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## Surfactant media for constant-current coulometry. Application for the determination of antioxidants in pharmaceuticals

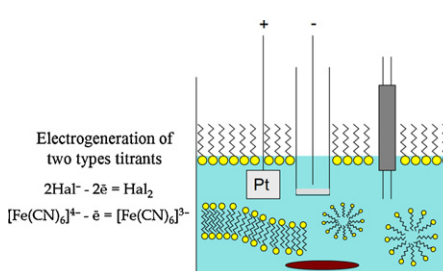
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### HIGHLIGHTS

- ▶ Applicability of surfactants in constant-current coulometry is shown for the first time.
- ▶ Reactions of antioxidants with electrogenerated titrants in surfactant media are investigated.
- ▶ Water insoluble antioxidants can be determined in water media with addition of surfactants.
- ▶ Coulometric determination of antioxidants in pharmaceutical dosage forms using surfactants media is developed.

### GRAPHICAL ABSTRACT



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### ABSTRACT

Effect of surfactant presence on electrochemical generation of titrants has been evaluated and discussed for the first time. Cationic (1-dodecylpyridinium and cetylpyridinium bromide), anionic (sodium dodecyl sulfate) and nonionic (Triton X100 and Brij® 35) surfactants as well as nonionic high molecular weight polymer (PEG 4000) do not react with the electrogenerated bromine, iodine and hexacyanoferrate(III) ions. The electrogenerated chlorine chemically interact with Triton X100 and Brij® 35. The allowable range of surfactants concentrations providing 100% current yield has been found. Chain-breaking low molecular weight antioxidants (ascorbic acid, rutin,  $\alpha$ -tocopherol and retinol) were determined by reaction with the electrogenerated titrants in surfactant media. Nonionic and cationic surfactants can be used for determination of antioxidants by reaction with the electrogenerated halogens. On contrary, cationic surfactants gives significantly overstated results of antioxidants determination with electrogenerated hexacyanoferrate(III) ions. The use of surfactants in coulometry of  $\alpha$ -tocopherol and retinol provides their solubilization and allows to perform titration in water media. Simple, express and reliable coulometric approach for determination of  $\alpha$ -tocopherol, rutin and ascorbic acid in pharmaceuticals using surfactant media has been developed. The relative standard deviation of the measurements does not exceed of 5%.

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### 1. Introduction

Surfactants are widely used in analytical chemistry at present time [1–3]. They are also called amphiphiles, i.e., compounds having both polar and nonpolar parts in their molecules. Depending

on the chemical structure of the hydrophilic moiety bound to the hydrophobic part, the surfactant may be classified as cationic, anionic, nonionic or zwitterionic.

The solubilization of non-polar organic compounds in aqueous micellar solutions for electrochemical measurements was the first reported application of surfactant assemblies in electroanalysis [4]. Surfactants act as suppressors in polarography (usually at concentrations below the critical micelle concentration (CMC)) due to their adsorption onto the electrodes surface. From other side, presence

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