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Natural Excipients and Extraction Methods

Mr. Darshan Dattatray Khot¹, Mr. S.S. Shelake²

¹Student, B.Pharm, Ashokrao Mane Institute of Pharmacy, Ambap, Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

²Guide, Assistant Professor, Ashokrao Mane Institute of Pharmacy, Ambap, Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad

ABSTRACT

The use of natural excipients to deliver the bioactive agents has been hampered by the synthetic materials. However, advantages offered by these natural excipients are their being non-toxic, less expensive and freely available. The performance of the excipients partly determines the quality of the medicines. The performance of the excipients partly determines the quality of the medicines. Excipients are any component other than the active substances intentionally added to formulation of a dosage form. Novel drug delivery systems are developed to address the challenges of drug development such as bioavailability, permeability, and poor solubility. Global excipient markets are expected to grow rapidly with the emerging trends in the pharmaceutical industry. The pharmaceutical industry is marketing refinement in the physical structure of active pharmaceutical ingredients (APIs). This article gives an overview of natural excipients which are used in conventional dosage forms as well as novel drug delivery systems. This review article explores the interface between conventional herbal knowledge and contemporary scientific discoveries as it digs into the most cutting-edge advancements in herbal technology. Herbal formulations serve as therapeutic solutions for numerous conditions due to their extensive advantages. Identifying and analyzing marker compounds, bioactive substances, and other primary components presents significant scientific challenges. Establishing standards represents a vital process for ensuring reliable biological effects. Growing herbal product usage has unfortunately led to misuse and contamination issues, causing consumer and manufacturer dissatisfaction and occasionally serious health consequences. Furthermore, this study examines how data analysis and machine learning applications contribute to creating personalized botanical treatments. This evaluation seeks to present a thorough perspective of the expanding botanical technology landscape by merging information from various fields, highlighting its capacity to revolutionize medical care and support environmental sustainability.

1. INTRODUCTION

An excipient, which comes from the word excipere meaning to take out or receive, refers to any substance mixed with the active pharmaceutical ingredient to provide consistency or act as a vehicle for administration. Active pharmaceutical ingredients cannot possess all the properties needed to create a therapeutic product alone. Therefore, a therapeutic product is always a combination of a drug and excipients. The traditional view of excipients as mere components other than the active substance has changed significantly. Excipients have evolved from being seen as inert, cheap vehicles to essential parts of the formulation. The pharmaceutical industry has refined the physical structure of active pharmaceutical ingredients (APIs). This article provides an overview of natural excipients used in conventional dosage forms and novel drug delivery systems. Drugs are vital for saving lives, restoring health, and preventing diseases and epidemics; however, they must be safe, effective, and of high quality. Their production, import/export, storage, supply, and distribution should be under government control through established norms and an effective regulatory system. To prepare a drug substance into its final dosage form, pharmaceutical ingredients are necessary. Natural plant-based excipients offer many advantages, including low cost, natural origin, minimal side effects, biocompatibility, and bio-acceptability. They also come from renewable sources, have environmentally friendly processing, local availability, better patient tolerance, and public acceptance. In summary, modern herbal technology has evolved from ancient practices into a blend of traditional knowledge and contemporary scientific methods. This development helps create effective herbal products and medicines. The traditional view of excipients as components that do not include the active substance has changed significantly. Excipients have shifted from being inert and inexpensive vehicles to essential parts of the formulation. The pharmaceutical industry is focusing on improving the physical structure of active pharmaceutical ingredients (APIs). This article provides an overview of natural excipients used in both conventional dosage forms and new drug delivery system.

1.1 History

Hippocrates, the father of medicine, categorized herbs by their essential qualities and created a diagnostic system. Developing analytical methods, including quantitative analysis, is important for confirming quality and maintaining a consistent chemical profile. Standardization is necessary to ensure biological activity and quality control in herbal drug displaying and manufacturing. Recent standardization methods include DNA fingerprinting, differential vibration polarography, and X-ray diffraction.

1.2 Ancient roots

Ancient civilizations like China and India documented herbal remedies in their traditional medicine systems, including Ayurveda and traditional Chinese medicine (TCM). Herbal knowledge was passed down through generations, relying on experiential wisdom rather than scientific understanding.

