Corrosion behavior of nickel and its alloys in aqueous solutions

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1- The introduction included a literature survey of the different theories of corrosion and corrosion inhibition. The corrosion of nickel and inconel 600 and inconel 690 alloys in aqueous solutions (acidic-alkaline and neutral) were given with particular emphasis on the effect of aggressive as well as inhibitive anions.2- The anodic and cathodic polarization curves were constructed for nickel, inconel 600 and inconel 690 alloys in hydrochloric acid solutions. The effect of acid concentrations on the kinetic parameters of the dissolution of nickel and inconel 600 and inconel 690 alloys was studied. It was found that :• Increasing the acid concentration was accompanied by an increase in the corrosion current density.• At the same acid concentration the current density decreased in the following order:Inconel 690 > Inconel 600 > NiThis indicates that inconel 690 is more resistance to corrosion in HCl than inconel 600 and Ni.3- The effect of addition of different concentrations of the essential oils was studied at 0.1 M hydrochloric acid solution and showed that:• By increasing the concentrations of oils the corrosion current density decreases and consequently the inhibition efficiency is increased.• The inhibition efficiency of the three essential oils was found to follow the order :Rosemary oil > Clove oil > Black Cumin4- The effect of rising temperature on the corrosion of nickel and Inconel 600 and Inconel 690 alloys at 0.1 M of HCl solution is observed that::• The variation of temperature has almost no effect on the shape of polarization curves.• The values of corrosion current density (Icorr) is increased.• The values of corrosion rate (R corr) is increased.5- The effect of temperatures on the corrosion inhibition of nickel and Inconel 600 and Inconel 690 alloys in 0.1 M of HCl acid contain 150 ppm of the three essential oils is observed that:• The inhibition efficiency was decreased by increasing the temperature indicating that the inhibition occurs through physical adsorption of the additives.• Thermodynamic functions of activation were calculated .6- The effect of increasing of Cl- ion concentrations on the potentiodynamic anodic polarization curves of nickel and inconel 600 and inconel 690 alloys was studied and. showed the following:• There is one active dissolution or oxidation peak was observed during the anodic scan until at the beginning of oxygen evolution, these indicated that the chloride ion concentrations are assumed to have influence on the dissolution kinetics of the passive film on the electrode surface. However, at higher concentrations of Cl- ion on the other hand, a tendency to destroy the passive film covered the electrode surface is observed.• Increasing of Cl- ions causes the current passing through the passive region to increase suddenly

and markedly at certain potential denoting the destruction of the passivating oxide film and the initiation of visible pits. Increasing the Cl- ions content, also, the shift the pitting potential of nickel and inconel 600 and inconel 690 alloys to the active (negative) direction.• At one and the same concentration the shift of Epitt to less noble values increases in the following order :Ni > Inconel 600 > Inconel 690This order reflects that, inconel 690 is more resistant to pitting attack than inconel 600 and than nickel.7- The effect of the three essential oils on the potentiodynamic anodic polarization curves of nickel and inconel 600 and inconel 690 alloys in 0.25 M sodium chloride was studied and showed that:• The increasing of the concentration of essential oils causes a marked shift of the pitting corrosion potential into the noble direction. This shift indicates an increasing resistance to pitting attack.• At one and the same oils concentration a shift of pitting corrosion potential into the noble (positive) direction, in accordance to the following sequence :-Rosemary oil > Clove oil > Black Cumin8- Cyclic voltammogram for nickel and inconel 600 and inconel 690 alloys in different concentrations HCl solution was studied and showed the following:• Increases the dissolution current density (I peak).• The integrated charge amount Δqa increases.• At one and the same concentration the shift of I peak to less noble values increases in the following order :Ni > Inconel 600 > Inconel 690This order reflects that, inconel 690 is more resistant to dissolution than inconel 600 and than nickel.9- The effect of the three essential oils on the cyclic voltammograms for nickel and Inconel 600 and Inconel 690 alloys in 0.1 M HCl solution was studied and showed the following:• Decreased the dissolution current density (I peak).• The integrated charge amount Δqa decreases.• At one and the same concentration the shift of I peak to more noble values increases in the following order :Rosemary oil > Clove oil > Black Cumin