Результати. Досліджуваний екстракт у концентрації розчину 1 % був ефективним лише відносно мікроорганізмів *S. aureus, B. subtilis* та *C. albicans*. Субстанція у розчинах з концентрацією 10 % та 5 % пригнічувала ріст практично усіх використаних в експерименті штамів мікроорганізмів, крім *P. vulgaris*. Найбільш вразливими до дії досліджуваного густого екстракту в концентрації 10 % були штами *S. aureus, S. pyogenes* та *P. aerugenosa*, зона затримки росту яких становила понад 22,0 мм.

Для розчинів густого екстракту сланей *C. islandica* спостерігалася прямо пропорційна залежність між концентрацією розчину та його антирадикальною активністю: для 1 % розчину вона становила 69,17±1,61 %, для 5 % розчину – 74,15±1,73 % , для 10 % розчину – 76,31±1,90 %.

Висновки. Отримані результати вивчення антимікробної та антирадикальної дії розчинів густого екстракту сланей *C. islandica* враховані при розробці технології отримання лікарських засобів на основі досліджуваної субстанції та увійшли до заявок на патент України на винахід та патент України на корисну модель.

ENZYMATIC TREATMENT OF MEDICAL PLANTS IMPACT ON BIOACTIVE COMPOUNDS

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Introduction. Medical herbs have been used for centuries for their therapeutic properties. They contain a wide range of bioactive compounds, including polyphenols, alkaloids, and terpenes, which exert various physiological effects. However, the bioavailability and efficacy of these compounds can be limited by factors such as poor absorption, metabolism, and degradation. To increase therapeutic action and taste quality some medical herbs can be processed by enzymatic fermentation. Enzymatic treatment is a promising approach to enhance the bioavailability and potency of bioactive compounds in medical herbs. Enzymes can catalyze specific chemical reactions, resulting in the modification, release, or stabilization of active compounds.

Bioactives, bionutrients and chemical composition of fermented herbs varies with the different degree of fermentation. An important role is related on temperature, time, relative humidity, pH value, and oxygen availability during fermentation to improve the quality of fermented herbs. This paper explores the impact of enzymatic treatment on bioactive compounds in medical herbs, examining the potential benefits and limitations of this approach.

The aim of the study. It has to be stressed that herbal medicines, being based on plant-derived products, are chemically complex mixtures containing multiple major and minor constituents with multiple potential targets and mechanisms. By enzimatic oxidation whether in modern medicine or in traditional medicine, active compounds may be converted or concentrated into other metabolic components during fermentation. And it can be useful of maintaining health, to be administered

for a specific condition, or both, for health promotion and therapy for chronic conditions. However, usage of fermented herbal remedies may become conventional in the treatment of complex disease.

Materials and methods (animals and methods, patients and methods). The crude herbs used in this study were provided from local places and forestic zone. It included homology of medicine and food materials such as Rubus idaeus, Rubus fruticosus, Hypericum perforatum, Plantago major, Betonica officinalis etc.

Funding sources or registered topic of the research. No funding sources or conflicts of interest were reported for this study.

Results. Enzymatic oxidation is the key biochemical reaction in all types of herbal and tea processing, and is positively correlated with the degree of fermentation. The quality of final product is correlated with enzymatic oxidation process during fermentation.

Free amino acids contribute essentially to the flavor features of fermented herbs, and their contents change significantly during fermentation.

Some research has shown that the concentrations of a few free amino acids-such as glutamic acid, glutamine, leucine, serine, isoleucine, phenylalanine, threonine, and theanine-decrease appreciably during fermentation, while other amino acids appear small alter.

It resulting that free amino acids may be converted into other metabolic components during fermentation and biochemical synthesis, the concentration of active compounds that are specific for medical herbs also rise up.

Several studies have suggested that some important volatile aroma components in fermented herbs are derived from the conversion of amino acids. However, little is known about the metabolism of free amino acids during partial and full fermentation.

The same as for different types of tea the different degrees of fermentation in herbal tea processing, manufactured herbs and leaves can be classified into three types; herbs and leaves without fermentation are processed into traditional drying, those that are partially fermented are processed into middle or partial fermented herbs, and those that are fully fermented are processed into full enzymatic oxidized herbs or different kinds of black tea.

Benefits of Enzymatic Treatment:

Enhanced Extraction. Enzymes can break down cell walls and release bioactive compounds that are otherwise inaccessible. This improves the extraction yield and makes more compounds available for absorption.

Increased Bioavailability. Enzymatic treatment can modify the structure of bioactive compounds, making them more easily absorbed and utilized by the body. For example, glycosylation of polyphenols can increase their solubility and bioavailability.

Improved Stability. Enzymes can stabilize bioactive compounds and prevent their degradation by oxidation or other chemical reactions. This prolongs their shelf life and maintains their therapeutic potency.

Enhanced Therapeutic Efficacy. Enzymatic treatment can produce new bioactive compounds with improved pharmacological properties. For ex., enzymes can modify the structure of alkaloids to enhance their binding affinity to receptors.

Increased micronutrients value. During fermentation of medical herbs process, occurring degradation of protein and proteinaceous amino acid metabolism associated with enzymatic reactions. Amino acids contribute to the nutritional value and quality of fermented herbal products.

