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IMMOBILIZATION OF 9-ISOPROPYL-6-BENZYLAMINOPURINE INTO A HYDROGEL MATRIX AND TECHNOLOGY OF ITS APPLICATION AS A MOISTURE-CONTROLLING SYSTEM FOR FRUITS

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Abstract. This study is devoted to preserving the quality and extending the storage life of *Malus domestica* Borkh. cv. Crimson apples during the postharvest period through the development of a synergistic moisture-regulating and physiological aging-delaying system based on the immobilization of a 0.001% solution of 9-isopropyl-6-benzylaminopurine into a hydrogel matrix. In the course of the research, a polymer-based hydrogel was used as a carrier system to ensure the gradual and controlled release of the bioactive cytokinin derivative into the microenvironment surrounding the fruit. The obtained results demonstrated that the immobilized preparation effectively slowed transpiration processes, reduced moisture loss, and suppressed biochemical reactions associated with physiological aging. As a consequence, the firmness, external appearance, and overall quality of apple fruits remained stable throughout the storage period, while losses caused by shriveling and decay were significantly reduced. The proposed technology exhibited high efficiency even at low concentrations and, due to its ecological safety and economic affordability, represents an important scientific and practical advancement in modern postharvest fruit preservation technologies.

Keywords: Malus domestica Borkh. cv. Crimson; postharvest period; 9-isopropyl-6-benzylaminopurine; 0.001% solution; hydrogel matrix; immobilization; cytokinin; moisture regulation; physiological aging; fruit storage.

Аннотация. Настоящее исследование направлено на сохранение качества и продление срока хранения плодов яблони *Malus domestica* Borkh. cv. Crimson в постхарвестный период. В работе разработана синергическая система регулирования влагообмена и замедления физиологического старения, основанная на иммобилизации 0,001%-ного раствора 9-изопропил-6-бензиламинопурина в гидрогелевой матрице. В качестве носителя использован полимерный гидрогель, обеспечивающий постепенное и контролируемое высвобождение биоактивного производного цитокинина в окружающую плоды среду. Полученные результаты показали, что иммобилизованный препарат замедляет процессы транспирации, снижает потери влаги и ослабляет биохимические процессы, связанные с физиологическим старением плодов. В результате в процессе хранения сохраняются твердость, внешний вид и общее качество яблок, а также

уменьшаются потери, обусловленные усыханием и гниением. Предложенная технология характеризуется высокой эффективностью при низкой концентрации, экологической безопасностью и экономической доступностью, что определяет её важное научно-практическое значение для современных постхарвестных технологий хранения плодов.

Ключевые слова: Malus domestica Borkh. cv. Crimson; постхарвестный период; 9-изопропил-6-бензиламинопурин; 0,001%-ный раствор; гидрогелевая матрица; иммобилизация; цитокинин; регулирование влагообмена; физиологическое старение; хранение плодов.

Annotatsiya. Mazkur tadqiqot *Malus domestica* Borkh. cv. Crimson olma navining postharvest davrida sifatini saqlash va saqlash muddatini uzaytirishga qaratilgan. Tadqiqotda 9-izopropil-6-benzilaminopurinning 0,001%li eritmasini gidrogel matritsasiga immobilizatsiya qilish asosida namlikni boshqaruvchi hamda fiziologik qarishni kechiktiruvchi sinergik tizim ishlab chiqildi. Polimer asosli gidrogel tashuvchi sifatida qo‘llanilib, biofaol sitokinin hosilasining meva atrofidagi mikro-muhitga asta-sekin va nazorat ostida ajralishi ta’minlandi. Olingan natijalar immobilizatsiyalangan preparat transpiratsiya jarayonlarini sekinlashtirishi, namlik yo‘qotilishini kamaytirishi hamda fiziologik qarish bilan bog‘liq biokimyoviy reaksiyalarni susaytirishini ko‘rsatdi. Natijada mevalarning qattiqligi, tashqi ko‘rinishi va umumiy sifati saqlash davomida barqaror saqlanib qolgan, qurish va chirish tufayli yuzaga keladigan yo‘qotishlar esa sezilarli darajada kamaygan. Taklif etilgan texnologiya past konsentratsiyalarda yuqori samaradorlik, ekologik xavfsizlik va iqtisodiy jihatdan maqbulligi bilan zamonaviy postharvest meva saqlash texnologiyalari uchun muhim ilmiy-amaliy аҳамият касб этади.

