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Corrosion stability of an aluminium alloy used in making of some cooking pans in Sri Lanka

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In addition to aluminium, aluminium alloys commonly used for making of some cooking pans in Sri Lanka contain of Si, Fe, Cu, Mn, Mg, Cr, Zn and Ti as minor elements. In the present work, the stability of one such alloy against corrosion, at ambient temperature in several aqueous media in the pH range of 5.0 to 6.5 that closely resembles the physicochemical status of liquid foods cooked using these vessels were investigated. The electrochemical techniques; immersion test, open circuit potential measurements and potentiodynamic polarization techniques were used to determine the corrosion parameters and the rate of corrosion of the alloy in the selected experimental conditions.

The results of the immersion tests indicated that, the rates of corrosion of the alloy in several aqueous media; tap water from municipal water supply, citric acid and acetic acid dissolved in tap water and pH adjusted to 5.0 did not exceed 0.7 mm yr^{-1}.The open circuit potentials corresponding to the alloy in all above solutions increased positively with time indicating the formation of passive oxide films on the alloys resulting a decrease in the rate of corrosion with time. Potentiodynamic polarization studies showed that in the above aqueous media the corrosion potentials fall in the ranges of (-362 to -739 mV) vs. the silver/silver chloride electrode and corrosion currents fall in the range of (~10.00 to ~24.24) μA cm^{-2}.

The immersion test results indicated that, the alloy can undergo corrosion with rates in the range of about 1.4 to about 2.1 mm yr^{-1} in solutions of tap water, gallic acid and tartaric acid containing sodium chloride [2%(w/v) NaCl].The highest rates of corrosion of about 2.1 mm yr^{-1} for the alloy were observed in tartaric acid solution containing 2 %(w/v) NaCl. The open circuit potentials for these solutions increased negatively with time indicating adsorption of negatively charged chloride ions on the surface of the alloys resulting in an increase in the rate of corrosion with time. The corrosion potentials and corrosion current found from the potentiodynamic studies for the alloy containing 2%(w/v) sodium chloride solution of municipal tap water, gallic acid and tartaric acid at pH 5.0 were in the ranges of about -693 to about -760 mV vs. Ag/AgCl electrode and ~ 59.26 to ~79.43 μA cm^{-2} respectively.

The results indicated that the alloy can undergo corrosion significantly if it is used in aqueous media containing gallic acid or tartaric acid at pH 5 or 2 %(w/v) NaCl in tap water, gallic or tartaric acid solutions at pH 5 containing 2 %(w/v) NaCl in the ranges studied.

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