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(Review Article)

Medicinal Plant in Pharmaceutical Industry: A Review

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Abstract

Medicinal plants have been utilized since ancient times and continue to serve as a significant source of bioactive compounds in modern drug discovery and development. Plant-derived constituents have contributed extensively to the formulation of numerous therapeutic agents, highlighting their enduring importance in the pharmaceutical industry. Medicinal plants are inherently polychemical in nature, containing multiple active constituents that exert polyvalent effects on human physiology. These complex interactions may influence endogenous biochemical pathways as well as interact with conventional pharmaceuticals. In recent years, the global use of medicinal plants as part of complementary and alternative medicine (CAM) has increased substantially. This growing reliance reflects a broader acceptance of natural therapies for the prevention and treatment of various diseases. However, the complex composition of herbal formulations also presents challenges, particularly in terms of herb–drug interactions. For example, certain herbal medicines, including components of traditional Chinese medicine, may either potentiate or attenuate the anticoagulant effects of Warfarin, potentially leading to adverse clinical outcomes. Such interactions underscore the need for careful monitoring and informed usage when herbal remedies are combined with conventional medications.

Keywords: Pharmaceutical, Herbal medicines, Nutraceutical, Medicinal Plant.

INTRODUCTION

Surprisingly, most modern drugs are derived from plants. For about a 1,000 years, a few plant-animal categories have been regarded as a hotspot for producing restorative specialists. Reports of the presence of written documents on the medicinal properties of herbals dating back to 2600 BC and the medicinal plant records of the ancient Mesopotamian period have prepared the way for potential drug development based on plants and natural goods. The most moderate record, "Ebers Papyrus," an Egyptian traditional medicine record from 2900 BC, lists 700 plant-based medications.[1] Both traditional Chinese medicine and the Indian Ayurveda system have been documented before the year more than 2,000 BC, roughly speaking (Atanasov et al., 2015). It's. It is amazing how many different medicinal plants are found all over the world. According to reports, approximately 70,000 plant species, ranging from lichens to trees to higher levels, have been shown to have the potential to treat a variety of illnesses (Kuruppu et al., 2019). According to the WHO, 21,000 medicinal plants are utilized in various clinical settings. According to Panmei et al. (2019), conventional natural specialists continue to use homegrown medicine frameworks in rural areas. These frameworks involve over 2500 plants for the treatment of basic ailments and are thought to be among the best techniques in Indian clinical procedures. India is home to more than 100 genera of plants that are used in indigenous healing techniques throughout the world. India ranks second in terms of exportation and provides the highest number and quality of medicinal plants. With 16 agroclimatic zones, it is regarded as one of the world's 12 super biodiversity focal places.).[2]

According to the WHO, 21,000 medicinal plants are utilized in various clinical settings. According to Panmei et al. (2019), conventional natural specialists continue to use homegrown medicine frameworks in rural areas. These frameworks involve over 2500 plants for the treatment of basic ailments and are thought to be among the best techniques in Indian clinical procedures. India is home to more than 100 genera of plants that are used in indigenous healing techniques throughout the world. India ranks second in terms of exportation and provides the highest number and quality of medicinal plants. With 16 agro climatic zones, it is regarded as one of the world's 12 super biodiversity focal places. Home grown medication is viewed as one of the large science bases for antiquated and big level clinical framework. Around 75-80% of the total populace, in the significant non-industrial nations depends on regular items based medication for essential medical care because of their better social agreeableness and similarity with the human body and negligible unfavourable responses. Thus, a huge expansion in the investigation and utilization of home grown meds

by significant non-industrial nations throughout recent many years might be noticed. As expressed by the World Wellbeing Association (WHO) utilization of customary medications (counting home grown drugs) is considered as helpful practices that approached into development many a long time back and is still practically speaking till date. The development of herbal medicines is entirely dependent on traditional medicines, which use treatment preparations made from medicinal plants. The previous proof recommends that the act of natural medication in India, China, Egypt and Syria have been occurring for north of 5000 years. The traditional Indian texts on human medication incorporate Rigveda, Atharva Veda, Charaka Samhita and Sushruta Samhita Kamboj.2001 It is mentioned in the Rigveda that humans learned to tell edible plants from poisonous ones by watching animals. In this way the regular and logical practices followed by our old civilization cleared a promising way for the improvement of home grown drugs Kamboj (2000). The study of how native people used plants and how they interacted with people. Society meds of all developments of the world have large amounts of home grown cures. That medicinal plant use has become commonplace in basic health care systems like South Africa's. Today, it could be seen that individuals are attempting all and any sure strategy to dispose of pressure, contamination, and manufactured drugs. Biodiversity gives every one of the labor and products which structure a fundamental necessity for the endurance of creatures like staple, scavenge and tranquilize. In this paper, an outline of the nearby and worldwide exploration articles concerning the logical premise of multi restorative properties of customary plants that are privately found in Indian locales is outfitted.[1]

