Academicia Globe: Inderscience Research

ISSN: 2776-1010 Volume 4, Issue 10, Oct. 2023

THE USE OF HTS IN FOLK MEDICINE

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Abstract

The problem of renewable raw materials for the production of biologically active preparations used in the national economy and medicine is one of the most important tasks of chemical technology.

Based on the results of our research, it has been established that a number of valuable products such as chlorophyll, porphyrins and their metal complexes, intermediates for the synthesis of vitamins E, K, carotene, biflovonoids, lipids, etc., can be obtained from the isolation of silkworms (VTS).

Silkworm caterpillars, feeding on mulberry leaves, receive a rich assortment of various biologically active substances. Along with chlorophyll, the silkworm receives vitamins: carotene (provitamin A), B vitamins, ascorbic acid (vitamin C), riboflavin, folic acid, various organic acids, etc. A fairly complete picture of these data is given in the monograph by G.M. Talyshinsky [1]. The vitamin content in vitamin leaves depends on the type of plant, variety and phase of their development. Studies [2, 4, 5] have shown that the amount of ascorbic acid in the mulberry leaf increases in the process of its ripening, reaching a maximum by the time of fruiting of the mulberry tree (~0 400 mg per 100 g of fresh leaf), i.e. in the V instar of spring feeding silkworm caterpillars. Then, the entire period of formation and ripening of mulberries is characterized by a decrease in the carotene content in the leaf of mulberries of all varieties is observed during the fruiting period of the plant (~0.9 mg per kg of fresh leaf) and will remain at a close level until September, then drops sharply. It has also been established that during the ripening of mulberry leaves, the content of thiamine, riboflavin, is at a constant level.

The silkworm larva absorbs vitamins and organic substances necessary for its growth and development from the food, excreting their excess with its preparations. At the qualitative level, it has been established that BTS contains carotenoids, B vitamins, vitamin P and other useful compounds. In this article, we considered it necessary to dwell in more detail on the possibility of isolating from VTS those biologically active substances that are of significant practical interest.

Phytol (formula 1) and isomeric isophytol (2) are the unlimited, significant attention of researchers. This is due to the fact that they are used in the synthesis of vitamins E and KI [3], which are widely used in medical practice and veterinary medicine. Lack of α-tocopherol or vitamin E (3), which is a product of condensation of trimethylhydroquinone with phytol, causes muscle atrophy and infertility in animals. In the case of vitamin K I or phylloquinone (**4**) the phytolic residue is bound to the nucleus of naphtaquinone. Vitamin KI is used in therapy as a drug that accelerates blood clotting. Both vitamins are used in livestock and poultry farming as part of premixes.

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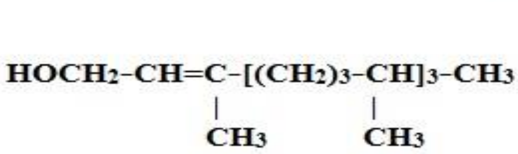

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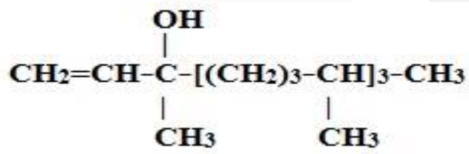

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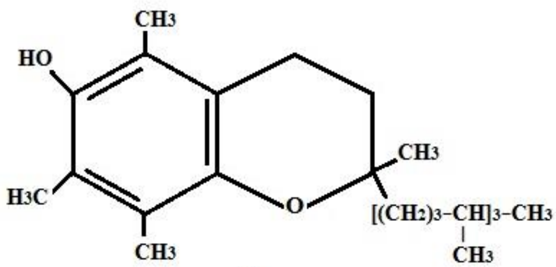

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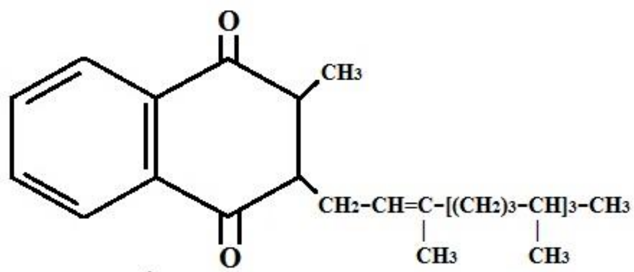

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The ever-increasing demand for these vitamins in various sectors of the national economy cannot be satisfied by natural sources, in which they are contained in relatively small quantities (~40-70 mg%) [3]. In addition, their separation from the products of processing of natural raw materials requires complex methods of purification from concomitant impurities. Known industrial methods for the synthesis of racemic forms of vitamins E and KI are based on the use of isophytol, synthesized, in turn, according to a multi-stage scheme [2]. However, this does not exclude the prospect of replacing isophytol (2) with (1), which will allow the synthesis of optically active vitamins E (3) and K_1 (4), which show a greater therapeutic effect compared to the corresponding racemates [2]. The expediency of a particular alcohol component in the synthesis of vitamins is determined not only by the availability of phytol or isophytol, but also by their cost.

As a rule, the source of phytol is the chlorophyll of various plants, which for this purpose is either subjected to alkaline hydrolysis or treated with the enzyme chlorophyllase. In this case, nettle and mint are proposed as raw materials. The published methods differ not only in the conditions of saponification of plant chlorophyll, but also in various methods of isolating the target compound.