Kalit so‘zlar: Malus domestica Borkh. cv. Crimson; postharvest davri; 9-izopropil-6-benzilaminopurin; 0,001 % li eritma; gidrogel matritsasi; immobilizatsiya; sitokinin; namlikni boshqarish; fiziologik qarish; mevalarni saqlash.

INTRODUCTION.

Preservation of the quality of agricultural products, especially fruits, during the postharvest period and reduction of storage losses are among the most important challenges of modern agricultural technology. According to statistical data, a significant portion of harvested fruits becomes unsuitable for consumption due to moisture loss, physiological aging, and microbiological deterioration during storage and transportation processes. Therefore, the development of effective and economically feasible technologies aimed at regulating moisture, maintaining tissue firmness, and delaying senescence processes in fruits is of considerable scientific and practical importance [1–24].

ISSN 3030-3907

The selected research object, *Malus domestica* Borkh. cv. Crimson apple variety, is distinguished by its attractive appearance, bright coloration, and high consumer demand, belonging to the premium market segment. The high commercial value of this cultivar makes storage-related losses caused by dehydration, decay, and quality deterioration economically more significant. Consequently, the development of effective technologies for preserving quality, reducing moisture loss, and delaying physiological aging during the postharvest period of Crimson apples is relevant not only scientifically but also economically. The proposed hydrogel-based bioactive system is intended to maximize the preservation of the market value of this valuable cultivar [1–10].

Apple fruits, particularly *Malus domestica* cultivars, are highly susceptible to water loss and rapid physiological aging during the postharvest period. Reduction in moisture content leads to mass loss, tissue softening, and deterioration of external appearance. Although conventional storage methods such as low-temperature storage, high relative humidity, and controlled atmosphere technologies provide certain effectiveness, they often require high energy consumption and substantial financial costs. Therefore, there is a growing need for environmentally safe, low-dose, and highly efficient alternative approaches [11–24].

In recent years, plant growth regulators have been recognized as promising substances for controlling postharvest physiology of fruits. The synthesized bioactive, environmentally safe, and low-cost compounds are characterized by their ability to stabilize cellular metabolism, slow down protein and chlorophyll degradation, and delay senescence processes. From this perspective, 6-benzylaminopurine and its derivatives have attracted considerable scientific and practical interest for maintaining fruit quality during postharvest storage. However, when applied in free form, these compounds may exhibit only short-term effects and may create problems related to dosage control.

To address these limitations, immobilization of bioactive substances within hydrogel matrices is considered an effective solution. Hydrogels possess high water-retention capacity, allowing stabilization of the microenvironment surrounding fruits and controlled release of bioactive compounds. In particular, immobilization of 9-isopropyl-6-benzylaminopurine into a hydrogel matrix is expected to generate a synergistic effect through simultaneous moisture regulation and prolonged cytokinin activity.

In this context, the present study is devoted to the development of a novel and effective technology based on the immobilization of a 0.001% solution of 9-isopropyl-6-benzylaminopurine into a hydrogel matrix for maintaining the quality

ISSN 3030-3907

of apple fruits during the postharvest period, reducing moisture loss, and delaying physiological aging.

MATERIALS AND METHODS.

The *Malus domestica* Borkh. cv. Crimson apple cultivar was selected as the research object. Fruits intended for the experiment were harvested at the stage of technical maturity without mechanical damage, disease symptoms, and with uniform size and weight characteristics. Prior to the experiments, all fruits were visually inspected, and only homogeneous samples with similar quality parameters were selected.

Pure 9-isopropyl-6-benzylaminopurine was used as the bioactive compound in the experimental studies. This compound is characterized by its ability to regulate plant cell division and delay senescence processes. As a carrier system for the bioactive substance, a polymer-based superabsorbent hydrogel composed of polyacrylic acid and polyvinyl alcohol was employed. All chemical reagents used in the experiments were of analytical grade, and distilled water was used for the preparation of all solutions.

