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Methods of express determination of gentamicin

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Abstract

Methods have been developed for the rapid determination of gentamicin based on visual colorimetric and colorimetric assessment, as well as using the method of diffuse reflectance spectroscopy (DRS). Indicator papers with immobilized colorimetric reagent – ninhydrin are proposed. The stability, as well as the influence of the temperature and heating time of the test means on the reaction of ninhydrin with gentamicin, was studied. Color scales were obtained for the visual colorimetric determination of gentamicin in the concentration range of 0.5-32 mg/ml. The range of unreliability of the test reaction (0.2-0.8 mg/ml) and the detection limit (0.75 mg/ml) were determined. A linear dependence of the intensity of the Green color channel of the RGB color model ($y = 50x + 143$; $r^2 = 0.99$) on the logarithm of the gentamicin concentration was constructed. The range of the determined contents during the colorimetric determination was 0.5-32 mg/ml, the detection limit was 0.29 mg/ml. The correctness of the test method was confirmed by the "introduced-found" method ($Sr \leq 0.16$). Linear dependences of the area and perimeter of the radar diagrams were obtained for the determination of gentamicin. The interaction of immobilized ninhydrin with gentamicin on the paper surface was assessed using the SDO method. The dependence of the Gurevich-Kubelka-Munk function on the logarithm of the gentamicin concentration is linear and is described by an equation of the form $y = 0.242x + 0.088$; $r^2 = 0.97$, the detection limit was 0.10 mg/ml. The content of gentamicin in the commercial drug "Gentamicin" (solution for intravenous and intramuscular administration) was estimated using the developed test methods and spectrophotometry. It was shown that the content of gentamicin in the studied preparation corresponds to that declared by the manufacturer, the relative standard deviation did not exceed 0.09.

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References

[1] S.C. Rao, R. Srinivasjois, K. Moon. One dose per day compared to multiple doses per day of gentamicin for treatment of suspected or proven sepsis in neonates. *Cochrane Database of Systematic Reviews.* **2016**. No.12. P.1465-1858.

[2] A.P. Arzamastsev. Pharmaceutical chemistry. *Moscow: Geotar Medicine.* **2004**. (Russian)

[3] O.M. Petrukhin, M.V. Kostitsyna, E.V. Shipulo, E.V. Vladimirova, A.A. Dunaeva, T.G. Dzherayan. Complexation of aminoglycoside antibiotics with metal cations as a derivatization reaction: determination of gentamicin by equilibrium electrochemical and spectrophotometric methods. *Journal of Analytical Chemistry.* **2009**. Vol.64. No.9. P.951-957. (Russian)

[4] E.G. Kulapina, V.V. Baraguzina, O.I. Kulapina. Ionometric determination of gentamicin and kanamycin in biological fluids and dosage forms. *Pharmaceutical Chemistry Journal.* **2004**. Vol.38. No.9. P.48-51. (Russian)

[5] O.V. Voronezhtseva, T.N. Ermolaeva. Determination of aminoglycoside antibiotics in food using piezoquartz immunosensors. *Sorption and Chromatographic Processes*. **2011**. Vol.11. No.1. P.68-76. (Russian)

[6] E.V. Khaldeeva, E.P. Medyantseva, N.A. Imanaeva, and G.K. Budnikov. Determination of gentamycin using an amperometric immunoenzymatic sensor. *Journal of Analytical Chemistry*. **2002**. Vol.57. No.12. P.1284-1289. (Russian)

[7] G.Ya. Levin, L.N. Sosnina. Spectrophotometric method for determining the concentration of aminoglycosides in blood plasma. *Antibiotics and Chemotherapy*. **2014**. Vol.59. P.3-4. (Russian)

[8] H. Wang, J. Ren, Y. Zhang. Use of p-dimethylaminobenzalhyde as a coloured reagent for determination of gentamycin. *Talanta.* **1993**. Vol.40. No.6. P.851-853.

[9] E.P. Shupilova, I.V. Buko, O.V. Shulyakovskaya. Determination of the content of residual amounts of streptomycin in dairy products using high performance liquid chromatography with mass spectrometric detection. *Health and the Environment.* **2015**. Vol.2. No.25. P.221-226. (Russian)

[10] V.G. Amelin, A.M. Andoralov, N.M. Volkova, A.I. Korotkov, T.B. Nikeshina, I.I. Sidorov, A.A. Timofeev. Identification and determination of toxicants using a standard additive in food, food raw materials and feed by high performance liquid chromatography/high-resolution time-of-flight mass spectrometry. *Analytics and Control*. **2015**. Vol.19. No.2. P.189-207. (Russian)

[11] P. Frutos, S. Torrado, M.E. Perez-Lorenzo, G. Frutos. A validated quantitative colorimetric assay for gentamicin. *Journal of Pharmaceutical and Biomedical Analysis.* **2000**. Vol.21. No.6. P.1149-1159.

[12] State Pharmacopoeia of the Russian Federation. XIII ed. *Ministry of Health of the Russian Federation. Moscow.* **2015**. Vol.1. 1470p. (Russian)

[13] Yu.A. Zolotov, V.M. Ivanov, V.G. Amelin. Chemical test methods of analysis. *Editorial URSS.* **2002**. 304p.

[14] V.M. Ivanov, O.V. Monogarova, K.V. Oskolok. Capabilities and prospects of the development of a chromaticity method in analytical chemistry. *Journal of Analytical Chemistry*. **2015**. Vol.70. No.10. P.1165-1178.

[15] E.I. Selifonova, I.V. Kosyreva, R.K. Chernova. Colorimetric determination of lysine after electrophoretic separation from a mixture of α-amino acids. *News of Saratov University. Chemistry. Biology. Ecology.* **2011**. Vol.11. P.33-38. (Russian)

[16] V.V. Apyari, S.G. Dmitrienko. Using a digital camera and computer data processing for the determination of organic substances with diazotized polyurethane foams. *Journal of Analytical Chemistry.* **2008**. Vol.63. No.6. P.530-537.

[17] A.V. Marakaeva, I.V. Kosyreva. Express analysis of amoxicillin via colorimetric testing. *Chem. Pap*. **2020**. Vol.74. P.2381-2388.

[18] Yu.V. Kholin, N.A. Nikitina, A.V. Panteleimonov, E.A. Reshetnyak, A.A. Bugaevsky, L.P. Loginova. Metrological characteristics of binary response detection techniques. *Timchenko*. **2008**. 128p. (Russian)
[19] Anastasiya V. Tumskaia, Vladislav S. Doronin, Irina V. Kosyreva, Sergey Yu. Doronin. Methods of express determination of gentamicin. *Butlerov Communications*. **2021**. Vol.67. No.8. P.79-88. DOI: 10.37952/ROI-jbc-01/21-67-8-79 (Russian)