1. **Medieval and Renaissance periods:** Herbalism thrived in medieval Europe, with monasteries playing a key role in preserving and spreading herbal knowledge. The Renaissance brought about herbal encyclopedias, such as those by herbalists John Gerard and Nicholas Culpeper.
2. **18th to 19th Century:** The discovery of active compounds like morphine from opium represented a shift towards isolating specific elements for medicinal use. Technological advances, such as distillation and improved microscopy, enhanced the study of plant compounds.
3. **20th Century:** The pharmaceutical industry combined herbal knowledge with modern science, leading to the creation of drugs like aspirin derived from willow bark. Improvements in extraction techniques, such as Soxhlet extraction, made it easier to obtain plant compounds.
4. **Late 20th Century to present:** Analytical technologies like chromatography and mass spectrometry transformed the way herbal constituents are identified and measured.
5. **Digital Era:** Online databases and bioinformatics tools make sharing herbal knowledge easier globally. Ongoing research in phytochemistry and pharmacognosy continues to reveal the healing potential of herbs.
6. **Current Trends:** Precision farming and controlled environments improve the growing conditions for medicinal herbs. New delivery systems like nanocarriers enhance the targeted delivery of herbal extracts.

1.3 Objective

1. **Standardized extraction methods:** Develop standardized methods for extracting active compounds from herbs.
2. **Identification of bioactive compounds:** Focus on identifying and understanding the bioactive compounds in herbs.
3. **Formulation of effective delivery systems:** Create innovative delivery systems to ensure herbal medicines work well.
4. **Full potential use:** The main goal is to use the complete potential of herbal medicines.
5. **Chemical structure diversity:** Herbal medicines show diversity in their chemical structures.
6. **Biodiversity use:** Use the biodiversity of herbs for medicinal purposes.
7. **Changed natural product screening:** New technologies have changed how we screen natural products.
8. **Discovery of new drugs:** Help discover new drugs through better screening methods.
9. **Human health benefit:** The aim is to improve human health by using advancements in herbal technology.

1.4 Ideal quality of pharmaceutical excipients.

- ✓ They must be non-toxic and acceptable to regulatory agencies in all countries where the product will be marketed.
- ✓ They must be commercially available in an acceptable grade in all countries where the product will be manufactured.
- ✓ They must be physiologically inert.
- ✓ Their cost must be acceptably low.
- ✓ They must be physically and chemically stable both alone and when combined with the drug and other dosage components.
- ✓ They must be free of any unacceptable microbiological load.
- ✓ They must be color compatible so they do not produce any off-color appearance.
- ✓ They must not negatively affect the bioavailability of the drug(s) in the product

2. CLASSIFICATION

2.1. Natural excipients are categorized into three distinct groups based on their source

1. **Excipients derived from plants:** These originate from different plant parts such as seeds, roots, bark, leaves, and fruits. They are frequently employed in pharmaceuticals due to their biodegradability, compatibility with living tissues, safety, and affordability. Primarily made up of carbohydrates. Examples: Starches, Natural Gums, Cellulose

2. **Excipients of animal origin:** Sourced from animals, these primarily comprise proteins or fats. Their application necessitates meticulous regulatory oversight due to concerns regarding possible disease transmission, although they are typically safe when processed properly. Examples: Gelatin, Lactose, Beewax, Honey
3. **Excipients of mineral origin:** These are naturally occurring inorganic materials extracted from the earth. They are appreciated for their stability, inertness, and utility in pharmaceutical manufacturing. Examples: Bentonite, Silica, Kaolin.

2.2 Natural excipients can be categorized based on their chemical composition.

1. **Carbohydrates:** This is a significant and primary category of natural excipients, frequently consisting of polymers made up of repeating monosaccharide units. They are extensively utilized for purposes such as binding, filling, and disintegration.

Examples Include: Starch

- **Starch:** Starch, a natural polysaccharide polymer, is abundantly found in fruits, roots, pedicles, and leaves of plants.

Classification of starch

1. Raw starch
2. Amphoteric starch
 2. **Polymer:** Natural polymers are derived from various sources, and this review aims to succinctly address them based on their origins. Relevant examples pertaining to the current subject will be highlighted.

Examples: Polysaccharides.

