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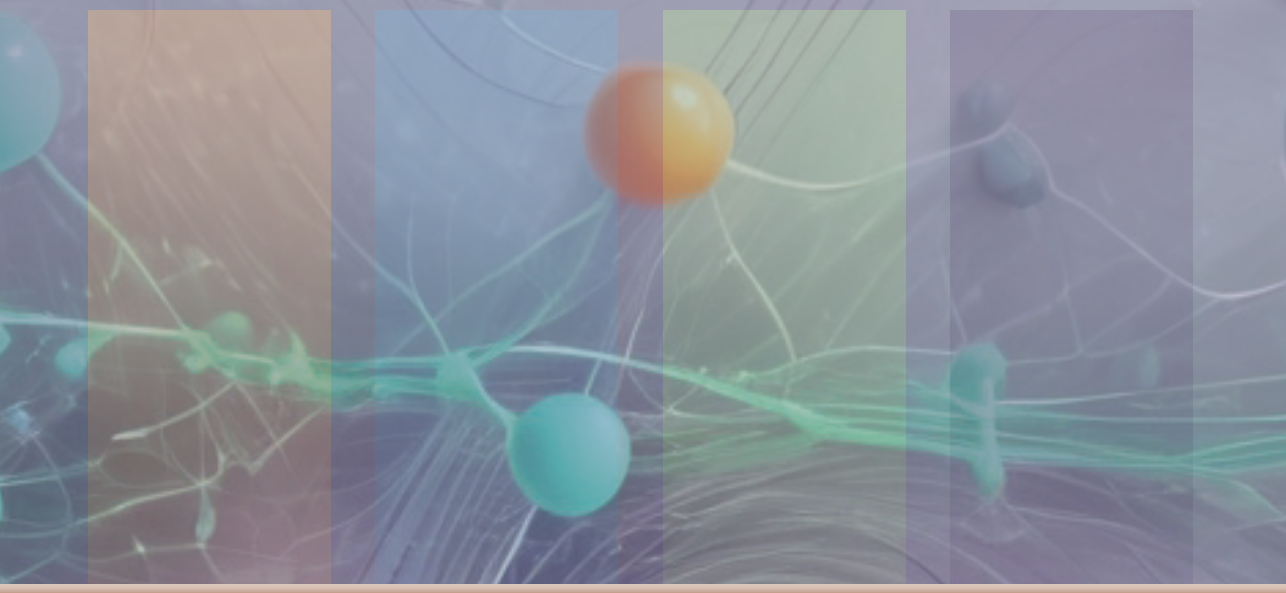

MODERN ASPECTS OF SCIENCE AND EDUCATION

COLLECTIVE MONOGRAPH

MODERN ASPECTS OF SCIENCE AND EDUCATION

Compiled by
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based on the materials of the scientific and practical online conference with international participation April 25, 2025

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based on the materials of the scientific and practical online conference with international participation on May 14, 2025

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Висновки. Ефективність – висока ефективність у лікуванні запальних шкірних захворювань. Безпечність – потребує моніторингу побічних ефектів та фотозахисту. Індивідуалізація – персоналізований підхід до вибору та дозування.

Бензоїлпероксид, ізотретиноїн та азелаїнова кислота є невід'ємними компонентами сучасної дерматологічної практики. Вони демонструють високу ефективність у лікуванні запальних шкірних захворювань і знаходять своє місце у програмах anti-age терапії. Проте їх застосування потребує уважного моніторингу можливих побічних ефектів та обов'язкового використання фотозахисту. Індивідуалізація підходу до вибору та дозування активних інгредієнтів дозволяє досягти максимального терапевтичного ефекту при мінімізації ризиків, що забезпечує високий рівень безпеки та задоволеності пацієнтів

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STANDARDIZED METHODS FOR ANALYSIS OF THE ACTIVE SUBSTANCE TRIAMCINOLOL IN VETERINARY

Triamcinolol or (11β,16α)-9-fluoro-11,16,17,21-tetrahydroxypregna-1,4-diene-3,20-dione is a synthetic glucocorticosteroid, which is used as an active pharmaceutical ingredient (API) in the form of salts: acetonide, benetonide, furetonide, hexacetonide and diacetate. Triamcinolol, together with other components, is used in the form of combination drugs and exhibits anti-inflammatory, antishock, antiallergic, and immunosuppressive effects. The production of high-quality and effective medicines to improve the quality

and prolong life, providing the best treatment is important not only for pharmaceutical practice, but also for veterinary medicine[1].

