

Review Article



Remarkable Contribution of Natural Excipients in Finished Pharmaceutical Products (FPPs)

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ABSTRACT

Today, medicinal science is becoming very advanced. Various types of formulations are discovered for treatment of different types of disease. As we know that dosage form is a combination of active pharmaceutical ingredient (API) and excipients therefore it is clear that any pharmaceutical dosage forms cannot be formulated without the use of excipients. Excipients are the major part of formulation. They do not show any adverse effect but promotes the therapeutic activity of Pharmaceutical products. The bio-availability and stability of dosage form directly depends on the nature of excipients. Synthetic excipients have some toxic properties so the uses of natural excipients are coming in the picture. This review shows the importance of natural excipients in modern time and their application for better results in medicinal sciences.

Keywords: Natural Excipients, Active pharmaceutical ingredients, Finished Pharmaceutical Products, Fillers.

INTRODUCTION

The word Excipient was came from Latin word, "excipients" which mean to receive, to gather and to take out. The standard of any formulation depends on active pharmaceutical ingredient (API), manufacturing processes and the excipients used. Excipient plays a great role in the performance of the API and to support the safety & efficacy. Excipients are generally used as diluents, binders, surfactants, preservatives and sweeteners in common dosage forms like syrups, tablets and capsules¹. The toxicity, adverse effects and approval from regulatory authorities causes difficulties with synthetic excipients. Due to these problems with synthetic excipients researchers show more attraction towards the use of herbal excipients in formulations².

In present days, herbal excipients are replacing the use of synthetic excipients in pharmaceutical industry, because of less toxicity, easily availability and low expenses. And users are also interested in natural/herbal ingredients. Consumers believe that herbal substances are safer in comparison to synthetic one. The modern view is that excipients also enhance the rate of absorption and permeability of formulation. In pharmaceutical industries, Herbal excipients are very popular in these ages. Hence, this review article shows knowledge of herbal excipients which are used in general formulation³.

What is Pharmaceutical Excipients?

Pharmaceutical excipients may be described as in-active ingredients that are combining with medicinally active compounds to formulate the medicines. The substances, which is an in-active compound is referred as an excipient (Additives, Adjuncts). Excipients combine with API and helps in improving the functioning and effectiveness of the medicinally active compounds. Excipients makes drug

product better significantly. The function of excipients is to enhance the stability, absorption, bulk and durability of active compounds. Excipients are very important for the product variability. In any pharmaceutical formulation, the amount of excipients is probably 3 times more than therapeutically active compound⁴⁻⁵.

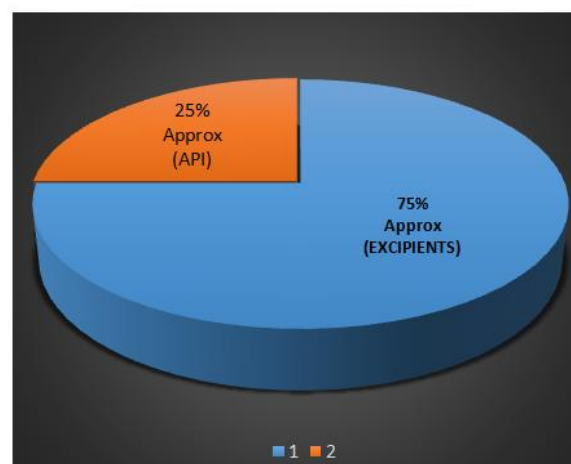


Figure 1: Percentage of Excipients & API in dosage form.

Natural Excipients

Natural excipients are those substances that are obtained from various natural sources like Plants, Animals and Minerals and used in formulations. Natural excipients are widely used because of its less toxicity, less side effect and low expenses.

Classification of Excipients

Excipients are generally classified on the basis of their application and function in the formulations.⁶



Table 1: List of various herbal pharmaceutical excipients.