2.3 Natural excipients are classified based on their application and functions.

1. **Colorants:** Colorants are natural dyes obtained from plants, animals, and invertebrates. Common colorants come from vegetable dyes sourced from plants like roots, bark, leaves, wood, and other biological sources like fungi and lichens. Synthetic colorants are made in labs and do not occur in nature. Colorants from natural sources are safe because they are non-carcinogenic, non-toxic, and biodegradable. Several active compounds in plants serve as colorants, including various pigments like anthocyanins, carotenoids, betalains, crocin, and anthraquinone.



Fig. No. 1 Aloe Vera Extract

- Examples of Natural Colourants: Saffron, Turmeric, Henna

2. **Binders & Adhesive (Granulators):** These materials hold powders together to form granules. They also promote cohesive compacts that keep the compressed tablet intact during handling and shipping. Binders add cohesiveness to powder ingredients and help with tablet formation. Herbal binders, often made from polysaccharides or plant mucilage, are typically used in this process. Binders are excipients, which can be dry powders or liquids, that hold together all the ingredients in a dosage form.

- Examples of Natural Binders: Guar, Starch, Geletin

3. **Diluents.** These are also known as bases. They are added to tablet formulations to increase the bulk when the drug dose is too low to achieve the required volume. Fillers and diluents are excipients that improve the bulk of a formulation or dilute a liquid formulation. The main role of fillers and diluents is to provide a structural form and fill the size of the dosage form, making it suitable for administration by increasing the volume. Fillers are inert and easily compatible with all formulation ingredients. Fillers are used in solid, semi-solid, and liquid dosage forms



Fig. No. 2 Natural Diluents

- Examples of Natural Binders - Lactose, Mannitol

4. **Sweetener's:** -Sweeteners are used to improve palatability and shelf life of food products. Impart sweet taste to the formulations. They don't contribute to weight gain, don't cause cavities and don't raise blood sugar levels. Sweetness reduces or masks bitterness, sourness and saltiness. Natural agents are applied as flavoring and sweetening agents in herbal excipients for oral drug formulations. These agents make the medications more palatable for patients, including those in pediatric formulations.



Fig. No. 3 Natural Sweeteners

- Examples of Natural Sweeteners: Stevia, Liquore, Honey

5. **Disintegrants:** Disintegrating agents speed up the swelling or breakdown of a tablet when it contacts a fluid. Disintegrants are added to the formulation because they break the dosage

form into smaller particles in contact with liquid. Smaller fragments have a greater surface area, which increases the drug's dissolution. For example, starch and cellulose are common disintegrants. These substances help break up or disintegrate a tablet when it comes into contact with water in the gastrointestinal tract. Disintegrants work through three mechanisms: by swelling (for example, starch), by improving the penetration of aqueous liquids (wetting agents, like clays), and by releasing gas from an effervescent base (like citric acid).

- Examples of Disintegrants: Starch, Guar Gum



Fig. No. 4 Natural Disintegrants

6. **Flavors:** Flavors can help cover up unpleasant-tasting active ingredients and encourage patients to finish their medication. The FDA defines a natural flavor as the essential oil, oleoresin, essence, extractive protein hydrolysate, distillate, or any product from roasting, heating, or enzymolysis, which contains flavoring components from a spice, fruit, fruit juice, vegetable juice, herb, bark, bud, root, or leaf.

- Examples of Natural Flavours: Cardamom oil, orange oil

➤ **Role of excipient in the development of dosage form.**

Excipients serve multiple roles during the development of a dosage form. They act as inactive ingredients that support the active pharmaceutical ingredient. They perform several important functions in the formulation process:

1. **Active Ingredient Stabilization:** Antioxidants protect APIs from oxidation. Excipients also shield active pharmaceutical ingredients (API) from environmental factors like moisture, light, and oxidation.
2. **Excipients in the Manufacturing Process:** Excipients such as lubricants, binders, and filler help the manufacturing of dosage forms run smoothly. They address sticking issues and make tablet compression easier without affecting the flow properties of powders
3. **Improvement of Bioavailability:** Excipients enhance drug bioavailability. They act as solubilizers or permeation agents to improve the API's solubility and permeability in the body. Surfactants like cyclodextrins are among the solubilizing agents used.
4. **Control of Drug Release:** Formulations can achieve sustained-release or delayed-release properties by using polymer and coating agents to manage the release of APIs.
5. **Satisfaction of Compliance:** Flavoring and sweetening agents improve the taste of medications. For children's preparations, they also add appealing colors. Additionally, excipients can enhance a drug's physical and chemical properties.



