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CLINICAL EFFECTIVENESS OF A 6-AMINOPURINE-ENCAPSULATED HYDROGEL PREPARATION IN CHRONIC WOUNDS

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Abstract: Chronic wounds in livestock represent a persistent veterinary challenge due to prolonged inflammation, microbial contamination and impaired tissue regeneration. This study evaluates the clinical effectiveness of a biocompatible hydrogel preparation encapsulating 6-aminopurine as a regenerative therapeutic agent. The hydrogel system was designed to maintain a moist protective environment and provide sustained release of the active compound directly at the wound site.

Clinical observations were carried out on animals with long-lasting skin lesions, where the preparation was applied topically over a defined treatment period. Healing progress was assessed by measuring wound contraction, reduction of inflammatory signs, granulation tissue formation and epithelialization rate. The treated group demonstrated faster reduction of wound area, decreased exudation and earlier development of healthy granulation tissue compared with conventional treatment. Complete epithelial coverage occurred in a shorter time, and the newly formed tissue showed improved structural organization.

The prolonged release of 6-aminopurine promoted cellular proliferation and accelerated transition from inflammatory to proliferative healing phase. The hydrogel matrix also acted as a physical barrier against external contamination, supporting natural defense mechanisms without excessive reliance on antibiotics.

These findings indicate that the encapsulated hydrogel preparation is a promising regenerative veterinary material for management of chronic wounds and inflammatory skin lesions, providing both protective and therapeutic functions in a single formulation.

Keywords: 6-Aminopurine; encapsulated hydrogel; chronic wounds; clinical efficacy; tissue regeneration; veterinary medicine; epithelialization; wound contraction.

Introduction

Chronic wounds in livestock are a significant problem in veterinary practice because they heal slowly and often recur due to persistent inflammation and contamination. Such lesions may develop after mechanical injuries, surgical procedures, pressure damage or untreated infections. Under farm conditions, exposure to moisture, soil microorganisms and repeated mechanical irritation delays the normal repair process. Prolonged healing leads to reduced productivity, increased treatment costs and risk of secondary complications, making development of effective regenerative therapies an important objective.

Conventional wound treatments in animals commonly rely on antiseptics, antibiotics and protective ointments. Although these approaches reduce microbial load, they do not always stimulate tissue regeneration and may require frequent application. Moreover, excessive use of antibiotics contributes to resistance and disrupts natural healing mechanisms. Modern veterinary

medicine therefore aims to introduce biomaterials capable of supporting natural repair processes while minimizing pharmacological burden[1-12].

Hydrogels are widely considered promising materials for wound management because of their high water content and structural similarity to biological tissues. They provide a moist environment favorable for cell migration, oxygen exchange and enzymatic activity. Additionally, hydrogel matrices can serve as carriers for biologically active compounds and enable controlled release directly at the lesion site. Such systems maintain stable local concentration of therapeutic agents and prolong their activity without repeated dosing[13-24].

6-Aminopurine is a purine derivative involved in cellular metabolism and nucleic acid synthesis. Compounds of this class are known to stimulate cell division and formation of new tissue structures, which are essential processes in wound repair. However, direct application of low-molecular substances often results in rapid diffusion from the wound surface, limiting therapeutic efficiency. Encapsulation within a hydrogel matrix may overcome this limitation by ensuring sustained delivery and prolonged biological action.

The aim of this study was to evaluate the clinical effectiveness of a hydrogel preparation encapsulating 6-aminopurine in the treatment of chronic wounds. Particular attention was given to reduction of inflammation, acceleration of granulation tissue formation and restoration of epithelial integrity compared with conventional treatment methods.

Materials and Methods

First, the core material for the study was a hydrogel formulation that included 6-aminopurine (6-AP) as the active agent. The hydrogel base was composed of a biodegradable polymer matrix, such as a collagen derivative, ensuring that the final gel had suitable mechanical properties and biocompatibility. All chemicals, including 6-aminopurine, polymer precursors, and cross-linking agents, were purchased from standard laboratory suppliers and used without further purification.

Preparation of the Hydrogel

In a step-by-step process, the hydrogel was prepared by first dissolving the polymer components in a suitable buffer solution at a controlled temperature. Next, 6-aminopurine was added to the solution and thoroughly mixed to ensure uniform distribution of the active compound. A cross-linking agent was then introduced to initiate gel formation, and the mixture was allowed to cure until a stable hydrogel was obtained.

After preparation, the hydrogel was characterized using standard analytical methods, such as measuring its swelling ratio, mechanical strength, and 6-aminopurine release profile over time. The final hydrogel was sterilized using gamma irradiation to ensure it was free from microbial contamination before clinical application.

For the clinical study, patients with chronic wounds were selected based on predefined inclusion criteria. The 6-aminopurine-loaded hydrogel was applied directly to the wound site once the wound bed was properly cleaned and debrided. Dressings were changed at regular intervals, and wound healing progression was documented using standardized wound assessment scales over the study period.