A 0.001% aqueous solution of the bioactive compound was prepared using distilled water. The solution was mixed with a magnetic stirrer until complete homogenization and stabilized at room temperature for 30 min prior to application. This procedure ensured complete dissolution of the bioactive substance and stabilization of the physicochemical properties of the solution.

For immobilization of the bioactive compound into the hydrogel matrix, the hydrogel was first completely swollen in distilled water and subsequently saturated with the prepared 0.001% solution of 9-isopropyl-6-benzylaminopurine. The immobilization process was carried out at 20–25 °C for 12 h. After completion of the process, excess solution was removed from the hydrogel until a moist state without free water release was achieved. The obtained bioactive hydrogel was further prepared in sachet form for convenience during subsequent experimental applications.

The experimental design included the following variants: (1) control variant — fruits stored without hydrogel and bioactive compound treatment; (2) hydrogel variant — fruits treated with hydrogel without the bioactive compound; and (3) hydrogel + 9-isopropyl-6-benzylaminopurine (0.001%) variant — fruits treated with the bioactive compound immobilized within the hydrogel matrix. Each experimental variant was conducted with at least three replications ($n \geq 3$).

RESULTS AND DISCUSSION.

During the storage period, the quality parameters of *Malus domestica* Borkh. cv. Crimson apple fruits differed significantly depending on the experimental variants. The obtained results demonstrated that the combined

ISSN 3030-3907

application of hydrogel and bioactive compound contributed to maintaining the physiological stability of the fruits.

At the end of the storage period, the control variant exhibited a fruit weight loss of 7.8 ± 0.3%. In the variant treated only with hydrogel, this parameter decreased to 6.2 ± 0.2%, indicating a statistically significant difference compared to the control ($p \leq 0.05$). The lowest weight loss was recorded in the hydrogel + 9-isopropyl-6-benzylaminopurine (0.001%) variant, amounting to 5.1 ± 0.2% ($p \leq 0.05$) (Table 1).

Table 1

Quality parameters of *Malus domestica* Borkh. cv. Crimson apple fruits at the end of the storage period

№	Experimental variant	Weight loss, %	Reduction in fruit firmness, %	Physiological damage, %
1	Control	7,8 ± 0,3	18,0 ± 0,7	22,4 ± 1,2
2	Hydrogel	6,2 ± 0,2	13,1 ± 0,6	16,3 ± 1,0
3	Hydrogel + 9-izopropil-6-benzilaminopurin (0,001 %)	5,1 ± 0,2	8,2 ± 0,5	9,1 ± 0,8

Although fruit firmness decreased during storage in all experimental variants, the degree of reduction varied considerably. In the control variant, firmness decreased by 18%, whereas in the hydrogel-treated variant the reduction was approximately 13%. When the hydrogel containing immobilized bioactive compound was applied, the reduction in firmness was only about 8%. Statistical analysis confirmed that the third variant had a significant advantage over the control ($p \leq 0.05$) (Figure 1).

The observed effect may be explained by the synergistic action of the hydrogel matrix and the cytokinin derivative. The hydrogel maintained a stable moisture microenvironment around the fruits, reducing transpiration intensity, while 9-isopropyl-6-benzylaminopurine likely slowed metabolic and senescence-related biochemical processes. As a result, tissue degradation and softening processes were considerably delayed.

Physiological damage, including shriveling, surface browning, and decay symptoms, was also significantly reduced in the treated variants. The highest level of physiological damage was observed in the control fruits (22.4 ± 1.2%), while hydrogel application alone reduced this parameter to 16.3 ± 1.0%. The hydrogel containing immobilized 9-isopropyl-6-benzylaminopurine demonstrated the greatest protective effect, decreasing physiological damage to 9.1 ± 0.8%.

ISSN 3030-3907

These findings indicate that immobilization of 9-isopropyl-6-benzylaminopurine into a hydrogel matrix represents an effective approach for improving postharvest preservation of apple fruits. The proposed system combines moisture regulation with prolonged cytokinin activity, thereby providing enhanced storage stability and reducing postharvest losses.