Figure No. 5 Role of excipients

➤ **Advantages:**

1. **Biodegradability:** Herbal excipients are biodegradable in nature, decomposing spontaneously without leaving harmful residues in the environment. This reduces the impact on the environment compared to synthetic excipients.
2. **Biocompatibility and Safety:** Most herbal excipients are well biocompatible, so less likely to elicit adverse reactions or toxicity, making them safer, especially for long-term use or in sensitive populations, such as children or the elderly.
3. **Non-toxicity and Hypoallergenic Nature:** Herbal excipients are suitable for use in sensitive patients and those allergic to synthetic chemicals due to their nontoxic and hypo allergic nature, if processed appropriately.
4. **Sustainability:** Herbal excipients are renewable resources derived from plants but renewable at the same time. They can be grown and harvested in the environment in a sustainable manner, thus reducing dependence on petrochemical-based synthetic excipients.

➤ **Disadvantages:**

1. **Variability in Content:** The chemical content of herbal excipients varies based on geography, climate, and harvesting. This leads to differences in the final product from one batch to another.
2. **Risk of Contamination:** Herbal excipients can be contaminated by microbes, pesticides, or heavy metals during growing or processing. This raises safety concerns, so proper quality control is necessary.
3. **Limited Supply:** Some herbal excipients may have limited availability or be seasonal, which can disrupt supply chains and production plans.
4. **Lower Stability:** Herbal excipients tend to break down faster than synthetic ones. They are more susceptible to degradation from environmental factors like temperature, light, or moisture, which shortens shelf life.
5. **Complex Extraction and Processing:** Extracting and purifying the active parts of herbal excipients is usually more difficult and costly than for synthetic excipients, leading to higher production costs.

3. EXTRACTION

Herbal extraction is a process that involves obtaining bioactive compounds from plant material. The term extraction is used to isolate and concentrate specific substances, such as essential oils, antioxidants or beneficial compounds, for various applications. The extracted substance may be further used for processing in any dosage form such as tablets or capsules, emulsion, cream etc. Thus, extraction procedures contribute significantly to standardization of quality of herbal drug.

The extraction process includes the following steps: -

Selection of plant material: select the specific part of the plant containing the desired compound, such as leaves, roots, flowers etc.

1. **Preparation:** wash and clean of plant parts and remove the impurities and unwanted substances.
2. **Grinding or crushing:** it helps to increase the surface area of the plant material to facilitate the extraction process.

3. **Selection of solvent:** select the solvent based on the nature of the compounds you want to extract. solvent such as used mostly water, ethanol, methanol, or the organic solvent.
4. **Extraction:** The process of isolation of soluble material from an insoluble residue, which may be liquid or solid by treatment with solvent based on the physical nature (solid or liquid) of crude drug to be extracted.
5. **Filtration:** filtration means separation of liquid extract from solid plant material to obtain a crude extract concentration: remove the solvent from extract to concentrate the desired compounds. This can do through methods like evaporation or distillation.
6. **Purification:** further refine the extract to remove undesirable components.
7. **Storage:** Preserve the final extract in suitable conditions to maintain its stability and efficacy.

Method of Extraction

1. Maceration
 2. Digestion
 3. Decoction
 4. Infusion
 5. Percolation
 6. Continuous hot extraction (Soxhlet extraction)
1. **Maceration:** In this process, solid ingredients are placed in a sealed container along with the solvent. They are allowed to sit for at least 3 days, usually between 3 to 7 days, with frequent stirring until the soluble matter dissolves. After that, the mixture is strained using sieves or nets. The solid residue is pressed, and the combined liquids are clarified by filtration or by letting them settle and then pouring off the clear liquid.



Fig. No. 6 Maceration

2. **Digestion:** This process extracts the desired chemical components by applying gentle heat to the crude drug powder being used. Digestion is a modified form of maceration. It is suitable only when moderately high temperatures are acceptable. This method increases the solvent's ability to penetrate the material.

