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STUDY OF COMPOUNDS OBTAINED ON THE BASIS OF REACTION WITH ALDEHYDE GROUP OF GOSSYPOL

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Abstract: This article provides a comprehensive overview of gossypol derivatives, emphasizing their synthesis, structural features, and therapeutic potential. It serves as a foundation for further exploration and development of these compounds in medicinal chemistry and drug discovery.

Key words: Gossypol, polyphenol, Schiff base, pigment, yellow, cotton, acetone, solvent, solubility.

Gossypol is a natural polyphenolic compound found in cotton plants (genus *Gossypium*). It is known for its aldehyde groups, which are reactive and can participate in various chemical reactions. The study of compounds derived from reactions involving the aldehyde groups of gossypol is of significant interest due to its diverse biological activities, including antitumor, antiviral, and contraceptive properties. Below is an overview of the types of reactions and compounds that can be obtained based on the reactivity of the aldehyde groups in gossypol:

➢ **Schiff Base Formation**

Gossypol's aldehyde groups can react with primary amines to form Schiff bases (imines). This reaction is widely used to create derivatives with potential biological activities.

Example: Reaction with amino acids, peptides, or hydrazides.

Applications: Schiff base derivatives of gossypol have been studied for their anticancer and antimicrobial properties.

➢ **Reduction of Aldehyde Groups**

The aldehyde groups in gossypol can be reduced to alcohols using reducing agents like sodium borohydride ($NaBH_4$) or hydrogenation.

Product: Gossypol is converted to gossypol diol.

Applications: Reduced gossypol derivatives may exhibit altered biological activities and reduced toxicity.

➢ **Condensation Reactions**

Gossypol can undergo condensation reactions with compounds like urea, thiourea, or guanidine to form cyclic derivatives.

Example: Formation of gossypol-urea or gossypol-thiourea adducts.

Applications: These derivatives are explored for their potential as antiviral or antiparasitic agents.

➢ **Complexation with Metal Ions**

The aldehyde and hydroxyl groups of gossypol can coordinate with metal ions (e.g., Cu^{2+}, Fe^{3+}, Zn^{2+}) to form metal complexes.

Applications: Metal complexes of gossypol are studied for their enhanced antioxidant, anticancer, and antimicrobial activities.

- **Reaction with Thiols**

Gossypol can react with thiol-containing compounds (e.g., cysteine, glutathione) to form thioacetal or thioketal derivatives.
Applications: These derivatives may have improved solubility and reduced toxicity, making them suitable for drug development.

- **Oxidation of Aldehyde Groups**

The aldehyde groups of gossypol can be oxidized to carboxylic acids using oxidizing agents like potassium permanganate ($KMnO_4$) or hydrogen peroxide (H_2O_2).
Product: Gossypol dicarboxylic acid.
Applications: Oxidized derivatives may have altered biological properties and improved pharmacokinetics.

- **Formation of Heterocyclic Compounds**

Gossypol can react with compounds like hydrazines or hydroxylamines to form heterocyclic structures (e.g., pyrazoles, oxazoles).
Applications: These heterocyclic derivatives are investigated for their potential as enzyme inhibitors or anticancer agents.

- **Polymerization and Crosslinking**

Gossypol's aldehyde groups can participate in polymerization reactions or crosslinking with other polymers.
Applications: Used in the development of biomaterials, drug delivery systems, or coatings.

- **Derivatization for Analytical Purposes**

Gossypol derivatives are often synthesized for analytical purposes, such as improving detection or quantification in biological samples.
Example: Derivatization with fluorescent or chromogenic reagents.

- **Biological and Pharmacological Significance**

The modification of gossypol's aldehyde groups can significantly alter its biological activity, toxicity, and pharmacokinetic properties.
Studies focus on enhancing its therapeutic potential while minimizing side effects, particularly in cancer therapy and male contraception.

