POTENTIOMETRIC DETERMINATION OF DISINFECTANTS ALLOCATED IODINE IN CONTACT WITH IODIDE

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Equipment's disinfection for the pharmaceutical industry is carried out by treatment with a mixture of hydrogen peroxide with a peroxy acid containing surfactant. For the detection of either peroxiacid or the total residual amount of oxidants in the mixture the ability of those compounds to oxidation of iodide ion is used.

The decreasing of iodide-ion activity is detected in buffer solution with the pH set point. For the peroxide acids and/or hydrogen peroxide the ability of those compounds to oxidation of iodide-ions is used.

Based on these principle two potentiometric detectors for the determination of residual quantities of oxidants-disinfectants, in the washing waters of pharmaceutical industry, have been developed by us.

Detector contents platinum red-ox electrode and iodide-selective electrode. Because of that typical combination electrode, working without outer reference electrode, is obtained. Potential of platinum electrode depends only on the ratio of $[I_2]^{1/2}$/ $[I^-]$ concentrations and potential I^- of selective electrode depends on $[I^-]$ concentration. If both electrodes combined into one cells, then the measured voltage is proportional only to the log of I_2 concentration, because the terms containing $[I^-]$ cancel each other:

$$E = \underbrace{\left(E^0_{(I_2/I^-)} + \frac{RT}{F} \ln \frac{[I_2]^{1/2}}{[I^-]} \right)}_{\text{Pt-electrode}} - \underbrace{\left(E^{0'} - \frac{RT}{F} \ln [I^-] \right)}_{I^-\text{-ISE}} = \text{const} + \frac{RT}{2F} \ln [I_2].$$

During analysis of discrete probes Nernst angle coefficient (29,6 мВ at 298 К) and super Nernst angle coefficient for the concentration of $H_2O_2 \geq 10^{-7}$ mol/L have been obtained. At H_2O_2 concentration is < $3 \cdot 10^{-6}$ mol/L 1,0 ml $5 \cdot 10^{-3}$ mol/L of KI solution per 100 mL of the sample solution is recommended to add.

$$(NH_4)_6Mo_7O_{24} \cdot 4H_2O + H_2O + H_2O_2 = (NH_4)_6Mo_7O_{25} + 5H_2O$$

$$(NH_4)_6Mo_7O_{25} + 2J^- + 2H^+ + J_2 + H_2O$$

It was proved that between redox-potential and log of iodine concentration in pH < 8-9, containing of iodide-ions excess (≥ 10^{-3} mol/L) the linear dependence over a wide range of iodine (triiodine-ions) (3-4 periods) concentration, which does not affect the pH of the solution, exists.

Based on the existing fact the simple and accurate method of direct potentiometric detection of oxidants-disinfectants has been developed. The oxidants-disinfectants react with iodide-ions with the further elimination of free iodine.

During this reaction the redox-potential of the platinum electrode in appropriate conditions (temperature, time of incubation, concentration of potassium iodide, ionic strength of solution, buffer capacity of solution for the pH creating) is measured.

The influence of nature and concentration of the inert salts of electrolytes have been studied. These salts had been used for the creating of constant ionic strength of tested oxidant-disinfectant solution.

It has been shown that, at a concentration of model solutions $10^{-5} – 10^{-3}$ mol/l of iodine (triiodide - Ions) the relative error of the determination is 1,2 – 0,8%; at 10-6 mol/L of iodine - ≤ 1,8%; at 10-7 mol/L of iodine – ≤ 9,2%.

The methods have been developed and the possibility of measurement of the potassium hydrogenperoxomonosulphate and the magnesium salt of monoperoxy phthalic acids' concentrations in the work solutions of the next disinfectants: "Dismozon" and "Ecocid S" has been shown.

Method which has been proposed is also suitable for the detection of many other oxidizing agents, which form free iodine during the interreacting with iodide-ions.

The chemical transformations, taken as a basis of analytical methods, for example of potassium hydrogenperoxomonosulphate and magnesium salt of monoperoxy phthalic acid, are shown on the scheme:

$$KHSO_5 + 2KI + H_2SO_4 = I_2 + H_2O + KHSO_4 + K_2SO_4$$

$$I_2 + 2KI = KI_3$$