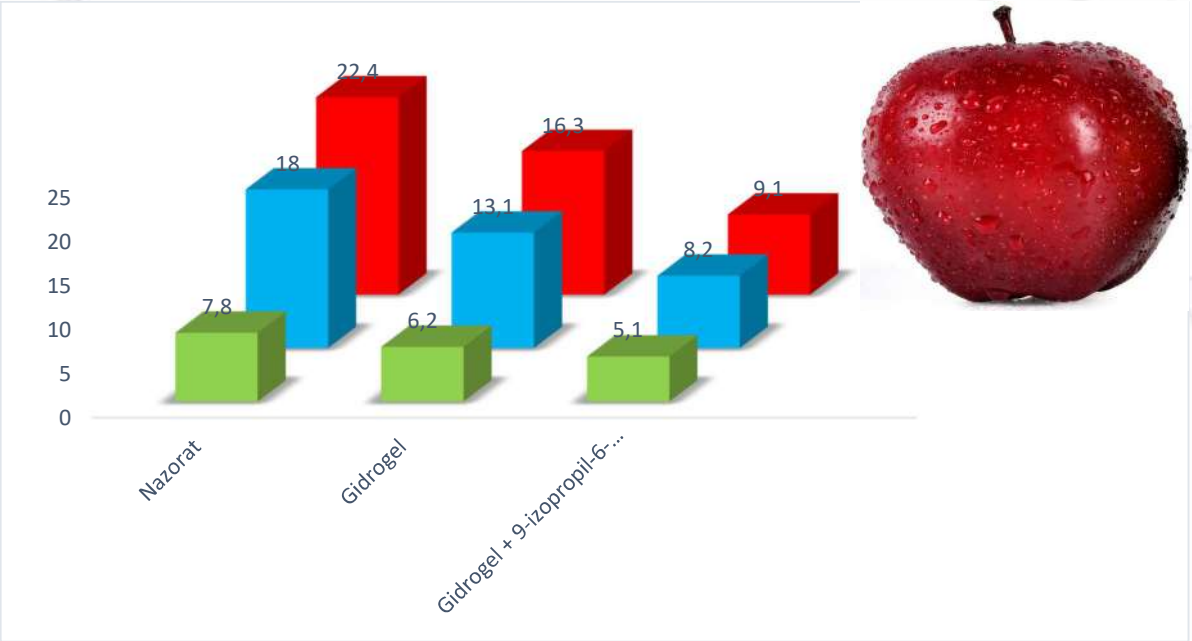


Figure 1. Quality indicators of *Malus domestica* Borkh. cv. Crimson apple fruits at the end of the storage period.

Analysis of external appearance and physiological damage demonstrated that by the end of the storage period, 22–25% of fruits in the control variant exhibited shriveling and discoloration symptoms. In the hydrogel-treated variant, this parameter decreased to 15–18%, whereas in the hydrogel + bioactive compound variant it did not exceed 8–10%. This effect can be explained by the cytokinin-related senescence-delaying activity of the bioactive compound.

Analysis of variance (ANOVA) revealed statistically significant differences among the experimental variants for all major quality parameters ($p \leq 0.05$). In particular, the parameters related to weight loss and fruit firmness demonstrated the most stable and favorable results when the hydrogel containing immobilized bioactive compound was applied.

The obtained results indicate that immobilization of the bioactive compound within the hydrogel matrix in sachet form ensured its gradual release and provided prolonged and stable physiological effects on the fruits. This approach prevented rapid degradation of the bioactive compound and significantly improved storage efficiency.

Overall, the hydrogel-immobilized 9-isopropyl-6-benzylaminopurine (0.001%) treatment was identified as the most effective variant for maintaining

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apple fruit quality during storage by keeping weight loss within the 5–8% range, preserving fruit firmness, and stabilizing external quality characteristics.

CONCLUSION.

The conducted studies demonstrated that immobilization of 9-isopropyl-6-benzylaminopurine into a hydrogel matrix represents an effective technological solution for maintaining the physiological stability of fruits during the postharvest period. The developed hydrogel system possesses gradual and controlled moisture-release properties, which contribute to maintaining optimal water balance within fruit tissues.

