CHEMICALLY MODIFIED ELECTRODES FOR STEROID DETECTION

Derina K.V., Lukina A.A.

Tomsk Polytechnic University,Leninavenue 30, Tomsk, 634050, Russia,
e-mail:derinakv@tpu.ru

Steroids play a sufficient role in the human body. They have a several biological functions, such as, structural, synthetic, protective. Therefore, the quantification of steroid compounds in different objects (for example, blood serum or food) is highly important for clinical practice. Recently, there is a variety of analytical methods for this purpose. In this work we suggest a novel approach to steroid detection by voltammetry.

Mostly steroids are the compounds with high molecular mass (more than 300 g/mol). Consequently, steroid electrooxidation runs under high potential. As a result, the applying of modified electrodes is necessary .Therefore, the usage of modified electrodes is necessary, because modifiers help to decrease the oxidation potential.

In this work 2,6-diacetyl-2,4,6,8-tetraazobicyclo[3.3.0]octane-3,7-dione-diphosphonicacid (DPADGU) and Ni nanoparticles (Ni NP) were used as a modifying system for carbon composite electrode (30% of pyrolytic graphite and 70% of HDPE). Carbon composite electrode (CCE) has renewable surface. Therewith, such electrode is adsorption resistive. Nevertheless, it has low electrode active surface due to the low carbon contain. As a result, the application of Ni NP allows increasing active electrode surface.DPADGU helps to decrease the oxidation potential. Chitosan, dextran and agarose was tested as bonded agents. Potassium ferrocyanide redox pair was used for the estimation of obtained electrode surfaces. It was shown that the application of agarose gel allowed receiving the largest active electrode surface (near to 10.5 cm^2). Besides, the morphology of obtained surfaces was investigated by scanning electron microscopy and IR-spectroscopy.

Cyclic measurements were carried out to estimate the voltammetric profile and to study the influence of the scan rate on the electrochemical response at a different concentration in 5.0 mL of supporting electrolyte solution. The measurements were performed in the potential range from 0.0 to 2 V. The scan rate was varied from 10 to 300 mVs^{-1}. The peak of cholecalciferol was obtained at +0.7 V. The electrooxidation current dependence on vitamin D_3 concentration is linear in range from 0.1 up to 70 μM. This linear range is relevant to the cholecalciferol content in dietary supplements and blood serum. The LOD and LOQ values were 0.05 and 0.17 μM, simultaneously. The oxidation peak current increased non-linearly with the square root of scan rate ($v^{1/2}$).