Available online at www.derpharmachemica.com

ISSN 0975-413X
CODEN (USA): PCHHAX

Der Pharma Chemica, 2016, 8(19):334-337
(http://derpharmachemica.com/archive.html)

Corrosion resistance of SS 316 L alloy in artificial saliva in the presence of a soft drink

M. Sangeetha[1], S. Rajendran[2], N. Pavazhanayagam[3], C. Sobiga[4] and P. Valentine Nancy[5]

[1]*Corrosion Research Centre, Department of Chemistry, RVS School of Engineering and Technology, Dindigul-624005, India*
[2]*Corrosion Research Centre, Department of Chemistry, St Antony's College of Arts and Science for Women, Dindigul -624005, India*
[3]*Government Higher Secondary School, P.chatrapatti, Odanchatram, Dindigu, India*
[4]*Department of Biomedical Engineering, RVS School of Engineering and Technology, Dindigul – 624005, India*
[5]*Department of Agricultural Engineering, RVS School of Engineering and Technology, Dindigul – 624005, India*

ABSTRACT

Corrosion resistance of orthodontic wires made of SS 316 L alloy in artificial saliva in the absence and presence of a soft drink namely sprite has been evaluated by polarisation study, when corrosion resistance increases, the linear polarisation resistance value increases and the corrosion current value decreases, the present study reveals that; the corrosion resistance of SS 316 L alloy decreases in the following order; sprite only > sprite + Artificial saliva > Artificial saliva. It is concluded that people who have been implanted with orthodontic wires made of SS 316 L alloy need not dither to take the soft drink sprite orally.

Keywords: Orthodontic wires, SS 316 L alloy, Corrosion resistance, Soft drink, Polarisation study

---

INTRODUCTION

Corrosion of metallic implants is of vital importance, because it can adversely affect the mechanical integrity and bio-compatibility of implants. Many metals and alloys have been used in dentistry as orthodontic wires. Their corrosion behavior in artificial saliva has been investigated by several researchers. The corrosion resistance of SS 316 L in artificial saliva in presence of a Tablet Ciprofloxacin Hydrochloride IP has been evaluated by polarization study and AC impedance spectra by Mohamed Kasim Sheit et al., [1]. Rajendran et al., have evaluated the corrosion resistance of three metals namely, SS 316L, mild steel (MS) and mild steel coated with zinc (MS-Zn) in artificial saliva in the absence and presence of spirulina. The order of corrosion resistance of metals in artificial saliva, was SS 316L > MS > MS-Zn [2]. Impact of modified acidic soft drinks on enamel erosion was studied by T Attin et al., [3] H. Devlin et al., have determined the rate of change in indentation hardness of enamel in permanent teeth exposed to Coca-Cola® [4]. Two types of gold alloys and one type of pure titanium have been submitted to corrosion in artificial saliva for periods of up to about 2 months have been investigated by Dag Brune et al ., [5] The present work is undertaken to investigate the corrosion resistance of orthodontic wire made of SS 316 L alloy in artificial saliva in the absence and presence of soft drink (sprite).

MATERIALS AND METHODS

Preparation of Artificial saliva solution

Artificial saliva is prepared in laboratory and the composition of artificial saliva is as follows: KCl - 0.4 g/lit, NaCl - 0.4 g/lit, $CaCl_2.2H_2O$ - 0.906 g/lit, $NaH_2PO_4.2H_2O$ - 0.690 g/lit, $Na_2S.9H_2O$ -0.005 g/lit, Urea – 1 g/lit.

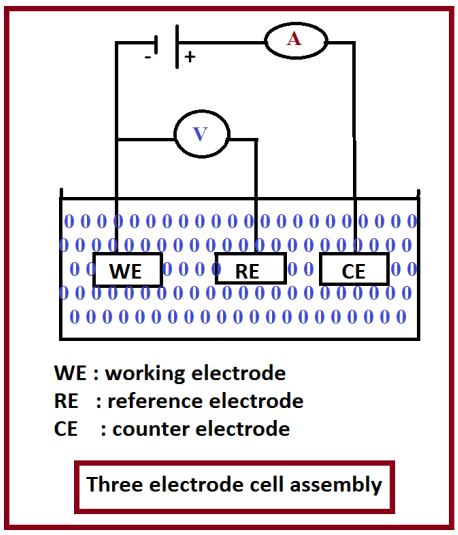
The composition of sprite is given in Table:1

