

**How to make the sewage, containing aspirin non-injurious by means of electro-oxidation**

E. Danilova, D. Weichgrebe, M. Baturova,  
A. Vedenjapin, A. Skundin

The Institut of Organic Chemistry of the Russian Academy of Sciences, Russia  
University of Hannover, Germany

For many centuries the people have been treated with the aspirin. To prevent the penetration of aspirin into the environment (rivers, water-reservoirs) the methods of aspirin failure in industrial and other flows have been developed. An investigation of a conceivable application of an electro-chemical method of the anode oxidation of aspirin as an alternative method to that of the ozone treatment seems to be of interest.

The electrochemical oxidation has been carried out in a standard three-electrode cell. All the potentials have been recalculated for the normal hydrogen electrode (n.h.e.). A platinum electrode has been used as an auxiliary electrode and a platinum plate or a plate made of a fibrous carbon material, modified by manganese oxides, - as a working electrode. A salicylic acid has been subjected to the oxidation,  $c = 0,03M$ , because while diluting in a water solution the aspirin is hydrolyzed into the salicylic acid. The oxidation products have been studied using microbiological and chemical methods.

The potentiodynamic curves received on a platinum electrode within an interval of 0,5 - 1,4 V, in a solution of the salicylic acid show a distinct spike of the oxidation of an organic substrate in the field of 0,8 - 1,2 V. The repeated cycling within the interval of 0,5 - 1,4 V leads to a gradual decrease of the spike height and the cycling within the interval of 0,8 - 1,2 V gives a sharp decrease of a substrate oxidation intensity. All the above-stated shows that at 0,5 V the adsorption of salicylic acid take place and at 0,8 - 1,2 V the salicylic acid has been oxidized and the hemosorbic products have been yielded. At the potentials ca 1,4 (n.h.e.) these products are removed from the surface at the expense of the destructive oxidation. In this manner the electrode regeneration takes place. The chemical analysis of the oxidation products has shown that the primary oxidation of the reference acid proceeds to an appropriate chinon, which thereupon undergoes a further transformation. In so doing the availability of humic acids among the termination products is quite possible.

Special investigations have shown that chinon is oxidized at potentials, larger than 1,7 V (n.h.e.).

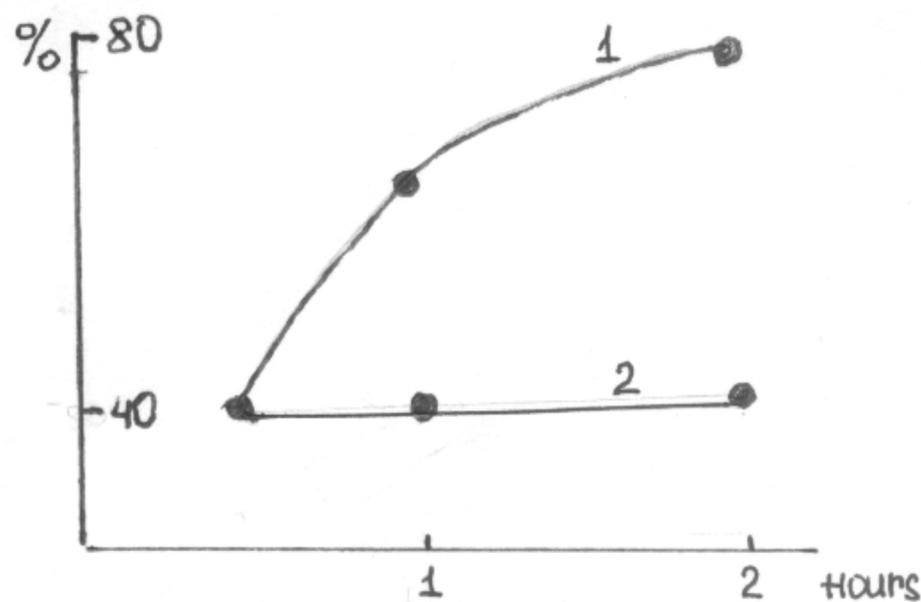
A microbiological analysis has shown that the biological activity of products of potentiostatic electrooxidation of the salicylic acid falls by 40 - 60% as compared to the reference substrate. In this case the increase of the oxidation potential from 0,8 to 2,0V renders the salicylic acid solution more harmless. The prolongation of the time of a solution treatment from 30 to 120 min. improves the obtained results. Halvostatic oxidation at current densities of 25 and  $50\mu A/cm^2$  takes place in the field of 1 - 1,3 and 1,5 - 1,6 V (n.h.e.) potentials, respectively. At the current density of  $50\mu A/cm^2$  the prolongation of the electrolysis time reduces the biological activity of the solution and the purification degree achieves 80% (Fig. 1). All the data given above have been received for a platinum anode. The use of a carbon anode gives practically the same results.

Special experiments have shown that the biological activity of chinon which is being formed at an initial stage of the salicylic acid oxidation amounts to 90% of the biological activity of the salicylic acid itself.

Therefore, the obtained results show that only in the course of the chinon electrolysis the physiologically harmless products, such as humic acids which are the basis of the soil fertility, can be yielded. In so doing the electrolysis is not accompanied by the liberation of toxic gases, does not induce the turbidity of the solution being treated and, therefore, represents an ecologically pure process.

**REFERENCES:**

1. Eller, Liebiger Annalen der Chemie, 1983, B.431, S.154



1-50, 2-25  $\mu A/cm^2$  Fig 2