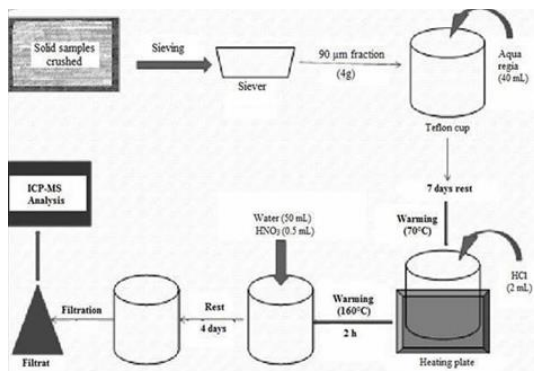


Fig. No. 7 Digestion

3. **Decoction:** In this process, the crude drug is boiled in a specific amount of water for a set time, usually 10 to 15 minutes, and then strained or filtered. This method works well for drugs that are tough and woody, such as roots, wood, and seeds, which contain thermo-stable water-soluble chemical constituents. These constituents are not affected by prolonged heating. Decoction is mainly useful for making herbal tea, which should be consumed within 24 hours.
4. **Infusion:** Infusion is a simple method of extraction used for volatile ingredients, vitamins, and soft materials. In this approach, the powdered crude drug is steeped in cold or hot water for a short time.



Fig. No. 8 Infusion

5. **Percolation:** The term percolation means "pass through." It refers to the slow movement of the solvent, or menstruum, through a column of drug powder under the influence of gravity through the column of the drug powder and during this movement it goes on extracting the drug molecules layer wise. In percolation the drug plant material is exhaustively extracted by fresh solvent. The extraction is continued until the sufficient compound is extracted. If necessary, the same material can be extracted with a second solvent.

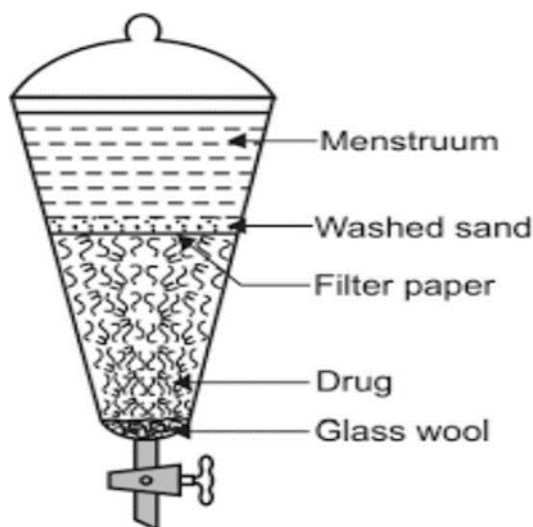


Fig. No. 9 Percolation

6. **Continuous hot extraction/ Soxhlet extraction:** Soxhlet extraction works by continuously cycling a solvent to efficiently extract compound from solid samples. The process involves heating a selected solvent until it vaporizes. The vapor then condenses and drips onto the solid sample in a thimble. This constant cycle keeps the sample in contact with fresh solvent, which promotes extraction. The solvent, now enriched with dissolved compounds returns to the boiling flask, creating a closed-loop system.

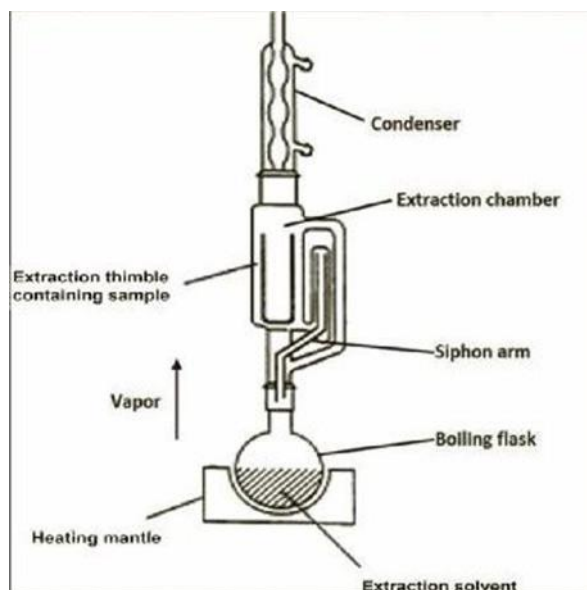


Fig. No. 10 Soxhlet extraction

Recycling the solvent improves extraction efficiency by preventing overheating and maintaining a steady temperature. The repeated cycle leads to the gradual accumulation of extracted compounds in the boiling flask, maximizing the overall yield. The effectiveness of Soxhlet extraction comes from its ability to create a continuous and controlled environment, optimizing the interaction between the solvent and the sample for thorough compound extraction.

