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Summary

Halitosis, also known as fetor ex ore, oral malodour, or bad breath, refers to a distinct, persistently unpleasant mouth odor. In the conducted research, I focus on pathologic halitosis concerning the oral cavity (oral malodour), whose main cause is the participation of bacteria catalyzing the transformation of non-volatile sulfur precursors into their volatile compounds (VSCs). VSCs are responsible for the unpleasant odor emanating from the oral cavity, as well as other conditions such as periodontitis.

Halitosis is a fairly common problem faced by modern society. The extent and seriousness of fetor ex ore are indicated by the increasing expenditures on various types of mouth fresheners - lozenges, chewing gums, mouthwashes, or antibiotics. The American industry allocates approximately 8.5 billion USD annually for these purposes. However, it should be emphasized that the current fight against fetor ex ore mainly involves masking the unpleasant mouth odor and is merely symptomatic treatment. Mouthwashes are also used, which, however, are associated with side effects such as changes in food taste, burning sensation, tooth discoloration. Another alternative is antibiotic therapy, but this is linked to the obvious, adverse effect on the natural microflora residing in our body.

Plant and herbal materials constitute a diverse wealth of active compounds with medicinal potential. Bioproducts obtained from the plant materials constitute components of phytopharmaceuticals used as ingredients in herbal medicines, dietary supplements, or cosmetics. This is an essential branch of the economy, as confirmed by the increase in financial expenditures on plant-derived medicines, where the value of this market in 2022 amounted to 148.5 billion USD globally, but an average annual growth of 11.2% of this value is expected over the next decade.

The research presented in this doctoral dissertation focused on the technology of producing phytopharmaceuticals as products containing active substances or a mixture of active substances obtained from a selected base of plant material. The manufacturing process of a

potential plant medicinal product included operations and basic unit processes: selection of raw material, physical and chemical process parameters, extractant, extraction techniques, purification, and the chemical and biological characterization of the obtained products. Additionally, the research was extended to rational methods of producing potential inhibitors of methionine γ-lyase (E.C 4.4.1.11) and D-cysteine desulfhydrase (E.C.4.4.1.15) enzymes obtained through chemical synthesis, preceded by molecular modeling of potential inhibitor structures. The main utility feature of plant bioproducts and synthetic products (as analogs to plant products) was the complete inhibition or reduction of the level of volatile sulfur compounds produced by bacteria. All obtained products underwent chemical analysis (spectroscopic, chromatographic methods - composition analysis) and biological studies implementing the safety criterion for the use of potential medicinal products (microbiological assessment, geno- and cytotoxicity studies). 12 selected plant materials and 21 synthetic compounds were examined. The final stage consisted of the pre-formulation of a potential medicinal product in the form of a gel based on selected components and testing its in vivo activity on an animal model (dogs). The conducted research in the field of organic technology and bioengineering contributed to expanding knowledge on the disease unit that is halitosis, potential inhibitors of enzymes responsible for VSC secretion, and provided new phytopharmaceuticals as fine chemicals for biomedical application. In the future, research may be expanded to a human model.