion parameters such as charge transfer resistance (R_t) and the double layer capacitance (C_{dl}) were calculated. During AC impedance spectra were recorded the scan rate (V/s) was 0.005; Hold time at E_f (s) was zero and quite time (s) was 2. C_{dl} values were calculated.

RESULT AND DISCUSSION

3.1 Analysis of Impedance plots

Corrosion resistance of SS 316 L alloy and SS 18/8 alloy in Artificial Saliva in the absence and presence of

Bermuda grass extract has been evaluated by impedance study. When corrosion resistance increases, Charge transfer Resistance (R_t) and Impedance value increases; double layer capacitance (C_{dl}) value decreases for SS 316 L alloy in presence of Bermuda grass extract and Artificial Saliva. For SS 18/8 system the Charge transfer Resistance (R_t) and Impedance value decreases and the double layer capacitance value increases in presence of Bermuda grass extract and Artificial Saliva. [9-15]

SS 316 L alloy and SS 18/8 alloy

Corrosion resistance of SS 316 L alloy and SS 18/8 alloy immersed in various test solutions are shown in the figures. The corrosion parameters namely Charge transfer Resistance (R_t), double layer capacitance (C_{dl}) and impedance values are shown in table 2.

Table 2: Corrosion parameters of metals immersed in artificial saliva (AS) in the presence and absence of Bermuda grass extract obtained by Impedance study.

System	R_t ohm cm^2	C_{dl} F/ cm^2	Impedance Log (z/ohm)
SS 316 L + AS	6501	7.844×10^{-10}	4.041
SS 316 L + AS + Bermuda grass extract	14612	3.490×10^{-10}	4.340
SS 18/8 + AS	3869	1.318×10^{-9}	3.929
SS 18/8 + AS + Bermuda Grass extract	2233	2.283×10^{-9}	3.591

When SS 316 L alloy immersed in Artificial Saliva (AS), Charge transfer Resistance (R_t) value is 6501 ohm cm^2 . The double layer capacitance value is 7.844×10^{-10} F/ cm^2 . The impedance value is 4.041 (z/ohm). When SS 18/8 alloy immersed in Artificial Saliva (AS), Charge transfer Resistance (R_t) value is 3869 ohm cm^2 . The double layer capacitance value is 1.318×10^{-9} F/ cm^2 . The impedance value is 3.929 (z/ohm).

When SS 316 L alloy immersed in the system consisting of AS and Bermuda grass extract, the Charge transfer resistance value increases to 14612 ohm cm^2 , the double layer capacitance value decreases to 3.490×10^{-10} F/ cm^2 . The impedance value increases to 4.340 (z/ohm). This indicates the SS 316 L alloy is more corrosion resistant in AS + Bermuda grass extract system than in AS system.

When SS 18/8 alloy immersed in the system consisting of AS and Bermuda grass extract, the Charge transfer resistance value decreases to 2233 ohm cm^2 , the double layer capacitance value increases to 2.283×10^{-9} F/ cm^2 . The impedance value decreases to 3.591 (z/ohm). This indicates the SS 18/8 alloy is less corrosion resistant in AS + Bermuda grass extract system than in AS system.

Thus the impedance study leads to the conclusion that SS 316 L alloy is more corrosion resistant than SS 18/8 alloy in presence of AS and Bermuda grass extract.

This study reveals that people having orthodontic wires made of SS 316 L alloy, can take Bermuda grass extract

orally without any hesitation. Because in this medium the corrosion resistance of SS 316 L alloy increases.

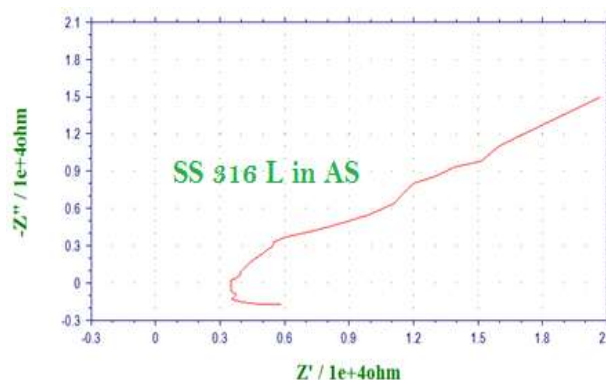


Fig. 1: Nyquist plot of SS 316 L alloy immersed in AS.

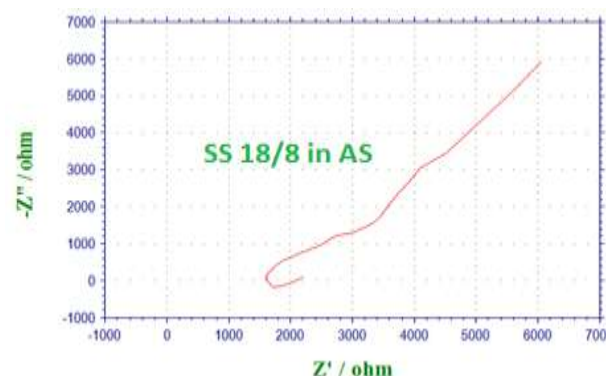


Fig. 2: Nyquist plot of SS 18/8 alloy immersed in AS.



Fig. 3: Nyquist plot of SS 316 L alloy immersed in AS + Bermuda grass extract.

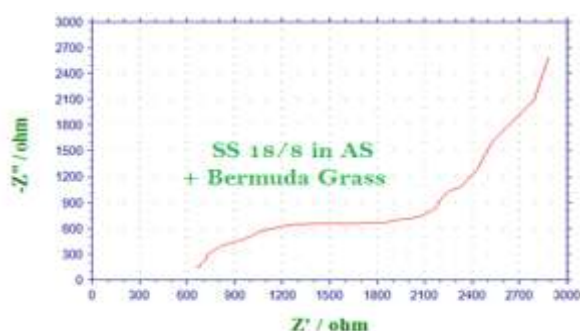


Fig. 4: Nyquist plot of SS 18/8 alloy immersed in AS + Bermuda grass extract.



CONCLUSION

- Corrosion resistance of SS 316 L alloy and SS 18/8 alloy in artificial saliva (AS) in the absence and presence of Bermuda grass extract has been investigated by electrochemical study namely, impedance study.
- This study reveals that people having orthodontic wires made of SS 316 L alloy, can take Bermuda grass extract orally without any hesitation. Because in this medium the corrosion resistance of SS 316 L alloy increases.
- But the people having orthodontic wires made of SS 18/8 alloy, should avoid taking Bermuda grass extract orally. Because in this medium the corrosion resistance of SS 18/8 alloy decreases.

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