4. RESULT

Today, the main concern is patient compliance. To address this, we need to develop flavor-based excipients, which are effective but perishable materials. Additionally, flavoring excipients offer many benefits. They are non-toxic, widely available, and more affordable than artificial substitutes. In modern science, artificial excipients were developed and used extensively until the twentieth century. However, as their price and safety became questionable, researchers began looking to ancient knowledge for natural excipients.

The performance of excipients partly determines the quality of medicines. The traditional view of excipients as just inert and low-cost vehicles has changed considerably over the last decade. The Ayurvedic system is in high demand, with strict regulations that promote the advancement of dosages using natural excipients. In this context, the natural excipients used in Ayurvedic medicine could serve an important purpose as sweeteners, binders, suspensions, and adhesives.

5. KNOWLEDGE GAINED

The review article provided significant insight into the role, importance, and evolving applications of natural excipients in modern pharmaceutical formulations. The key learnings are outlined below:

1. Expanded Understanding of Excipients

The article clarified that excipients are no longer considered simple inert additives. Instead, they have become critical formulation components, influencing stability, bioavailability, processing, and patient acceptability. Their function now extends from basic support to enhancing pharmacokinetics and pharmacodynamics of drug products.

2. Classification and Diversity of Natural Excipients

A detailed understanding was gained regarding the classification of natural excipients based on:

Source (plant, animal, mineral),

Chemical nature (carbohydrates, polymers),

Function in formulations (binders, disintegrants, sweeteners, colorants, etc.).

Each category offers unique advantages such as biocompatibility, biodegradability, cost-effectiveness, and regulatory acceptance.

3. Advantages of Natural Excipients

Natural excipients were shown to possess several benefits:

Non-toxicity and safety, Biodegradability,

Wide availability and low cost, Environmental sustainability,

Better patient tolerance and public acceptance.

Their renewability and minimal side effects make them preferable over synthetic alternatives.

4. Limitations and Challenges

The article highlighted challenges such as: High variability in composition,

Risk of microbial or chemical contamination, Limited supply for some botanicals,

Lower stability compared to synthetic excipients, Complex extraction and purification requirements, Regulatory complexities.

These limitations emphasize the need for standardization and quality control.

5. Knowledge of Extraction Methods

Comprehensive knowledge was gained on traditional and modern extraction techniques, including:

Maceration, digestion, infusion, decoction, percolation, Soxhlet extraction,

Microwave-assisted extraction, Supercritical fluid extraction (SFE).

These methods illustrate how plant-based raw materials can be efficiently processed for pharmaceutical use.

6. Applications of Natural Polymers

Polysaccharides such as starch, pectin, gums, alginates, and cellulose play major roles as: Binders

Disintegrants

Controlled-release agents Gelling and thickening agents Stabilizers

Their ability to form hydrogels and respond to physiological environments supports advanced drug delivery methods.

7. Impact on Novel Drug Delivery Systems

The review explained that natural excipients are now integrated into advanced drug delivery platforms such as:

Controlled-release tablets Oral colon-targeted systems Nano-formulations

Tissue engineering matrices

They enhance targeted delivery and improve overall therapeutic effect.

6. SKILL ACQUIRED

Communication Skill

Communication skill is a need of any profession as brick in building. To understand other's opinion and to express our few in only is based on communication skill.

Listening Skill Learning Skill

Learning is a skill acquired by a person by their birth. Having good learning and adaptability skills can differentiate you with others

Scientific writing

Literature review, Drafting of review/report, Formatting of report.

Time management skill

I acquire the ability to set goals, focus, organize, prioritize, communicate and delegate.

Pharmaceutical ethics

Ethics make employees strong. It is not actually to be compulsory followed by employees but it is the moral behavior of the person

7. CONCLUSION

Natural pharmaceutical excipients are gaining significant attention from researchers. They help in developing both traditional dosage forms and new drug delivery systems. Recently, chemically modified natural excipients are being used more often to address the limitations of their original forms. These excipients play an important role not only in pharmaceuticals but also in food, textiles, and paper industries. More research is needed in the future to explore their many features and potential uses in drug delivery for better pharmaceutical formulations. The development of natural excipients is gaining recognition. Some polysaccharides from plants, such as carrageen in, alginate, gum arabic, guar gum, and carob gum, have shown various applications in controlled dosage forms.