Herbal Drug

Herbal medicine, also known as botanical medicine or phytomedicine, is the use of plants and plant extracts for medicinal purposes. It has been used for centuries in many cultures and is still widely used today. Herbal medicine is used to treat a variety of conditions, including allergies, asthma, eczema, premenstrual syndrome, rheumatoid arthritis, fibromyalgia, migraine, menopausal symptoms, chronic fatigue, irritable bowel syndrome, and cancer, among others. However, it is important to take herbal supplements under the guidance of a trained provider, as they can potentially interact with prescription medications and worsen certain medical conditions. Ongoing work on the subject is necessary to ensure that herbal medicines are both effective and safe, encouraging rational use of this therapeutic option.Herbal medicine has substantially displaced modern allopathic medicine worldwide. Other than being employed in scientifically validated medical treatments, herbal medicinal items such as raw materials, completed products, and herb preparations have become more common as alternatives to herbal medicine. These products are created from a combination of different substances found in plants used for medicine. [2]

Demands of Medicinal Plants

The demand for medicinal plants is increasing worldwide due to the safer, cheaper, and lesser side-effects of herbal medicines compared to mainstream allopathic medicines. Most medicinal plants are harvested from the wild, often unsustainably, which can lead to the local extinction of many medicinal plant species. The continuous exploitation of several medicinal plant species from the wild and substantial loss of their habitats are the primary threats to medicinal plants. Rising demand with shrinking habitats may lead to the local extinction of many medicinal plant species. The sucacess of the medicinal plants sector mainly depends on the awareness and interest of the farmers as well as its other supportive government policies, availability of assured markets, profitable price levels, and access to simple and appropriate agro-techniques. The sustainable use behavior could be promoted through effective interventions, and the sustainability of the local market is still inseparable from effective regional management. There are several important points to keep in mind before jumping into medicinal plant production, such as working with "new crops" and checking local regulations and the status of plants before heading out. Some of the plants in greatest demand include goldenseal, ginseng, black cohosh, mayapple, and skullcap. [16]

Popular medicinal plants

Echinacea: Known for its potential to treat a variety of ailments, including wounds, burns, and respiratory issues
Gingko: Often used to improve memory and treat various cognitive disorders
Ginseng: Believed to have several health benefits, such as boosting energy and reducing stress
Ginger: Widely used for its anti-inflammatory and digestive properties
Turmeric: Gaining attention for its potent anti-inflammatory properties
Chamomile: Known for its calming and anti-inflammatory effects, often used to aid sleep and digestion
Calendula: Recognized for its anti-inflammatory and antiseptic properties, commonly used in skincare products
Holy Basil: Used for its antimicrobial, anti-inflammatory, and expectorant propertie
Lavender: Known for its calming and sleep-inducing effects, often used in aromatherapy and skincare products. [17]

Herbal Industries

Herbal industry in India is a significant contributor to the country's economy. India is the second largest exporter of medicinal plants in the world, next to

China, and is a host to more than three hundred thousand herbal medicine preparations used in ancient healing systems such as Unani and Homeopathy

The industry faces challenges such as differing regulatory requirements, limited market in foreign countries, and insufficient regulatory guidelines, particularly for good manufacturing practices

The demand for herbal medicines is increasing, and the industry is valued at over Rs 80 billion, with herbal exports occupying a share of 3% of the total Indian pharmaceutical export

The industry is also expanding, with the herbal products market in India estimated to grow at a CAGR of 18% between 2019 and 2024. The future of the industry lies in sustainable cultivation practices, regulatory harmonization, and the development of a sustainable value chain for medicinal and aromatic plants. Some of the top herbal companies in India include Zoic Pharmaceuticals, Himalaya Herbals, and Care Botanicals. [12]

The regulations for commercializing herbal products in India are governed by the Drugs and Cosmetics Act of 1940 and the Drugs and Cosmetic Rules of 1945. The act and rules regulate the import, manufacturing, sale, and distribution of drugs, including herbal products, in India to commercialize herbal products in India, manufacturers must obtain a product registration certificate and/or import license from the Central Drugs Standard Control Organization (CDSCO), which is the national drug regulatory authority in India

The application for registration and/or license must be made in Form 40, either by the manufacturer or their authorized agent in India. The application must include various documents, such as a free sale certificate, GMP certificate, and manufacturing license, among others, The CDSCO may also conduct inspections of the manufacturing premises and take samples of the drugs for testing and analysis. The regulations aim to ensure the safety, quality, and efficacy of herbal products in India. [13]