Table : 1 Composition of sprite

NUTRITION INFORMATION			
Per	100ml	330ml	RI(%*)
Energy	117kJ/28kcal	386kJ/92kcal	5
Fat	0g	0g	0
of which saturates	0g	0g	0
Carbohydrate	6.6g	22g	8
of which sugars	6.6g	22g	24
Protein	0g	0g	0
Salt	0g	0g	0

Potentiodynamic Polarization

Polarization studies were carried out in a CHI- electrochemical work station with impedance model 660A. It was provided with iR compensation facility. A three electrode cell assembly was used is shown in scheme 1. The working electrode was carbon steel. A SCE was the reference electrode. Platinum was the counter electrode. From polarisation study, corrosion parameters such as corrosion potential (E_{corr}), corrosion current (I_{corr}), Tafel slopes anodic = b_a and cathodic = b_c were calculated and polarization study was done. The scan rate (V/S) was 0.01. Hold time at (Efcs) was zero and quiet time (s) was two.



Scheme 1: Three electrode cell assembly

RESULTS AND DISCUSSION

Electrochemical studies such as polarization study have been used to confirm the formation of protective film formed on the metal surface during corrosion inhibition process [6-13]. If a protective film is formed on the metal surface, the corrosion current value (I_{corr}) decreases.

The potentiodynamic polarization curves of **SS 316 L alloy** immersed in Artificial Saliva (AS) in the absence and presence of soft drink, obtained from polarization study are shown in Fig-1.The corrosion parameters , namely, corrosion potential (Ecorr mV vs SCE), Tafel slopes (bc mV/decade; ba mV/decade) , linear polarization resistance(LPR ohm cm^2), and corrosion current (Icorr A/cm^2) values are given in Table 2.

Table 2: Corrosion parameters of SS 316 L alloy immersed in Artificial Saliva (AS) in the absence and presence of soft drink (sprite), obtained from polarization study

System	E_{corr} mV $_{SCE}$	b_c mV/ decade	b_a mV/ decade	LPR ohm cm^2	I_{corr} A/cm^2
AS	-427	204	273	1341401	3.783×10^{-8}
Sprite only	-528	145	312	1875739	2.290×10^{-8}
AS + Sprite	-537	141	248	1534702	2.552×10^{-8}

