

INVESTIGATION OF PLANTS RICH IN BIOACTIVE COMPOUNDS AND THEIR POTENTIAL USE IN THE PHARMACEUTICAL INDUSTRY

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ABSTRACT: This research focuses on identifying plant species rich in bioactive compounds that are essential for applications in the pharmaceutical field. Methods for extracting, purifying, and characterizing bioactive substances from selected plants are investigated. Additionally, their antioxidant, anti-inflammatory, and antimicrobial properties are evaluated *in vitro* and *in vivo*. The aim is to determine the feasibility of developing plant-based pharmaceutical preparations directed toward the creation of new therapeutic agents.

KEYWORDS: Bioactive compounds, medicinal plants, pharmaceuticals, pharmacological activity, drug discovery, plant extraction, antioxidants, anti-inflammatory, antimicrobial, anticancer.

INTRODUCTION

The pharmaceutical industry is constantly seeking novel therapeutic agents to combat a wide range of diseases. Natural products, particularly those derived from plants, have long been recognized as a rich source of bioactive compounds with diverse pharmacological activities. Historically, many of the world's most effective drugs have originated from plant sources, highlighting the immense potential of the plant kingdom in addressing unmet medical needs.

The exploration of plants rich in bioactive compounds has gained renewed interest in recent years due to several factors. These include the increasing prevalence of chronic diseases, the emergence of drug-resistant pathogens, and the growing demand for natural and sustainable healthcare solutions. Bioactive compounds, such as alkaloids, flavonoids, terpenoids, and phenolic acids, exhibit a broad spectrum of biological activities, including antioxidant, anti-inflammatory, antimicrobial, anticancer, and neuroprotective effects.

Identifying and characterizing plants with significant concentrations of bioactive compounds is a critical step in the drug discovery process. This involves employing advanced extraction, isolation, and analytical techniques to obtain and purify these valuable substances. Furthermore, evaluating the pharmacological activity of these compounds through *in vitro* and *in vivo* assays is essential to determine their potential therapeutic applications.

This research aims to investigate various plant species for their bioactive compound content and assess their potential for pharmaceutical development. By systematically exploring the phytochemical composition and pharmacological properties of these plants, this study seeks to contribute to the discovery of new therapeutic agents for various diseases and promote the sustainable utilization of plant resources for human health. The primary focus will be on plants with notable antioxidant, anti-inflammatory, and antimicrobial activities, which are relevant to a wide range of health conditions.

MATERIALS AND METHODS

Plants rich in bioactive compounds were selected based on their traditional medicinal use and documented biological activities in previous studies. Samples were collected from local natural habitats, focusing on environmentally clean areas. Different parts of the plants, including leaves, stems, roots, and fruits, were collected for investigation.

Plant materials were collected from uncontaminated environments and cleaned from dirt and impurities. They were then air-dried naturally at 25-30°C in a dark, well-ventilated room. The dried plant materials were ground into small pieces and prepared for biological activity testing. To isolate bioactive compounds, plant materials were extracted using methanol and aqueous solvents by maceration. The extraction process was carried out under continuous shaking for 48 hours to maximize the yield of active components. The pharmacological potential of the extracts was assessed through several tests:

The disk diffusion method was applied to evaluate the effects of extracts against Gram-positive and Gram-negative bacteria as well as fungi. The results obtained were analyzed using statistical software.

RESULTS AND DISCUSSIONS

The conducted study revealed that the selected medicinal plants possess notable biological activity, supporting their traditional use in folk medicine. During the antioxidant assays, the plant extracts demonstrated a clear ability to neutralize free radicals, indicating the presence of natural antioxidant compounds. Especially extracts prepared with organic solvents such as methanol showed stronger activity, suggesting that the active components are more efficiently extracted in such mediums.

The antimicrobial testing also confirmed that several of the extracts were effective against common pathogenic bacteria and fungi. Growth inhibition was observed in multiple microbial strains, showing that these plants may serve as natural sources for developing antimicrobial agents. Extracts obtained from certain plant parts, such as leaves and roots, appeared to be more effective, which may be due to a higher concentration of active substances in those parts.

In anti-inflammatory tests, the plant extracts showed potential to reduce inflammation markers, supporting the claims of their traditional use in the treatment of swelling, pain, and inflammatory conditions. This effect was more pronounced in some plant species, indicating that the therapeutic potential may vary depending on the plant type and the extraction method used.

Additionally, cytotoxicity studies suggested that some of the extracts were able to affect the growth of abnormal cells while showing minimal impact on healthy cells. This selective activity highlights the possibility of further investigation into their anticancer properties. Although not all extracts showed strong effects, a few demonstrated promising results that justify deeper pharmacological evaluation.

Overall, the findings are consistent with existing literature on medicinal plants and their bioactive compounds. The observed biological activities may be due to the synergistic effects of multiple compounds naturally present in the plants. However, further detailed studies, including the isolation of individual active components and *in vivo* testing, are recommended to better understand their mechanisms and potential for pharmaceutical application.

CONCLUSION

The study of plants rich in bioactive compounds highlights their significant role as a natural source of pharmacologically active substances. Many medicinal plants contain diverse classes of bioactive molecules such as alkaloids, flavonoids, tannins, and terpenoids, which exhibit a wide

range of biological activities. These compounds have shown promising results in the treatment and prevention of various diseases, making them valuable candidates for pharmaceutical development.

Given the growing interest in natural and plant-based therapies, the pharmaceutical industry is increasingly turning to botanical sources for drug discovery and development. The integration of traditional knowledge with modern In summary, exploring bioactive compounds in plants not only supports the development of new, effective, and safer drugs but also promotes sustainable use of natural resources. Further in-depth research, standardization, and clinical validation are essential to fully harness the medicinal potential of these plants in the pharmaceutical field.scientific research enhances the chances of identifying novel therapeutic agents

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