API used for the manufacture of medicinal products must meet all quality criteria. The quality, efficacy and safety of medicinal products for use in medical, pharmaceutical and veterinary practices are fundamental aspects. All stages of medicinal product analysis are controlled in accordance with established requirements of the European Medicines Agency (EMA) – https://www. ema. europa.eu/), the Food and Drug Administration (FDA—https://www.fda.gov/). Analysis of medicinal products of chemical origin is carried out according to Pharmacopoeias - the State Pharmacopoeia of Ukraine (SPU), the European Pharmacopoeia (Eur. Ph.), the British Pharmacopoeia (Br. Ph.), the United States Pharmacopoeia (USP). The literature describes the use of liquid chromatography (LC), mass spectrometry (MS), proton magnetic resonance (1H NMR spectra), or a combination of these methods in scientific studies of the substance triamcinolol[2].

The State Pharmacopoeia of Ukraine (SPU) does not regulate the analysis of the substance triamcinolol, medicinal products containing triamcinolol. The European Pharmacopoeia regulates the analysis of the substance triamcinolol, its salts – acetonide, hexacetonide[3]. Identification of triamcinolol and its acetonide and hexacetonide salts is carried out by methods of infrared absorption spectrophotometry (2.2.24) and thin-layer chromatography (TLC) (2.2.27) with detection in ultraviolet light at 254 nm. Triamcinolol hexacetonide is identified by the obtained chromatograms: the principal peak in the chromatogram of test solution is similar in retention time and size to the principal peak in the chromatogram of reference solution. In addition, all three compounds are identified by physical characteristics, for example, by the value of specific optical rotation (2.2.7). Purity and related compounds are determined

1 Argenti, D, Jensen, B.K., Hensel, R. et al. A mass balance study to evaluate the biotransformation and excretion of [14C]-triamcinolone acetonide following oral administration. J Clin Pharmacol. 2000; 40:770-780; McIntyre PW, Wu JL, Kolte R, Zhang R, Gregory RL, Bruzzaniti A, et al. The antimicrobial properties, cytotoxicity, and differentiation potential of double antibiotic intracanal medicaments loaded into hydrogel system. Clinical Oral Investigations. 2019; 23: 1051– 1059; Nagendrababu V, Murray PE, Ordinola-Zapata R, Peters OA, Rôças IN, Siqueira JF, et al. PRILE 2021 guidelines for reporting laboratory studies in Endodontology: a consensus-based development. International Endodontic Journal. 2021; 54: 1482–1490; Shi J, Lian H, Huang Y, Zhao D, Wang H, Wang C, et al. In vitro genotoxicity evaluation and metabolic study of residual glutaraldehyde in animal derived biomaterials. Regenerative Biomaterials. 2020; 7: 619–625.

2 Viral Maru, Manisha Rajan Madkaikar , Shumail Sattar, et al. Response of intra canal medicaments on viability and survival of SHEDs Response of intra canal medicaments on viability and survival of SHEDs. The Journal of Clinical Pediatric Dentistry. 2022. 46 (5). doi: 10.22514/jocpd.2022.009.

3 European Pharmacopoeia. (11-th ed.). Council of Europe, Strasbourg: EDQM. 2022. Vol. 3. P. 4266–4269.

using the LC method (2.2.29) with UV-spectrophotometric detection at 254 nm for triamcinolol acetonide and hexacetonide, at 238 nm for triamcinolol. The peculiarities of the chromatography conditions for the three compounds are the composition of the mobile phase and UV detection (tab.1)

Table 1

The chromatography conditions of Triamcinolol, Triamcinolol acetonide and Triamcinolol hexacetonide