Catechins are the most abundant polyphenolic antioxidants* – flavanols of the flavonoid family found in a lot of medical herbs, also in different kinds of tea. In large quantities they are found in many fruits, berries and leaves of apples, persimmons, quince, apricots, peaches, plums, cherries, grapes, cacaos, strawberries, wild strawberry, currants, raspberries, dewberries and other berries. Catechins have powerful antioxidant properties, in bioactive combinations they may act in the cell as pro-oxidants*. The structure of catechin is the key determinant of its free-radical scavenging and metal chelating activities. Their antioxidant activity substantially depends on the number and placement of hydroxyl and other chemical groups.

Catechins are reactive oxygen species* scavengers and metal ion chelators, whereas their indirect antioxidant activities comprise induction of antioxidant enzymes, inhibition of pro-oxidant enzymes, and production of the phase II detoxification enzymes and antioxidant enzymes - metabolize oxidative toxic intermediates. Most of fermented medical herb's polyphenols are produced by enzymatic oxidation of raw herbs catechin. The structures of some novel oxidation products in fermented herbs during accumulation process occurring to biotransformation and increasing of pigmentation, plus concentration of active compounds.

In addition, forming and degradation of herbal flavins and quinones (epigallocatechin dimer quinones) are major pathways in catechin oxidation during herbal fermentation, and understanding of the biochemical mechanism is important in clarifying fermented polyphenols

Oxidative stress and reactive oxygen species are implicated in aging, cellular mutation and related dysfunctions, such as cancer, neurodegenerative disease, cardiovascular diseases, diabetes etc. Due to their antioxidant properties, catechins may be beneficial in preventing and protecting against diseases caused by oxidative stress on a molecular stage that starts at cellular level.

Conclusion. Bioactives and bionutrients from plants are always in high demand in pharmaceutical, nutraceutical, and functional food sectors due to their health benefits. This intensifies the need of extraction of bioactives by different methods that can improve the yield and purity of the compound, line of herbal fermented products or pure substances. Enzymes take action in the release of bioactives from the plant material under optimized conditions (controlled temperature, humidity) so as to make the production process efficient. Though enzymatic process of bioactives have been used since long, it needs improvement to further enhance the yield, stable quality, reduce the process time, and make the process market competitive. Like other fermented products, the enzymatic herbal products also require information on product quality and functionality. Different methods of herbal processing, fermentation, extraction could bring about various compositions of bioactives. To our knowledge, there are not many works focused on studying the dual effect of enzymatic and sequential fermentation pretreatments on medical herbs. An initial

evaluation of enzymatic treatment and sequential fermentation in medical herbs is needed before the practice of herbal products in use as nutrients and treatment.

SCREENING ALGORITHM FOR DISCOVERY OF NOVEL DUAL-ACTING NON-COVALENT INHIBITORS FOR M^{PRO} and PL^{PRO} PROTEASES OF SARS-COV-2 CORONAVIRUS

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Introduction. Cysteine proteases of the SARS-CoV-2 coronavirus are crucial for its viral life cycle, making them important targets for developing antiviral drugs against COVID-19 [1]. There is currently significant interest in researching various mechanisms and targets for inhibiting the virus using experimental and computational tools. Developing new antiviral drugs capable of targeting multiple proteins of the virus simultaneously is a high priority. Therefore, in this context, various computational chemistry methods and algorithms have become essential tools for streamlining computer-driven drug discovery [2].

Aim of the study. To analyze the molecular scaffolds of ligand-target interactions of existing non-covalent inhibitors for the main (Mpro) and papain-like (PLpro) proteases of SARS-CoV-2 with a goal to identify the general scaffold allowing *in silico* discovery of new inhibitors with a dual-acting mode.

Materials and Methods. LigandScout 4.5 software for 3D-pharmacophore analysis, virtual screening and molecular docking [3]. AutoDock Vina 1.1.2 tools for molecular docking. Web-servers PLIP (Protein-Ligand Interaction Profiler) [https://plip-tool.biotec.tu-dresden.de/plip-web/plip/index] and Pharmit [https://pharmit.csb.pitt.edu/] for studying molecular binding mechanisms. Analysis and visualization was performed by Discovery Studio 2024 Suite.

Foundation. Grant № 42/0062 (2021.01/0062) “Molecular design, synthesis and screening of new potential antiviral pharmaceutical ingredients for the treatment of infectious diseases COVID-19” from the National Research Foundation of Ukraine.

Results. To study the inhibition mechanisms of SARS-CoV-2 Mpro and PLpro proteases, we selected various binding site models for each protease among a series of non-covalent inhibitors available in the Protein Data Bank [https://www.rcsb.org/]. The specificity of the kinetic binding profiles and structural features of the ligand molecules were analyzed.

In our research, we have identified key pharmacophore features of non-covalent ligands that inhibit both Mpro and PLpro. These features play a critically important role in the binding of the ligands to the proteins. The molecular binding mechanism between non-covalent inhibitors and Mpro is characterized by hydrophobic fragments around residues THR25-THR26 and HIS41, as well as interactions that form hydrogen bonds with the side-chain donor of the protease near residues MET165-GLU166 and GLY143-SER144. The analysis of the molecular