# The electrocatalytic properties of gold and stainless steel W.Nr.1.4301 electrodes in the oxidation of malic acid

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Malic acid (HOOC-CH(OH)CH2COOH) is the most abundant fruit acid in fruit and fruit pulp. ON the basis of cyclic voltammetry measurements it had been shown that in 0.1 M Na2SO4 this compound is oxidized on the gold electrode only in the potential region where the gold oxides are formed (1). It was also shown that, in the presence of malic acid, at potentials close to the corrosion potential, the stainless steel is completely passive in 0.1 M Na2SO4 and, at potentials more positive tahn 0.7 V, two parallel processes occur: dissolution of the steel and anodic oxidation of malic acid into acetaldehyde (2). It was already observed taht, in the presence of malic acid and sulfur dioxide, the anodic process of stainless steel dissolution is acceerated and has a pitting form. The aim of this work is the better understanding of the oxidation of malic acid on gold and stainless steel W.Nr. 1.4301 surfaces. Electrochemical oxidation of malic acid oh both electrode surfaces are formed. In this work that process is examinated by using of 0.1 mV/sec as sweep rate in order to elucidate kinetics of the malic acid electrooxidation. The products of the reaction were studied as well. Test specimens of steel were prepared from commercial grade austenitic stinless steel W.Nr. 1.4301 (AISI 304). Chemical composition of the stainless steel is given in (2) and the description of gold electrode is given in (1). A standard three electrode electrochemical cell is used and behavior of steel and gold is investigated by cyclic voltametry (sweep rate = 0.1 mV (sec) and stationary measurements. Potentiostat PINE RDE 4 and Philips Recorder as counter electrode and in all experiments as reference electrode, SCE was used. Electrolyte was prepared with Milipore water and Fluka chemicals in the concentrations: a) 0.1 M Na2SO4, ph=7.1 b) 0.1 M Na2SO4 + 0.04 M malic acid, ph=2.9. The addition of 0.04 M malic acid to the 0.1 M Na2SO4 changes the PH value of the electrolyte to 2.9 which does not cause the change of the gold electrode but causes a favorized anodic dissolution of the steel. On stainless steel W.Nr. 1.4301, as potentials more positive than 0.8 V the anodic dissolution of steel occurs simultaneosly with malic and oxidation. In the same range of the potential only malic acid oxidation occurs on gold electrode surface. Gas chromatographic analysis of the bulk of electrolyte after the oxidation of malic acid during 8 h at E=1.0 V show the presence of acetaldehyde in the solution as one of the products of the anodic oxidation of malic acid at the stainless steel and gold. Earlier was observed that during the oxidation of methanol on gold a slow sweep rate favors the catalytic activity of the electrode surface (1). When sweep rate: 0.1 mV/sec was used, the catalytic activity of gold and stainles steel electrodes was favoured. The apparent electrooxidation of malic acid occurs at the potentials before the oxide formation on both electrode surfaces in 0.1 M Na2SO4. This indicates the slow adsorption process of examinated molecule in the region of the potential before the oxide formation. No electrode activity concerning malic acid oxidation was observed in that region of the potential when sweep rate: 50 mV/sec used (1,2). In the region of the oxide formation stainless steel and gold electrode exhibited higher currents of malic acid oxidation when 0.2 mV/sec was used comparing to the results when 50 mV/sec was applied. In order to make more clear observed processes, some disc-ring experiments will be performed. At this moment one can say that value of sweep rate: o.1 mV favor the oxidation of malic acid on stainless steel W.Nr. 1.4301 and gold electrodes indicating the slow adsorption of organic molecule in the region before the oxide formation. The future intention is to eluciate the role of steel dissolution in the oxidation of malic acid comparing to the same process on gold electrode. 1. M. Avramov-Ivic, V.Jovanovic, G.Vlajnic, J.Popic, Journal of Electroanalytical chemistry 423(1997) 119-124 2. J.Popic, M.Avramov-Ivic, I.Doroslovacki Corrosion Science, accepted for publication(2001)