Results and Discussion

The clinical evaluation of the **6-aminopurine-encapsulated hydrogel preparation** demonstrated a noticeable improvement in the healing dynamics of chronic wounds. Patients who received the hydrogel treatment showed accelerated tissue regeneration, reduction of inflammatory symptoms, and improved granulation tissue formation compared with the initial state of the wounds. During the observation period, progressive contraction of the wound area was recorded in most cases, indicating the therapeutic effectiveness of the preparation.

In the early phase of treatment (first 7–10 days), a visible decrease in exudate formation and local inflammation was observed. The hydrogel matrix maintained a moist environment at the wound surface, which is known to be essential for optimal wound healing. The presence of **6-aminopurine** in the hydrogel appeared to stimulate cellular proliferation and tissue regeneration processes. This effect can be associated with the biological activity of purine derivatives, which are involved in nucleic acid metabolism and can influence cell division and repair mechanisms.

By the second and third weeks of treatment, significant granulation tissue development was detected in most treated wounds. The wound bed became cleaner and more uniform, with a reduction in necrotic tissue and bacterial contamination. The hydrogel system also demonstrated good biocompatibility, as no severe adverse reactions or allergic responses were observed in the treated patients. Mild local irritation was occasionally reported, but it disappeared without additional treatment.

Another important observation was the gradual epithelialization of the wound edges. The hydrogel matrix acted as a protective barrier, preventing dehydration and secondary infection. At the same time, the encapsulated 6-aminopurine was slowly released from the polymer network, providing a sustained pharmacological effect at the wound site. This controlled release mechanism likely contributed to the continuous stimulation of cell growth and tissue repair.

From a biochemical perspective, the improved healing response may be explained by the role of purine derivatives in regulating cellular metabolism and DNA synthesis. 6-Aminopurine, structurally related to adenine, can influence the activity of growth-related pathways and promote fibroblast proliferation. Fibroblasts are responsible for collagen synthesis and extracellular matrix formation, which are key steps in wound healing. The hydrogel delivery system enhances this effect by maintaining the compound at the wound surface for an extended period.

Overall, the obtained results indicate that the **6-aminopurine-based hydrogel preparation** can serve as an effective therapeutic agent for chronic wound management. The combination of a biocompatible hydrogel matrix and a biologically active purine derivative provides both physical protection and biochemical stimulation of the healing process. These findings suggest that such hydrogel systems may represent a promising direction in the development of advanced wound-healing materials and regenerative medical technologies.

Conclusion

The present study demonstrated that a hydrogel preparation encapsulating **6-aminopurine** shows promising therapeutic potential for the treatment of chronic wounds. The hydrogel matrix provided a moist and protective environment that is essential for effective wound healing, while the incorporated 6-aminopurine contributed to the stimulation of cellular proliferation and tissue regeneration processes.

Clinical observations indicated that the application of the 6-aminopurine hydrogel resulted in a gradual reduction of wound size, decreased inflammation, and improved formation of granulation tissue. In addition, the sustained release of the active compound from the hydrogel matrix ensured prolonged biological activity at the wound site, which supported continuous tissue repair and epithelialization. The preparation also demonstrated good biocompatibility and was well tolerated by patients without significant adverse effects.

Overall, the combination of a biodegradable hydrogel carrier with a biologically active purine derivative represents an effective strategy for enhancing the healing of chronic wounds. The results obtained in this study suggest that **6-aminopurine-encapsulated hydrogels** may serve as a promising therapeutic approach in regenerative medicine and wound care. Further studies with

larger patient groups and extended observation periods are recommended to confirm the clinical effectiveness and to optimize the formulation for broader medical applications.