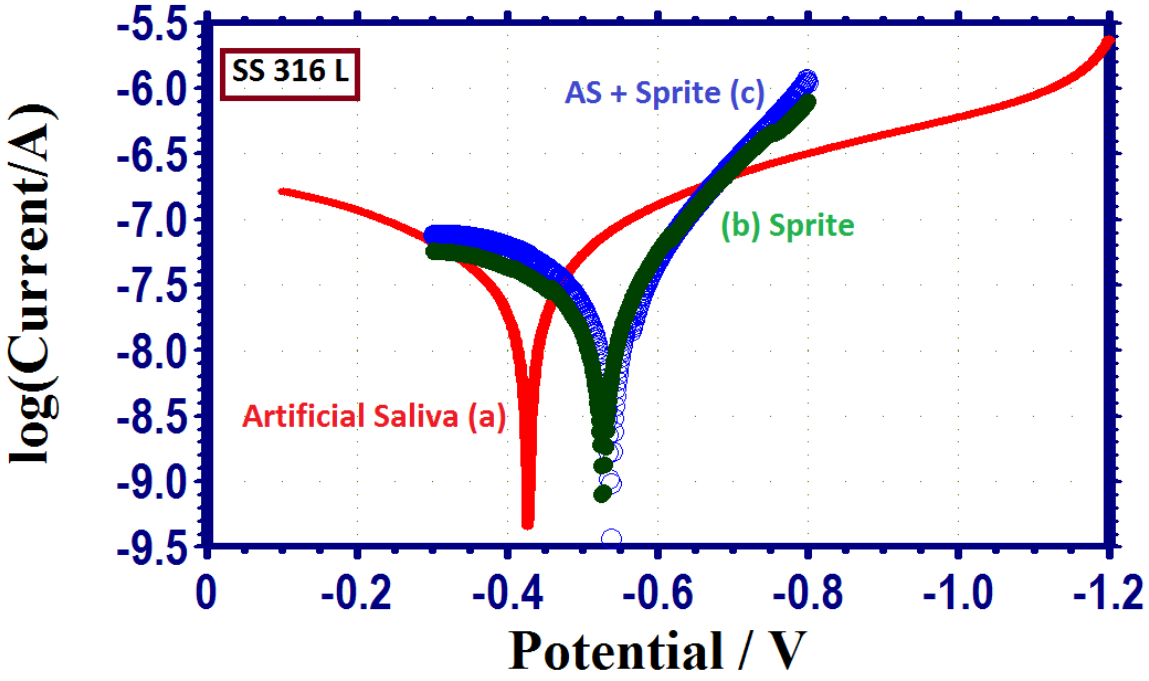


Fig 1: Polarisation curves of SS 18/8 alloy immersed in Artificial Saliva (AS) in the absence and presence of Tablet : (a) Artificial Saliva (AS) ; (b) Sprite only ; (c) AS + Sprite

When SS 316 L is immersed in artificial saliva the corrosion potential is -427 mV $_{SCE}$ corrosion current is 3.783 x 10^{-8} A/cm^2. Linear polarisation value is 1341401 ohm cm^2. SS 316 L is immersed in sprite only the corrosion potential -528 mV $_{SCE}$ corrosion potential sifted to the cathodic side that is the cathodic reaction is controlled predominantly. Corrosion current decreases from 3.783 x 10^{-8} to 2.290 x 10^{-8} and linear polarisation value is increased from 1341401 to 1875739 ohm cm^2.this indicates that SS 316 L alloy has more corrosion resistant in sprite than in artificial saliva when SS 316 L is immersed in AS + sprite corrosion resistance increases compared to artificial saliva only, however this corrosion resistance is lower than that in sprite only. This is may be due to presence of chloride ions present in artificial saliva

CONCLUSION

The present study reveals that; the corrosion resistance of SS 316 L alloy decreases in the following order; sprite only > sprite + Artificial saliva > Artificial saliva. It is concluded that people who have been implanted with orthodontic wires made of SS 316 L alloy need not dither to take the soft drink sprite orally.

REFERENCES

[1] H.Mohamed Kasim Sheit , Susai Rajendran , M.Seeni Mubarak , A Anandan and D. Renita , *Int J Nano Corr Sci and Engg.* **2016**, 3,1-18.
[2] S. Rajendran, J. Paulraj, P. Rengan, J. Jeyasundari and M. Manivannan , *Journal of Dentistry And Oral Hygiene*. **2009**, 1, 1-8.
[3] T Attin, K Weiss, K Becker, W Buchalla, and A Wiegand.*Oral diseases.* **2005**, 11, 7–12.
[4] H. Devlin, M. A. Bassiouny, D. Boston . *Journal of oral rehabilitation.* **2006**, 33, 26–30.
[5] Dag Brune, Dag Evje and Sigurd Melsom . *European Journal of Oral Sciences.* **1982**, 90, 168–171.
[6] R.Epshiba, A.Peter Pascal Regis and S.Rajendran, *Int. J. Nano. Corr. Sci. Engg.* **2014**, 1, 1-11.
[7] N. Kavitha and P. Manjula , *Int. J. Nano. Corr. Sci. Engg.* **2014**, 1, 31-38.
[8] R. Nagalakshmi , L. Nagarajan , R.Joseph Rathish , S. Santhana Prabha , N. Vijaya , J. Jeyasundari and S. Rajendran , *Int. J. Nano. Corr. Sci. Engg.***2014**, 39-49.
[9] J. Angelin Thangakani, S. Rajendran ,J. Sathiabama , R M Joany , R Joseph Rathis , S Santhana Prabha , *Int. J. Nano. Corr. Sci. Engg.* **2014**, 1, 50-62.
[10] A. Nithya , P.Shanthy, N.Vijaya, R.Joseph Rathish, S.Santhana Prabha, RM Joany and S. Rajendran, *Int. J. Nano Corr. Sci. Engg.***2015**, 2, 1-11.
[11] T.Gowrani , P.Manjula , Nirmala Baby, K.N.Manonmani, R.Sudha, T.Vennila, *Int. J. Nano. Corr. Sci. Engg.***2015**, 2, 12-21.
[12] Namita K. Johar, K. Bhrara, R.Epshiba and G. Singh**,** *Int. J. Nano Corr. Sci. Engg.***2015**, 2, 22-31.
[13] A.Christy Catherine Mary, S.Rajendran, Hameed Al-Hashem, R.Joseph Rathish, T. Umasankareswari and J Jeyasundari, *Int. J. Nano Corr. Sci. Engg.***2015**, 2, 42-50.