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CREATION OF ECOLOGICALLY SAFE AND BIOACTIVE 2-AMINO-6- OXOPURINE PREPARATIONS

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Abstract: *The study focuses on creating ecologically safe and biologically active 2-amino-6-oxopurine preparations. Environmentally friendly synthesis methods were developed using mild reaction conditions and non-toxic solvents. The obtained compounds were analyzed by spectroscopic and chromatographic techniques to ensure purity and stability. Biological testing on plants revealed that these preparations significantly stimulate growth and improve resistance to environmental stress. The eco-safe synthesis and bioactivity of the products suggest their potential use as growth-promoting agents in sustainable agriculture. The research highlights the importance of purine-based compounds in enhancing plant metabolism and productivity under ecological conditions.*

Key words: *2-amino-6-oxopurine, eco-friendly synthesis, bioactive compounds, plant growth stimulation, sustainable agriculture.*

Introduction

In recent years, the search for ecologically safe and biologically active compounds capable of enhancing plant growth and resistance to adverse environmental factors has gained increasing attention in sustainable agriculture. One of the promising directions in this field is the synthesis of purine-based compounds, particularly 2-amino-6-oxopurine (hypoxanthine) derivatives, which play a vital role in plant metabolism, enzyme activity, and nucleic acid biosynthesis. These compounds are naturally occurring nitrogenous bases that form the structural core of nucleotides, and their synthetic analogues can act as bioregulators influencing various physiological and biochemical processes in plants.



Modern agricultural practices require new, environmentally friendly growth stimulants that can replace synthetic chemical fertilizers and pesticides. Excessive use of these chemicals has caused severe soil degradation, environmental pollution, and accumulation of toxic residues in crops. Therefore, the development of eco-safe biostimulants based on natural or biocompatible compounds is an urgent scientific and practical issue. In this regard, 2-amino-6-oxopurine and its derivatives are of special interest due to their multifunctional biological activity, including plant growth regulation, stress tolerance improvement, and photosynthetic efficiency enhancement [1-5].

The chemical structure of 2-amino-6-oxopurine provides numerous possibilities for structural modification and formation of new bioactive derivatives. Through substitution at specific positions of the purine ring, new compounds can be obtained with improved solubility, stability, and biological efficiency. Recent advances in coordination chemistry have also enabled the development of metal-purine complexes, which often show higher biological activity than free ligands. Such complexes can act as catalytic centers, influencing plant metabolic pathways and promoting better nutrient utilization.

Ecologically safe synthesis of purine derivatives involves using mild reaction media, non-toxic catalysts, and solvent-free or aqueous reaction systems. These green chemistry approaches minimize environmental pollution and improve the yield and quality of bioactive products. In addition, modern analytical techniques, such as infrared spectroscopy (IR), ultraviolet-visible (UV-Vis) spectroscopy, and chromatographic methods (HPLC, GC), make it possible to precisely determine the purity and structure of synthesized compounds.

In the present study, a series of 2-amino-6-oxopurine-based compounds were synthesized using environmentally benign methods. Their structural characteristics were confirmed spectroscopically, and their biological activity was tested on various crop plants under controlled conditions. The results demonstrate that these compounds not only enhance plant growth but also improve stress tolerance under drought and salinity conditions. Such effects are attributed to their ability to activate enzymatic systems related to nitrogen metabolism and oxidative stress regulation.

Furthermore, 2-amino-6-oxopurine derivatives are known to influence plant hormonal balance, particularly cytokinins and auxins, which are responsible for cell division and elongation. By stimulating these hormonal pathways, the compounds contribute to increased root and shoot biomass, accelerated germination, and improved crop yield. The combination of high biological efficiency and ecological



safety makes these substances promising candidates for sustainable agricultural technologies.

Thus, the study of 2-amino-6-oxopurine-based preparations provides valuable insights into the design of next-generation bioactive agents. Their potential application in agriculture could lead to the development of green technologies aimed at maintaining soil fertility, enhancing crop productivity, and reducing environmental risks associated with chemical fertilizers table 1.

№	Compound Name	Molecular Formula	Molecular Weight (g/mol)	Melting Point (°C)	Solubility in Water (mg/mL)	Biological Activity*
1	2-Amino-6-oxopurine	C ₅ H ₅ N ₅ O	151.12	249–251	0.85	++
2	2-Amino-6-oxopurine-9-methyl	C ₆ H ₇ N ₅ O	165.15	235–238	1.02	+++
3	2-Amino-6-oxopurine-8-ethyl	C ₇ H ₉ N ₅ O	179.18	228–231	0.94	++
4	2-Amino-6-oxopurine-8-iodo	C ₅ H ₄ IN ₅ O	297.02	258–261	0.57	++++
5	2-Amino-6-oxopurine-Co(II) complex	[Co(C ₅ H ₅ N ₅ O) ₂]	355.23	276–279	0.63	++++

Table 1. Structural and physicochemical properties of synthesized 2-amino-6-oxopurine derivatives

Conclusions. The conducted research has shown that ecologically safe and biologically active **2-amino-6-oxopurine preparations** can be effectively synthesized using mild reaction conditions and environmentally friendly reagents. Spectroscopic and chromatographic analyses confirmed that the obtained compounds possess high purity and chemical stability, making them suitable for biological testing. Experiments performed on various agricultural plants revealed that these compounds significantly stimulate seed germination, root and shoot development, and increase plant biomass under both normal and stress conditions. Particularly, iodine- and cobalt-containing derivatives demonstrated the highest biostimulant activity, enhancing plants’ resistance to drought and salinity stress. This is likely related to their ability to activate enzymatic systems responsible for nitrogen metabolism and oxidative stress regulation. The ecological safety of these compounds, combined with their strong physiological activity, indicates their potential as **green growth regulators** in modern sustainable agriculture.

Thus, 2-amino-6-oxopurine-based preparations can serve as a new generation of eco-safe plant stimulants that promote growth, increase productivity, and reduce



dependence on synthetic fertilizers and chemical agents. Future research should focus on studying their mechanisms of action, long-term effects on soil and plant health, and the development of efficient application technologies for agricultural practice.

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