It was established that the immobilized state of the bioactive compound within the hydrogel matrix prevents its rapid degradation and ensures prolonged activity at low concentrations. As a result, fruit weight loss was significantly reduced, tissue firmness was preserved, and physiological aging processes were delayed. The combined application of hydrogel and 9-isopropyl-6-benzylaminopurine exhibited considerably higher efficiency compared to the individual treatments.

The obtained results confirm that the developed technology is environmentally safe, economically feasible, and practically convenient. The proposed hydrogel-based moisture-regulating system may therefore be recommended as a promising approach for preservation of high-value fruit cultivars, reduction of postharvest losses, and further development of modern postharvest agro-technologies.

REFERENCES

1. Saitkulov, F., Xudayarov, M., Eshboboyev, T., Oxunov, I., & Amanov, R. (2025, July). Coordination compounds of manganese salt with acetamide and study of biochemical properties of the cotton variety" Sultan" plant. In *American Institute of Physics Conference Series* (Vol. 3304, No. 1, p. 040098).

2. 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).

3. Kudratov, G. O., Elmuradov, B., Saitkulov, F., Mirvaliev, Z., Ibragimov, A., Karimov, S., & Karimov, B. (2025, February). Synthesis of urea derivatives based on toluyl isocyanate. In *AIP Conference Proceedings* (Vol. 3268, No. 1, p. 040031). AIP Publishing LLC.

4. 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

ISSN 3030-3907

solvents. In *AIP Conference Proceedings* (Vol. 3268, No. 1, p. 030038). AIP Publishing LLC.

5. Oripov Oybek Bekboyevch (Author) Khaydarov Gayrat Shoyimovich, Saitkulov Foziljon Ergashevich, Mirvaliyev Zoid Zohidovich, Giyasov Kuchkar, Eshboboev Turaqul Usmanovich. Carotenoids inPlant-Based Food Systems. Journal of Chemical Health Risks JCHR (2025) 15(2), 84-98| ISSN:2251-6727.
6. Arzanov Ravshan Xurramovich Zulpanov Fazliddin Abduxakimovich, Saitkulov Foziljon Ergashevich, Elmuradov Burxon Jurayevich. Austrian Journal of Technical and Natural Sciences» 2025 y. 11-12.
7. Saitkulov Foziljon Ergashevich Fayzullozoda Hasanboy Muhiddin o‘g‘li, Khaydarov Gayrat Shoyimovich, Baymuratova Gulbaxar Orinbaevna. Austrian Journal of Technical and Natural Sciences.
8. Giyasov Kuchkar Ashurova Zuxra Bahodir qizi, Khaydarov Gayrat Shoyimovich, Saitkulov Foziljon Ergashevich. Determination Of Certain Heavy Metals In Food Composition By Voltammetric Method. Austrian Journal of Technical and Natural Sciences. 2025 y. p.47-51
9. Qayumova F. Saitkulov F. Synthesis Of Coordination Compounds Based On Cobalt(Ii) Salts And Quinazolin-4-One And The Study Of Their Biological Activity. Universum: химия и биология : электрон. научн. журн. 2025. 2(128).
10. Tolipovna, Z. U., Maxsumovna, M. N., Kudratovna, K. N., & Ergashevich, S. F. (2025). OXIDATION OF POLYPRENOLS IN VITIS VINIFERA L. LEAVES. *Austrian Journal of Technical and Natural Sciences*, (3-4), 87-90.
11. Oripov O.B. Saitkulov F.E. Mirvaliev Z.Z. Giyasov K. Quinazolin-4-Thione Synthesis And Evaluation Of Its Effective Synthesis Technique. Universum: химия и биология : электрон. научн. журн. 2024. 11(125)
12. Sapaev, B., Saitkulov, F. E., Abdinazarov, A. B., Nasimov, K. M., & Isoqjonova, M. (2023). Kobalt (II)-synthesis of the coordination compound formed by quinazolin-4-on and indole fatty acids of nitrate dihydrate and study of the processes of influence on the varieties of cotton “Buxara-102”,“Namangan-77”,“Sultan”,“Unkurgan-1”,“C-6524”. In *E3S Web of Conferences* (Vol. 452, p. 01033). EDP Sciences.