Source: European Pharmacopoeia

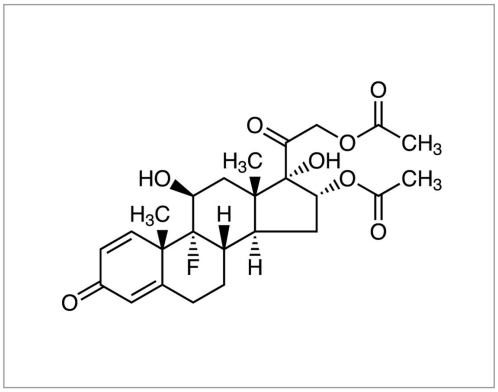
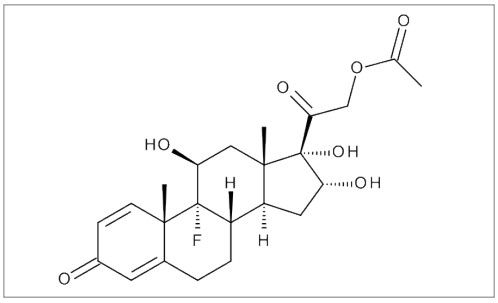
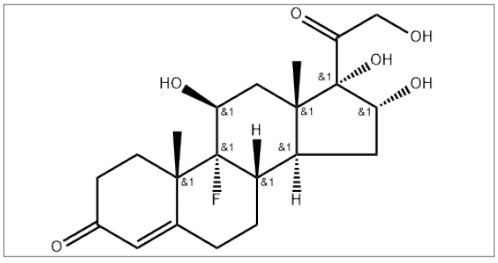
Chromatography conditions	Triamcinolol	Triamcinolol acetonide	Triamcinolol hexacetonide
Mobile phase	methanol R-water for chromatography R	mobile phase A: acetonitrile R-water for chromatography R; mobile phase B: water for chromatography R-acetonitrile R	water for chromato-graphy R-methanol R
Detection	238 nm	254 nm	254 nm
Flow rate	1.0 mL/min	1.5 mL/min	2.0 mL/min

Depending on the chemical structure and nature of the test compounds, their solubility, and the presence of certain functional groups, various organic solvents and their combinations are used for the mobile phase: methanol, water for chromatography, acetonitrile. The number and structure of impurities - related substances - depend on the characteristics of the chemical structure of compounds. For triamcinolone, three specific impurities A, B, C were tested: A. 9-fluoro-11β,17-dihydroxy-3,20-dioxopregna-1,4-diene16α,21-diyl diacetate (triamcinolone 16,21-diacetate), B. 9-fluoro-11β,16α,17-trihydroxy-3,20-dioxopregna-1,4-dien-21-yl acetate (triamcinolone 21-acetate), C. 9-fluoro-11β,16α,17,21-tetrahydroxypregn-4-ene-3,20- dione (pretriamcinolone). For triamcinolone acetonide, two specific impurities B, C were tested: B. 9-fluoro-11β,21-dihydroxy-16α,17-(1-methylethylidenedioxy)pregna-1,4,14-triene-3,20-dione(Δ14-triamcinoloneacetonide),C.9-fluoro-11β,21,21-trihydroxy-16α,17-(1-methylethylidenedioxy)pregna-1,4-diene-3,20-dione (triamcinolone acetonide 21-aldehyde hydrate). For triamcinolone hexacetonide, one specific impurity B was tested: B. (2′RS)-9-fluoro-11β-hydroxy-2′-methyl-3,20-dioxo- (16βH)-[1,3] dioxolo[4′,5′:16,17]pregna-1,4-dien-21-yl 3,3-dimethylbutanoate (tab.2).