- **Challenges and Future Directions**

Toxicity: Gossypol derivatives must be carefully designed to reduce toxicity while retaining biological activity.
Solubility: Many gossypol derivatives have poor solubility, which limits their bioavailability.
Structure-Activity Relationship (SAR): Further research is needed to understand how specific modifications to the aldehyde groups affect gossypol’s biological activity.
In summary, the aldehyde groups of gossypol serve as key reactive sites for the synthesis of diverse derivatives with potential applications in medicine, agriculture, and materials science. Continued research in this area holds promise for the development of novel therapeutic agents and functional materials.
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LITERATURE

1. Muallif: Zhang, W., Xu, J., & Liu, Y.
2. Nashr: *Journal of Natural Products*, 2015.
3. Nashr: *Cottonseed and Gossypol*, 1986.
4. Nashr: *Bioorganic & Medicinal Chemistry Letters*, 2018.

5. Khaitbaev Kh. Alisher, Toshov S. Khamza, Nazirova K. Yayra. Researches on implementation in medical practice of supramolecular complex of megosin with MASGA. Journal of Medicinal and Chemical Sciences (J. Med. Chem. Sci.). 2019. №3. P. 48-54.
6. Hakberdiev, S. M., Talipov, S. A., Dalimov, D. N., & Ibragimov, B. T. (2013). 2,2′-Bis {8-[(benzylamino) methylidene]-1, 6-dihydroxy-5-isopropyl-3-methylnaphthalen-7 (8H)-one}. *Acta Crystallographica Section E: Structure Reports Online*, *69*(11), o1626-o1627.
7. Khaitbaev A. K., Khakberdiev S. M., Toshov K. S. Isolation of Gossypol from the Bark of Cotton Roots //Annals of the Romanian Society for Cell Biology. – 2021. – С. 1069-1073.
8. Khamza, Toshov, Khakberdiev Shukhrat, and Khaitbaev Alisher. "X-ray structural analysis of gossypol derivatives." *Journal of Critical Reviews* 7.11 (2020): 460-463.
9. Толстикова Т.Г., Толстиков А.Г., Толстиков Г.А. На пути к низкодозным лекарствам // Вестник Российской академии наук. 2007. Т. 77. № 10. С. 867-874.
10. Khakberdiev, Sh M., et al. "Synthesis and structure of gossypol azomethine derivatives." *Young Scientist,(4)* (2015): 42-44.
11. Mahramovich, K. S. (2022). Results of computer study of biological activity of gossipol products. *Web of Scientist: International Scientific Research Journal*, *3*(6), 1373-1378.
12. Mahramovich, K. S. (2023). Structural analysis of supramolecular complexes of schiff bases. *American Journal of Interdisciplinary Research and Development*, *12*, 36-41.
13. Mahramovich, K. S., & Khodiyevich, K. S. (2023). Study of the practical significance of benzimidazole and some of its derivatives. *Open Access Repository*, *4*(02), 80-85.
14. Mahramovich, K. S. (2024). Study of synthesis, structure and biological activity of gossypol derivatives in computer program. *American Journal of Innovation in Science Research and Development*, *1*(2), 75-81.
15. Makhramovich, K. S. (2024). Synthesis of Schiff Bases, Supramolecular Complexes and their Influence on Macrophages. *Miasto Przyszłości*, *49*, 922-926.
16. Khakberdiyev, S. M. (2024). Synthesis of aminopyridine derivatives based on gossypol. *Miasto Przyszłości*, *48*, 1063-1068.
17. Mahramovich, K. S. (2024). Study of synthesis, structure and biological activity of gossypol derivatives in computer program. *American Journal of Innovation in Science Research and Development*, *1*(2), 75-81.
18. Makhramovich, K. S. (2024). Synthesis of Schiff Bases, Supramolecular Complexes and their Influence on Macrophages. *Miasto Przyszłości*, *49*, 922-926.
19. Khakberdiyev, S. M. (2024). Synthesis of aminopyridine derivatives based on gossypol. *Miasto Przyszłości*, *48*, 1063-1068.
20. Mahramovich, K. S. (2024). Study of synthesis, structure and biological activity of gossypol derivatives in computer program. *American Journal of Innovation in Science Research and Development*, *1*(2), 75-81.