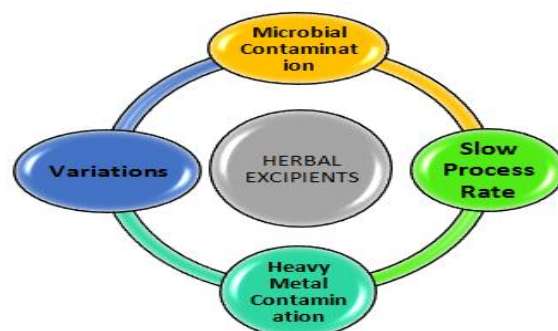
S.NO	TYPE OF EXCIPIENTS	HERBAL EXCIPIENTS
01	FILLERS	Plant Cellulose, Gelatin, Lactose, Sucrose, Glucose.
02	BINDERS	Acacia, Alginic Acid, Corn Starch, Alginate, polymers.
03	DISINTEGRANTS	Silicone, Gellan gum, Agar.
04	COATING AGENT	Gelatin, Arabi, Natural polymers.
05	LUBRICANTS	Castor oil, Mineral oil, Paraffin oil.
06	GLIDANTS	Vitamin D, Talc.
07	PRESERVATIVES	Clove oil, Cumin seeds, Neem oil, Cayenne pepper.
08	ANTIOXIDENTS	Clove oil, Cinnamon, Turmeric, Cocca
09	SWEATING AGENTS	Glucose, Lactose, Honey.
10	FLAVOURING AGENTS	Ginger, Raspberry, Lemon, Orange, Peppermint.
11	COLOURING AGENTS	Caramel, Chlorophylls, Carotenoids, Red beetroot, Turmeric, Saffron.
12	SOLVENT	Purified water, oils.
13	CHELATING AGENTS	Onions, Garlics, Chlorella, Brazil nuts.
14	BUFFERING AGENTS	Lemon juice.
15	SURFACE ACTIVE AGENTS	Ski waxes, Tea saponins.
16	VISCOSITY IMPARTING AGENTS	Gelatin, Aloe mucilage, Gums, Tragacanth.
17	EMULSIFYING AGENTS	Acacia gum, Gum Ghatti.

Advantages of Herbal Excipients

- Natural excipients, all are obtained from the natural resources. Hence, they are safe and biodegradable. They do not affect the environment.
- Chemically, all of these natural/herbal excipients are carbohydrates in nature. Hence natural excipients are non-toxic compounds.
- Natural excipients are cheaper and their manufacturing cost is less than synthetic excipients.
- Natural excipients are produced from a natural source and hence, they do not show any adverse effects or side effect on the human beings.
- Natural excipients are easily available from different natural resources.

**Figure 2:** Advantages of herbal excipients for pharmaceutical dosage forms.**Disadvantages of Herbal Excipients**

- During manufacturing, natural excipients come in contact with external environment and hence, there are many possibilities of microbial contamination.
- Natural excipients production depends on environmental conditions, regions and climates. Hence, the amount of different natural excipients and percentage of constituents also varies in different conditions.
- The process rate of manufacturing the natural excipients also depends on various factors that cannot be changed, so natural excipients have slow process rate of manufacturing the excipients.
- Herbal excipients have possibilities of heavy metal contamination⁷⁻⁸.

**Figure 3:** Disadvantages of herbal excipients for pharmaceutical dosage forms.

Binders

Excipients are also known as additives, which are used with active pharmaceutical ingredients to convert in to a pharmaceutical dosage form for suitable administration. As name indicates, Binders are the excipient which is use to bind or hold all ingredients used in formulation of the dosage form. Binders are mixed in formulation to convey plasticity or to increase the bonding strength between the particles in formulation⁹. The gripping of ingredients in tablets and granules is very important which is enhanced by binders. They ensure that the formulations are manufactured according to required physical strength and quantity. Binders are used either in a solution or in a dry form depending on the ingredients in the formulation & the method of preparation of dosage form. Generally, binders are used in solid or semi-solid formulations¹⁰.

Examples of dosage form in which binders are used are as follow:-

- Tablets, Pills, Pallets, Granules, Pastes etc.