Challenges and Obstacles in Medical Plant Trade and Market Development

The medicinal plant trade and market development face several challenges and obstacles. One of the primary challenges is the lack of regulation and standardization in the industry. The standards of purity and correct identification do not keep pace with the process of expansion, and the market prices for medicinal plants and derived materials provide only a limited insight into the workings of the market, and not on the precise information of profits, supply, and demand. The medicinal plant sector is largely less documented and inadequately regulated, and the economy generated by this sector is therefore not precise because of the enormous illegal trade. The marketing system in the medicinal plants sector is largely unregulated and inequitable, and the medicinal plant collectors are generally the marginal farmers and laborers who are often unaware of the real market prices of many medicinal plant species. Other challenges include insufficient regulatory guidelines, limited market in foreign countries, low availability of irrigation facilities, low yield unable to meet the commercial needs, and lacking linkages among different stakeholders. To mitigate these challenges, there is a need to develop coordinated efforts at each stage, which would be supported by an appropriate policy framework. The policy framework should focus on research, cultivation, collection, storage, processing, manufacturing, and marketing. The development of high-yielding varieties, restoration of barren lands, and allocation of land at one place based on farmer's choice and consensus are some of the suggested remedies. Direct selling to industry by producers should be encouraged, and buy-back arrangements between farmers and pharmaceutical companies might be useful. [12]

Overharvesting and Unsustainable Practices: Many medicinal plants are wild-harvested, leading to overexploitation and depletion of natural resources. Unsustainable harvesting practices can threaten the survival of plant species and disrupt ecosystems.

Habitat Destruction: Deforestation, land conversion for agriculture, urbanization, and other human activities contribute to the loss of natural habitats where medicinal plants grow. Loss of habitat reduces the availability of these plants and can lead to their extinction.

Legal and Regulatory Issues: Trade in medicinal plants is often subject to complex regulations, including permits, quotas, and restrictions on harvesting and trade. Inadequate enforcement of these regulations can result in illegal harvesting and trade, further threatening plant populations and undermining conservation efforts.

Quality Control and Standardization: Ensuring the quality, safety, and efficacy of medicinal plants is challenging due to variations in plant species, growing conditions, harvesting methods, and processing techniques. Lack of standardized protocols for cultivation, harvesting, processing, and storage can affect the consistency and reliability of herbal products.

Counterfeit and Adulterated Products: The herbal products market is plagued by counterfeit products and adulteration, where low-quality or ineffective ingredients are substituted for genuine ones. This undermines consumer confidence and poses risks to public health.

Cultural and Traditional Practices: Cultural beliefs, traditions, and indigenous knowledge play significant roles in the use and trade of medicinal plants. However, conflicts may arise between traditional practices and modern conservation or regulatory efforts, necessitating culturally sensitive approaches to conservation and sustainable use.

Market Access and Infrastructure: Limited market access, inadequate transportation infrastructure, and lack of market information and opportunities hinder

the development of medicinal plant trade, particularly in remote or rural areas where many medicinal plants are found.

Climate Change: Climate change poses a significant threat to medicinal plant populations by altering temperature and precipitation patterns, disrupting ecosystems, and increasing the frequency and intensity of extreme weather events. Climate change can also affect the distribution, abundance, and quality of medicinal plants.

Intellectual Property Rights and Benefit Sharing: Issues related to intellectual property rights, biopiracy, and equitable benefit sharing often arise when commercializing medicinal plants and traditional knowledge associated with their use. Ensuring fair and equitable sharing of benefits with local communities and indigenous groups is essential for ethical and sustainable trade.

Research and Development Challenges: Limited research and development investments in medicinal plants, including taxonomic studies, pharmacological research, clinical trials, and product development, hinder innovation and market expansion in the herbal products industry. [12].

CONCLUSION

The increasing global demand for medicinal plants and herbal products has significantly impacted the availability and management of natural resources. As the pharmaceutical industry increasingly incorporates plant-based materials into drug development, it becomes essential to ensure that these resources are utilized in a sustainable and scientifically responsible manner. Overharvesting, habitat destruction, and unregulated collection practices have led to the depletion of several valuable medicinal plant species. Therefore, the development and implementation of effective conservation strategies are crucial to maintain biodiversity and ensure a continuous supply of high-quality raw materials.

In this context, interdisciplinary research plays a vital role. Studies in phytochemistry help identify and standardize bioactive compounds, while ethnobotanical investigations provide valuable insights into traditional knowledge and usage patterns. Pharmacological research further validates the therapeutic potential of these plants, supporting their integration into modern medicine. However, alongside scientific advancements, there is a pressing need to address challenges related to raw material sourcing and processing. A significant proportion of herbal products are manufactured by small-scale industries, which often lack adequate infrastructure for research, quality control, and standardization. This limitation affects the consistency, safety, and efficacy of herbal formulations. To overcome these challenges, improvements are required in cultivation practices, including the adoption of Good Agricultural and Collection Practices (GACP). Additionally, advancements in post-harvest processing, storage, packaging, and quality assurance systems are essential to preserve the integrity of plant materials. Strengthening regulatory frameworks and providing technical support to small-scale enterprises can enhance their capacity to meet industry standards. Overall, a balanced approach that combines sustainable resource management, scientific validation, and industrial optimization is necessary to ensure the long-term viability of medicinal plants in the pharmaceutical industry.

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