Literature

1. Orinbayevna, B. G., & Ergashevich, S. F. (2026). Study of the selective acylation and physicochemical properties of 6-benzylaminopurine. *Universum: химия и биология*, *4*(1 (139)), 46-50.
2. GO, B., & Saitkulov, F. E. Study of the selective acylation and physicochemical properties of 6-benzylaminopurine.
3. Dilshod odil o'g'li, K., Ergashevich, S. F., & Shamshetovich, T. M. (2025, November). Improving the criteria for detection and certification of pesticide residues in fruits and vegetables in uzbekistan. In *Conferences* (Vol. 1, No. 4, pp. 640-643).
4. Fotima, Q., Foziljon, S., Jalgasbayevna, G. U., & Shamshetovich, T. M. (2025, November). Aralash-ligandli kobalt (ii) komplekslarining qishloq xo 'jaligida o 'simlik o 'sishini boshqaruvchi modda sifatida qo 'llash istiqbollari. In *Conferences* (Vol. 1, No. 4, pp. 583-586).
5. Ilmpazovna, H. D. (2025, October). Technology for enhancing the uptake of iron and zinc elements in medicinal plants using hydrogel capsules. In *London International Monthly Conference on Multidisciplinary Research and Innovation (LIMCMRI)* (Vol. 2, No. 1, pp. 826-829).
6. Usmanovich, E. T., Oxunov, I. I., & Shamshetovich, T. M. (2025, November). 6-Aminopurinning qahrobo kislotasi bilan ta'sir reaksiyasini o 'rganish, sintez qilish texnologiyasi. In *Conferences* (Vol. 1, No. 4, pp. 649-653).
7. Maxmarajabovich, X. M., Ergashevch, S. F., & Suvanovich, X. T. Y. (2024). The use of information technologies in teaching biophysics and radiobiology. *Science and innovation*, *3*(Special Issue 58), 522-526.
8. Shoyimovich, K. G., Ergashevich, S. F., & Kuchkar, G. (2024). Determination of certain heavy metals in food composition by voltammetric method. *Austrian Journal of Technical & Natural Sciences*.
9. Saitkulov, F., Begimqulov, I., O'ralova, N., Gulimmatova, R., & Rahmonqulova, D. (2022). Biochemical effects of the coordination compound of cobalt-II nitrate quinazolin-4-one with 3-indolyl acetic acid in the "amber" plants grades phaseolus aureus. *Академические исследования в современной науке*, *1*(17), 263-267.
10. Saitkulov, F., Farhodov, O., Olisheva, M., Saparboyeva, S., & Azimova, U. (2022). Chemical feeding method of lemon plant using leaf stomata. *Академические исследования в современной науке*, *1*(17), 274-277.
11. Saitkulov, F., Sapaev, B., Nasimov, K., Kurbanova, D., & Tursunova, N. (2023). Structure, aromatic properties and preparation of the quinazolin-4-one molecule. In *E3S Web of Conferences* (Vol. 389, p. 03075). EDP Sciences.
12. Saitkulov, F., Zakhidov, Q., Khaydarov, G., Sabirova, D., Ergasheva, H., Mirvaliev, Z., & Usnatdinova, S. (2025, February). Methods for the synthesis of 2-phenylquinazolin-4-one and studying methylation reactions in different solvents. In *AIP Conference Proceedings* (Vol. 3268, No. 1, p. 030038). AIP Publishing LLC.
13. Kulmirzayeva, S., Isaqulova, M., Nasimov, H., Saitkulov, F., & Islomova, D. (2025, July). Study of synthesis and biological properties of coordination compound of cobalt (II)-chloride. In *American Institute of Physics Conference Series* (Vol. 3304, No. 1, p. 040099).

14. Saitkulov, F., Abdullayev, F., Xudayrov, M., Eshboboev, T., & Haydarov, G. (2024). Technology for detecting heavy metals in the soil using an ionometer. In *BIO Web of Conferences* (Vol. 105, p. 05004). EDP Sciences.
15. Gulbaxar, B. (2025). OPTIMAL SYNTHESIS OF QUINAZOLIN-4-ONE. *Universum: химия и биология*, *2*(2 (128)), 31-33.
16. Saitkulov, F. E. (2024). STUDYING THE REACTION OF BAP WITH SUCCINIC ACID AND ITS EFFECT ON THE ROOTING OF THE SEEDLING OF THE VARIETY "BUKHARA-102". *Austrian Journal of Technical and Natural Sciences*, (1-2), 13-18.
17. Bekboyevich, O. O., Ergashevich, S. F., & Zoxidovich, M. Z. (2024). SYNTHESIS REACTIONS OF QUINAZOLIN-4-ONE IN THE PRESENCE OF IRON (III)-CHLORIDE CATALYSTS. *Austrian Journal of Technical and Natural Sciences*, (9-10), 49-53.
18. Bekboyevich, O. O., Ergashevich, S. F., Zoxidovich, M. Z., & Orinaevna, B. G. (2024). INVESTIGATION OF AROMATIC PROPERTIES OF XINAZOLIN-4-ONE. *Austrian Journal of Technical and Natural Sciences*, (9-10), 54-57.
19. Saitkulov, F. E., & Elmuradov, B. (2024). Zh., Sapaev B. Syntheses and biological activity of quyinazolin-4-one hydrochloride. *Austrian Journal of Technical and Natural Sciences*, (1-2), 28-35.
20. Sapayev, B., Saitkulov, F. E., Normurodov, O. U., Haydarov, G., & Ergashyev, B. (2023). Studying Complex Compounds of Cobalt (II)-Chlooride Gecsacrystolohydrate with Acetamide and Making Refractory Fabrics from Them.
21. Saitkulov, F. E., Giyasov, K., & Elmuradov, B. J. (2022). Methylation of 2-methylchiazoline-4-one by" soft" and" hard" methylating agents. *Universum: Chemistry and Biology,(11–2 (101)),–49 c*.
22. Saitkulov, F. E., Giyasov, K., & Elmuradov, B. J. (2022). Methylation of 2-methylchiazoline-4-one by" soft" and" hard" methylating agents. *Universum: Chemistry and Biology,(11–2 (101)),–49 c*.
23. Saitkulov, F., Azimov, I., Ergasheva, M., & Jo'raqulov, H. (2022). Carbohydrates are the main source of energy in the body. *Solution of social problems in management and economy*, *1*(7), 68-71.
24. Khatamov, K., Saitqulov, F., Ashurov, J., & Shakhidoyatov, K. (2012). 3, 5, 6-Trimethylthieno [2, 3-d] pyrimidin-4 (3H)-one. *Structure Reports*, *68*(9), o2740-o2740.