CORROSION RESISTANCE OF 18 CARAT GOLD IN SYNTHETICAL SALIVA IN PRESENCE OF ALMOX 250 DT TABLET

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Keywords: corrosion resistance of metals, 18 carat gold, synthetic saliva, orthodontic wires, Amoxicillin trihydrate

Corrosion resistance of 18 carat gold in artificial saliva, in the absence and presence of a Tablet, namely, Almox 250 DT has been evaluated by polarization study. It is observed that when 50 ppm of Almox is added to analytical saliva, linear polarization resistance of 18 carat gold increases, in presence of 50 ppm of 18 carat gold. Similar observation is made in presence of 200 ppm of Almox also. Hence it is concluded that people having orthodontic wires made of 18 carat gold, can take the Tablet Almox 250 DT without any hesitation, because in its presence corrosion resistance of 18 carat gold increases.

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Introduction

Corrosion resistance of metals and alloys in various body fluids has attracted the attention of many researchers. Corrosion resistance of biomaterials in synthetic body fluids such as blood plasma, urine, Hank solution, Ringer solution and artificial saliva has been extensively studied. The corrosion resistance of metals and alloys in artificial saliva has been reviewed recently. Corrosion resistance of various metals have been investigated in various synthetic (simulated) body fluids such as Ringer's solution,[1-4] simulated body fluids,[5,6] Hank solution,[7,8] blood plasma,[9-11] urine,[12-14] bovine serum,[15] and artificial saliva.[16-20]

Various metals and alloys have been used as biomaterials whose corrosion resistance has been investigated in artificial body fluids; various metals and alloys such as Ni-Al-Fe intermetallic alloys,[21] titanium alloy,[22] NiTi alloy,[23] CoCrMo alloys,[24,25] magnesium alloy,[26,27] Cr-Ni stainless steel, Cr-Ni-Mo stainless steel,[28] 316L stainless steel.[29,30] Five non-precious Ni-Co based alloys have been analyzed with respect to their corrosion behavior in artificial saliva.[31] The effect of different concentrations of eugenol in artificial saliva on titanium corrosion has been investigated by Kinani and Chtaini.[32]

The corrosion resistance of the commercial metallic orthodontic wires in a simulated intra-oral environment has been evaluated by Ziebowicz et al.[33] The results of corrosion resistance tests of the CrNi, NiTi, and CuNiTi wires showed comparable data of parameters obtained in artificial saliva. The effects of multilayered Ti/TiN or single-layered TiN films deposited by pulse-biased arc ion plating (PBAIP) on the corrosion behavior of NiTi orthodontic brackets in artificial saliva have been investigated by Liu et al.[34] The corrosion behavior of various metals and alloys in artificial saliva has been investigated. Rajendran et al have studied the corrosion resistance of artificial saliva in presence spirulina powder.[35] Corrosion behavior of metals in artificial saliva in presence of D-glucose has been investigated.[36]

Liu et al[37] have investigated corrosion behavior of nickel-titanium orthodontic wires in presence of artificial saliva using the methods of continue bending stress thought the 14 days experimental process, they have been findings that bending stress, loading condition with respect to corrosion behaviour. Koike et al[38] studied corrosion resistance of Titanium alloy in presence of Artificial Saliva at 37ºC using the method of potentiostatic polarization. They have found that all the mechanical properties and corrosion characters were tested. Anwar[39] et al investigated corrosion behavior of Ti and Ti 6Al4V in presence of artificial saliva using electrochemical methods. They found that as fluoride concentration increases, corrosion resistance is decreased. Rajendran[40] et al have studied the corrosion resistance of SS 316 L in Artificial Saliva in presence of electoral.

Dentists recommend the use of orthodontic wires to regulate the arrangement of teeth. After the regulation, people having these orthodontic wires, regulating the arrangement of teeth, have to take orally many tablets. These tablets may corrode the wires in the oral environment, especially saliva. Hence there is a need to investigate the influence of various tablets on the corrosion resistance of orthodontic wires made of many metals and alloys. Can people implanted with orthodontic wires made of 18 carat gold table Almox 250 DT Tablets orally? To give an answer this question, the following investigation was undertaken. Corrosion resistance of 18 carat gold in analytical saliva (AS) in the absence and presence of Almox 250 DT has been investigated by polarization technique.

Experimental

18 carat gold

The composition of 18 Carat gold [41] is given in Table 1.

Table 1. Composition of 18 carat gold

Gold	75%
Copper	5-15%
Silver	10-20%

Artificial Saliva

The composition of artificial saliva[42] is shown in Table 2.

Table 2. Composition of Artificial saliva

KCl	$0.4gl^{-1}$
NaCl	$0.4gl^{-1}$
$CaCl_22H_2O$	$0.906gl^{-1}$
$NaH_2PO_42H_2O$	$0.690gl^{-1}$
$Na_2S.9H_2O$	$0.005gl^{-1}$
Urea	$1gl^{-1}$

The composition of Almox 250DT is given Table 3.