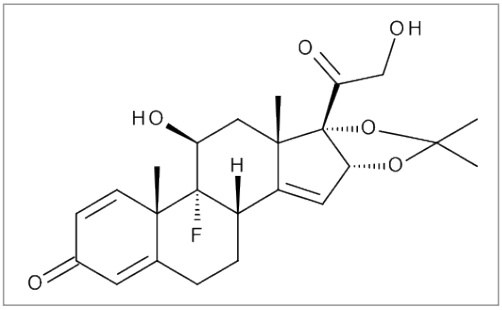
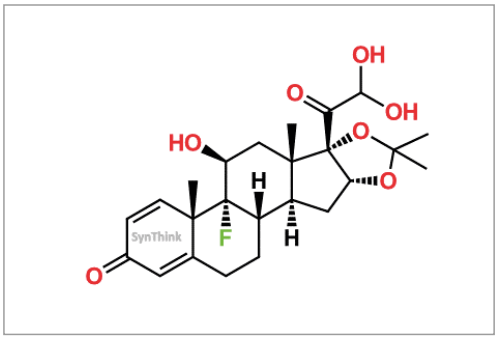
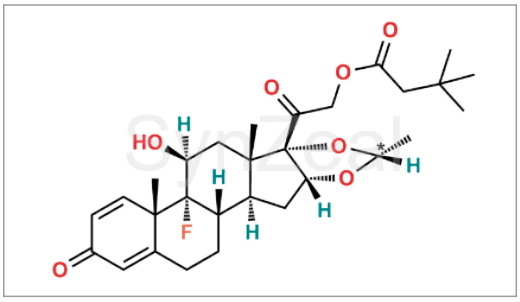
Table 2

Specific impurities of Triamcinolol and its derivatives

Source: European Pharmacopoeia

Substance	Specific impurities
1	2
Triamcinolol	 A.9-fluoro-11β,17-dihydroxy-3,20-dioxopregna-1,4-diene16α,21-diyl diacetate (triamcinolone 16,21-diacetate)  B.9-fluoro-11β,16α,17-trihydroxy-3,20-dioxopregna-1,4-dien-21-yl acetate (triamcinolone 21-acetate)  C.9-fluoro-11β,16α,17,21-tetrahydroxypregn-4-ene-3,20- dione (pretriamcinolone)

Continuation of table 2

1	2
Triamcinolol acetonide	 B.9-fluoro-11β,21-dihydroxy-16α,17-(1-methylethylidenedioxy)pregna-1,4,14-triene-3,20-dione (Δ14-triamcinolone acetonide)  C.9-fluoro-11β,21,21-trihydroxy-16α,17-(1-methylethylidenedioxy) pregna-1,4-diene-3,20-dione (triamcinolone acetonide 21-aldehyde hydrate)
Triamcinolol hexacetonide	 B.(2′RS)-9-fluoro-11β-hydroxy-2′-methyl-3,20-dioxo-(16βH)-[1,3]dioxolo[4′,5′:16,17]pregna-1,4-dien-21-yl 3,3-dimethylbutanoate

Identification of triamcinolone substances and its salts can be carried out using non-pharmacopoeial reactions on functional groups: keto, hydroxy, acetyl and unsaturated bonds. An important task remains the implementation of modern methods and their combinations: optical emission spectrometry with inductively coupled plasma (OES-ICP), plasma atomic emission spectrometry (PAES), mass spectrometry (MS) in the analysis of triamcinolol and its derivatives in order to increase the efficiency of the analysis[4].

4 4Welchinska O., Nizhenkovska I., Meleshko R. Suchasni pidkhody do farmatsevtychnoho analizu metodom *VERKH* alkaloyidu paklitakselu [Modern approaches to the pharmaceutical analysis by HPLC of paclitaxel alkaloid]. *Fitoterapiia. Chasopys – Phytotherapy. Journal*, 2024, 3, 168–174, DOI: https://doi.org/10.32782/2522-9680-2024-3-168; Welchinska O., Meleshko R., Nizhenkovska I. Using the HPLC method to study a mixture of substances containing acyclovir and hydrocortisone. *Modern medicine, pharmacy and psychological health*. Kyiv, 2024. 3 (17). P. 51-59 [in Ukrainian]

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СУЧАСНИЙ ФАРМАЦЕВТИЧНИЙ АНАЛІЗ: ІМПЛЕМЕТАЦІЯ ВИСОКОЕФЕКТИВНИХ ІНСТРУМЕНТАЛЬНИХ МЕТОДІВ

Світова фармацевтична промисловість зосереджена на розробці та виробництві найякісніших ліків для підвищення якості та подовження життя, забезпечення пацієнтів найкращим лікуванням. Процес створення лікарського засобу включає послідовні етапи, починаючи із скринінгу та ідентифікації потенційних сполук-кандидатів на лікарський засіб, оцінки біологічної активності та токсичності, аналізу лікарського засобу та визначення домішок, доклінічних та клінічних досліджень, фінального