Phytol was first obtained in 1906, and its structure was established in 1928 by T. Fitter and K. Lowenberg [1]. In 1939, P. Karer and B. Ringen proposed a method for the synthesis of phytol [4]. However, synthetic phytol has not found industrial application due to the complexity of its synthesis, as well as the relatively low yield of the product. Therefore, in the future, the main attention of researchers was paid both to the development of methods for obtaining it from natural raw materials and to the search for new sources suitable for its isolation.

Method of synthesis of vitamin E on the basis of phytol. A mixture of 0.192 g of 98.5% or 0.190 g of 100% (50*10-4 moles) tetramethylhydroquinone and 0.37 g of aluminosilicate in 5 ml of nonane, when stirred in a nitrogen current, is heated to a boil and distilled within 0.5 hours the water adsorbed on a catalyst with solvent vapors is distilled into a Dean-Stark nozzle prefilled with solvent. Then, a solution of 0.38 g of phytol is added to the boiling mixture in 0.5 hours (5*10-4 moth) in 5 ml of nonane under

ISSN: 2776-1010 Volume 4, Issue 10, Oct. 2023

conditions of continuous distillation of the reaction between water and solvent vapour. After the completion of the condensation process (TLC control in the hexane-ether system (2:1), iodine vapor developer, vitamin E Rf = 0.53), the reaction mass is cooled to 200 °C and filtered through a Schott filter No. 4. The separated catalyst is washed with nonane (3x10 ml). The combined filtrates are evaporated in vacuum and the technical vitamin E is purified on a column filled with silica gelene grade L 40/100. After chromatography, he receives 0.5 g of vitamin E with a content of 98.3% according to GLC. The yield of the product is 92.1% of the theoretical one.

Thus, according to the technology proposed by us, it is possible to effectively use HSE by processing them, separating protein meal, chlorophyll, which, in turn, can be processed into pheophorbide and phytol, fatty acids and, possibly, other biologically active substances.

As a result of our research, it has been established that silkworm caterpillars are a rich source of a large number of various biologically active substances, primarily porphyrins, which not only perform the most important biological functions in nature, but are also widely used in technology and medicine.

The search for applications of natural porphyrins and their derivatives is primarily concentrated in the field of medicine. This is due, first of all, to their low toxicity to living tissues and biological media. In addition, chlorophyll has a powerful antioxidant effect and thus protects cells from the harmful effects of constantly formed radicals from destruction by electrical charges on cell membranes and hydrogen ions in the foci of inflammation [5-8].

At present, chlorophyll-containing preparations (extracts, tinctures, infusions of herbs and plant leaves) occupy a significant place in the arsenal of medicines. Hundreds of works have been published in the literature devoted to the study of various aspects of the effect of chlorophyll preparations on the body of animals and humans.

In veterinary medicine, chlorophyll preparations improve the reproductive abilities of agricultural animals, accelerate their growth and development, and increase resistance to infections.

In humans, chlorofoll-containing preparations have been successfully used in the complex treatment of infectious diseases [8], alcoholism [5], and in photodynamic therapy of malignant tumors [3, 5-6,8].

The development of drugs and other biologically active agents based on chlorophyll derivatives seems to be one of the most promising areas of application in the problem of the use of prophyrins. It has now been established that:

1. A number of diseases, such as anemia, cancer, neuropsychiatric disorders, poisoning with lead and some organic substances, certain skin diseases, radiation injuries and other pathological abnormalities, are accompanied by a significant disturbance of porphyrin metabolism in the body. In porphyrins and lupus erythematosus, these disorders play a decisive role in the pathogenesis of diseases.
2. Exogenous porphyrins are able to accumulate in rapidly regenerating tissues. The fluorescence of individual porphyrin molecules makes them a convenient object for testing in biological media and tissues.
3. The photodynamic action of porphyrins has served as the basis for the use of compounds in photochemotherapy of tumors and other diseases.

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4. It has been found that some natural and synthetic porphyrins have significant catalytic and enzymatic activity, due to which they can act as activators or sensitizers of processes.
5. And, finally, porphyrins have the property of modifying the radiation damage of biological objects.
A significant number of works are devoted to the use of porphyrins in oncology. Hematoporphyrin and tetrasulfotetraphenylporphine were used to diagnose tumors using the selective tropism of these compounds and the ability to fluoresce in tissues. Metal complexes of hematoporphyrin and protoporphyrin have been studied as therapeutic agents that inhibit the growth of cancer cells in lung, stomach, rectum, etc. Studies on the treatment of certain types of malignant tumors with the combined use of porphyrins and visible radiation, as well as laser radiation, are of great practical importance.

Findings

In conclusion, the following can be stated: the given short list of areas of application of porphyrins shows that the need for these compounds is great, and undoubtedly the search for new cheap sources of these compounds is relevant. In accordance with the principles of the technology we have proposed, this problem is solved in two directions. On the one hand, research is being developed in the field of the scientific foundations of the technology for the extraction of chlorophyll and its modification products from HTS. On the other hand, new areas of application of chlorophyll by-products, in particular, pheophorbides and other porphyrins, are being sought.

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