Natural excipients have major advantages over synthetic ones since they are non-toxic, more cost-effective, and widely available. The growing awareness of these natural excipients is leading pharmaceutical companies to focus on their use in formulating products. Plant-derived gums and mucilages, such as carrageenin, thaumatin, storax, agar, and gum tree, fulfill many needs of pharmaceutical excipients. These natural sources enhance drug bioavailability, improve chemical stability, and provide specific therapeutic effects. Ongoing research and further development are necessary for proper use while ensuring compliance with regulations. Herbal excipients will be incorporated into modern drugs, blending traditional and modern therapeutic strategies. This shift could significantly improve patient outcomes and support the growing trend of holistic medicine.

8. REFERENCES

1. Aulton, M.E. (2002). *Pharmaceutics: The Science of Dosage Form Design*. Churchill Livingstone.
2. Jani, G.K., Shah, D.P., Prajapati, V.D., & Jain, V.C. (2009). "Gums and mucilages: Versatile excipients for pharmaceutical formulations." *Asian Journal of Pharmaceutical Sciences*, 4(5), 309-323.
3. Kumar, V., & Jhanji, P. (2013). "Emerging Role of Natural Excipients in Formulation Development." *International Journal of Pharmaceutical Sciences Review and Research*, 18(2), 23-29.
4. Pandey, S., Thakur, G.S., & Patel, D. (2014). "Herbal Excipients: An Application of Natural Polymers in Novel Drug Delivery Systems." *International Journal of Pharmaceutical Sciences and Research*, 5(12), 5535-5544.
5. Rowe, R.C., Sheskey, P.J., & Owen, S.C. (2006). *Handbook of Pharmaceutical Excipients*. Pharmaceutical Press.
6. Patel, N.M., & Patel, H.V. (2012). "Herbal Excipients in Novel Drug Delivery Systems." *Journal of Drug Delivery and Therapeutics*, 2(3), 18-24.
7. Shah, S.M., & Qazi, A.A. (2017). "Herbal Excipients: In the Present Era." *Journal of Advanced Pharmaceutical Technology & Research*, 8(3), 120-127.
8. Good manufacturing practices: supplementary Guidelines for the manufacture of pharmaceutical Excipients. WHO Expert Committee on Specifications For Pharmaceutical Preparations. Thirty-fifth report. Geneva: World Health Organization; Annex 5 WHO Technical Report Series, No. 885), 1999.
9. Brito M. Ayurvedic natural excipients: an advance option for modern medicaments. *Research and reviews: chem.* 2003; 7:1-18.
10. Poona V, Sagar G, Abhishek K, Yuvraj S, Pradesh M. Review Article Remarkable Contribution of Natural Excipients in Finished Pharmaceutical Products (FPPs). 2018; 52(02):714.
11. Nagpal N, Kaur P, Kumar R, Rahar S, Dhawan R, Arora M. Pharmaceutical Diluents and Their Unwanted Effects: A Review, *Bull. Pharm. Res.* 2016; 6(2):45-49.
12. Jawad R, Elleman C, Vermeer L, Drake AF, Woodhead B, Martin GP, et al. The Measurement of the β/α Anomer Composition within Amorphous Lactose Prepared by Spray and Freeze Drying Using a Simple $^1\text{H-NMR}$ Method. *Pharmaceutica Research*. 2012; 29(2):511524.
13. Thoorens G, Krier F, Leclercq B, Carlin B, Evrard B. Microcrystalline Cellulose, a Direct Compression Binder in a Quality by Design Environment – A Review, *Int. J Pharm.* 2014; 473(12):64-72.
14. Choudhary PD, Pawar HA. Recently Investigated Natural Gums and Mucilages as Pharmaceutical Excipients: An Overview, *J of pharma.* 2014;2014(2):1-9.
15. Karthik V. Excipients Used in the Formulation of Tablets. *Research and Reviews: J Chem.* 2016; 5(2):143-154.
16. Cortes-Rojas DF, Souza CRF, Chen MJ, Hochhaus G, Oliveira WP. Effects of Lipid Formulations on Clove Extract Spray Dried Powders: Comparison of Physicochemical Properties, Storage Stability, and in Vitro Intestinal Permeation. *Pharmaceutical Development and Technology*. 2018; 23(10):47-1056.