Table 3. The Composition of Almox 250 DT

Amoxicillin Tri hydrate IP	250 mg

Potentiodynamicpolarization

Polarization studies were carried out in a CHI – Electrochemical workstation with impedance, Model 660A. A three-electrode cell assembly was used. The working electrode was aluminium (exposed area is $1cm^2$). A saturated calomel electrode (SCE) was the reference electrode and platinum was the counter electrode. From the polarization study, corrosion parameters such as corrosion potential (E_{corr}), corrosion current (I_{corr}) and Tafel slopes (anodic = b_a and cathodic = b_c) and Linear polarization resistance (LPR) were calculated.

Results and Discussion

Analysis of Polarization study

To investigate the corrosion resistance of 18 carat gold in artificial saliva, in the absence and presence of Almox 250 DT Tablet, polarization study was employed. Polarisation study has been used to detect the formation of protective film on the metal surface.[43-52] when corrosion protection takes place linear polarization resistance (*LPR*) value increases and corrosion current (I_{corr}) decreases. The potentiodynamic polarization curves of 18 carat gold immersed in Artificial Saliva (AS) in presence of Almox 250DT are shown in Figure1. The corrosion parameters namely corrosion potential (E_{corr}), corrosion current (I_{corr}), Tafel slopes. (b_c = cathodic, b_a = anodic) and *LPR* are given in Table 4. The cathodic branch represents the oxygen reduction reaction, while the anodic branch represents the metal dissolution reaction.

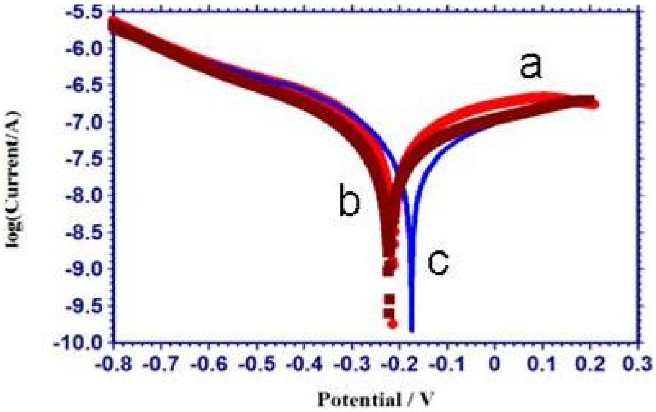

Figure 1. Polarization curves of Au 18ct immersed in various test solutions. a) AS b) AS+ 50 ppm Almox 250DT; c) AS + 200ppm Almox 250DT

When 18ct gold is immersed in artificial Saliva, the corrosion potential is -214 mV vs SCE [Figure.1(a)]. When 50ppm of Almox 250DT is added the corrosion potential is shifted from -214 to -222 mV vs SCE [Figure.1(b)]. That is the corrosion potential is shifted to the cathodic side. This indicates that cathodic reaction is controlled predominantly. Similarly when 200ppm of Almox 250DT is added the corrosion potential is shifted from -222 to -175 mV vs SCE [Figure .1(c)]. That is the corrosion potential is shifted to the anodic side. This indicates that anodic reaction is controlled predominantly.

When 50ppm of Almox 250DT is added to Artificial Saliva, the LPR value increases from $8.86110x10^5$ohm cm^2. This indicates that when 18ct gold is immersed in Artificial Saliva containing 50ppm of Almox 250DT, the corrosion resistance of 18ct gold increases. When 200ppm of Almox 250DT is added the LPR value increases from $1.435098x10^6$ to $1.462339x10^6$ ohm cm^2. That is corrosion resistance of 18ct gold increases at higher concentration of Almox 250DT.

This is supported by the fact that when 50ppm of Almox 250DT is added to Artificial Saliva, first corrosion current decreases from $5.113x10^{-8}Acm^{-2}$ to $3.035x10^{-8}$ Acm^{-2}. When 200 ppm of Almox 250DT is added the corrosion current decreases from $3.035x10^{-8}$ Acm^{-2} to $2.819x10^{-8}$ Acm^{-2}.

Thus polarization study reveals that when 18ct gold is immersed in artificial saliva in presence of 50ppm and 200ppm of Almox 250DT its corrosion resistance increases.

Conclusion

In presence of Almox 250 DT corrosion resistance of 18 carat gold increases.

Hence it is recommended that people implanted with orthodontic wire made of 18 carat gold can take Almox 250 DT Tablet with out any hesitation.

Table 4. Corrosion parameters of 18ct gold in Artificial saliva (AS) in the presence of Almox 250 DT obtained by Polarization method.

System	E_{corr} mV vs SCE	I_{corr} A cm^{-2}	b_a mVdecade^{-1}	b_c mVdecade^{-1}	*LPR* Ω cm^2
Artificial saliva (AS)	-214	$5.113x10^{-8}$	232.1	189	$8.86110x10^{5}$
AS+ Almox 50ppm	-222	$3.035x10^{-8}$	239.4	172.2	$1.435098x10^{6}$
AS+ Almox 200ppm	-175	$2.819x10^{-8}$	130.2	130.7	$1.462339x10^{6}$

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