

Fractality of the adsorbed layer of Triton-X-100 on the mercury electrode and its influence on the oxidation processes of o- and p-nitrophenols

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Fractal morphology of the adsorbed layer of Triton-X-100 has been studied. The study has been conducted using *ac* voltammetry in combination with recently developed method, size scaling of the hanging mercury drop electrode, for determination of the adsorbed layer fractal dimension.¹ Simultaneously, the adsorption process of Triton-X-100 has been studied by means of phase-sensitive *ac* voltammetry (out of phase mode) in 0.5 M NaCl, 3×10^{-2} M NaHCO₃, pH 8.3. The investigation has been performed in the concentration range from 0.06 to 10 mg/l Triton-X-100, for 1 min accumulation time. Results were elaborated for potential $E = -0.35$ V vs. Ag/AgCl/3 M KCl reference electrode.

It was found that the adsorbed layer of Triton-X-100 has a fractal structure (Fig. 1). The fractal dimension varies depending on fractional electrode coverage and reflects the structural changes of the layer during the adsorption process. At fractional electrode coverage of $\theta \approx 0.8$, corresponding to the bulk concentration of ≈ 0.4

mg/l, the fractal dimension of Triton-X-100 layer shows pronounced peak with $D \approx 2.6$. This jump of D indicates complete reorganization of Triton-X-100 adsorbed layer.

The electroreduction of o- and p-nitrophenols in the presence of adsorbed layer of Triton-X-100 have been studied by phase sensitive *ac* (in phase mode) and SW voltammetry. The reduction mechanism of nitrophenols is completely changed from non-reversible $4 e^-$ step to reversible one-electron reduction leading to radical anions, exactly at the T-X-100 concentration for which the peak of fractal dimension was observed. For the o-nitrophenol the stabilization of radical-anion was observed for the fractional electrode coverages $\theta > 0.8$. For p-nitrophenol for $\theta > 0.8$ the irreversibilization of one-electron reduction was observed. These results reflect differences in electrode reaction kinetics of two nitrophenols and their incorporation into Triton-X-100 adsorbed layer.

1. Risović, D., Gašparović, B. and Čosović, B., *Langmuir*, 17, 2001, 1088-1095.

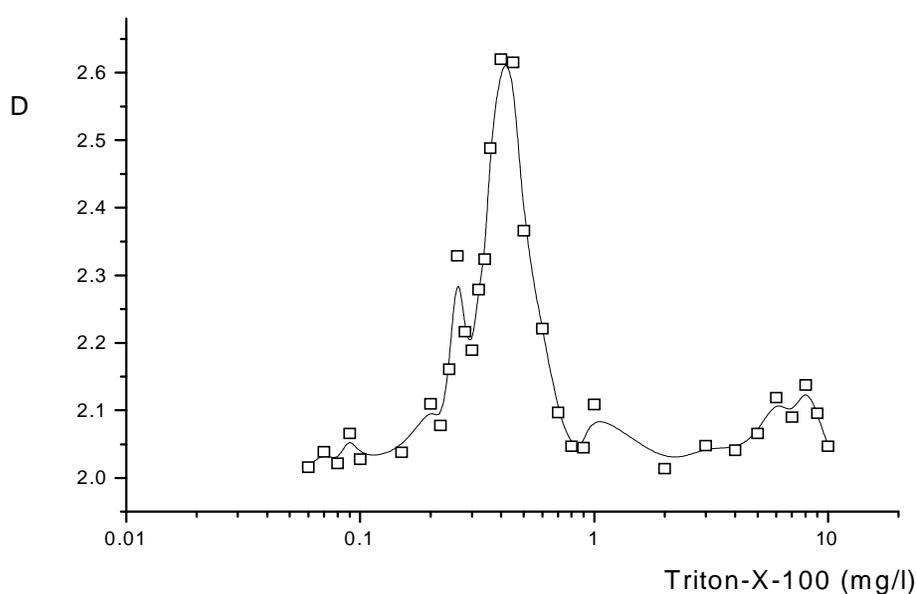


Fig.1. Dependence of the fractal dimension on bulk Triton-X-100 concentration.