Advantages of Natural Binders

Natural binders are widely used in the pharmaceutical and food industry as excipients for manufacturing due to following reasons:-

- Have low toxicity
- Biodegradable
- Easily available
- Low cost
- Enhances stability
- Improve the texture
- Prevent the breakage of dosage form etc.¹¹

Disadvantages of Synthetic Binders

Synthetic binders can lead the processing difficulties like rapid over granulation, hardness of formulation, reduction in dissolution properties of formulation. When synthetic binders are used in formulations, the mixing of strong disintegrants is required during process. But the uses of synthetic binders are normally very costly. Synthetic binders show negative effect on formulation stability and also film coating appearance is observed many times on finished products due to the use of synthetic binders¹²⁻¹³.

Table 2: List of some natural excipients used as Binders.

S.no	Name of Excipients	Source (plants)	Family
01	Gum Ghatti	Anogeissus latifolia	Combretaceae
02	Albizia gum	Albizia zygia	Leguminosae
03	Cassia tora	Cassia tora Linn	Leguminosae
04	Gum acacia	Acacia Arabica	Combretaceae
05	Khaya gum	Khaya grandifolia	Labiatae
06	Satavari mucilage	Asparagus racemosus	Apocynaceae
07	Tamarind seed	Tamarindus indica	Leguminosae
08	Abelmoschus mucilage	Abelmoschus esculentus	Malvaceae
09	Fenugreek mucilage	Trigonella foenum-graecum	Leguminosae

Fillers and Diluents

Generally, in any pharmaceutical dosage form Active Pharmaceutical Ingredients (API) shows the therapeutic effect, but API does not administered directly, they combines with excipients to get a suitable form for patient compatibility. Fillers and Diluents are those excipients which are used to enhance the bulk of any solid formulation or to dilute any liquid formulation. The major function of fillers and diluents is that, they provide a structural form and fill the size of dosage form and make them suitable for administration by enhancing the bulk volume. Fillers are inert in nature and easily compatible with all ingredients of formulation. Fillers and diluents are used in solid, semi-solid and liquid dosage form¹⁴⁻¹⁵.

Examples of dosage form in which fillers and diluents are used are as follow:-

- Tablets, Pills, Pallets, Paste, Solutions, Suspensions, Emulsions etc.

Advantages of Natural Fillers and Diluents

Now a days, Natural fillers and diluents are used in many pharmaceutical industries and food industries. Being biodegradable in nature they have no side effect and adverse effect, have no toxicity, easily availability, economic, no environmental affect¹⁶.

Disadvantages of Synthetic Fillers and Diluents

Synthetic fillers and diluents are artificially manufactured in laboratories and industries. Hence, they are expensive economically. Their manufacturing also damages the environment. Synthetic filler also have some major side-effects or adverse effects. Sometimes, they are also



incompatible with specific ingredients. Synthetic fillers also shows toxicity, due to any mistake in processing¹⁷.

Table 3: List of some natural excipients used as Fillers and Diluents.

S.no	Name of Excipients	Sources
01	Cellulose	Plants
02	Lactose	Milk
03	Sucrose	Cane
04	Glucose	Various Fruits
05	Gelatin	Animals

Lubricants

Lubricates are the excipients which is used for the purpose of lubrication means making the process smooth by applying some substances. Lubricants are used for preventing the clumping of ingredients which is used in formulation during process. Lubricants decrease the friction between the particles and processing equipment and maintain the stickiness of formulation. Lubricants are added in small quantities to formulation like solid dosage forms¹⁸. Lubricants also have properties like Anti-adherents. Lubricants also enhance product flow by reducing inter particulate friction. There are generally two types of lubricants, first one is hydrophilic in nature. Generally hydrophilic lubricants have poor lubrication properties and do not show as Anti-adherents properties. Second is hydrophobic in nature. Hydrophobic lubricants are most widely used in pharmaceutical industries. These are used in low volume because they have high lubricating property. They also have Anti-adherent and Glidants like action¹⁹.

Examples of dosage form in which lubricants are used are as follow:-

- Tablets, Capsules, Pills, Pastes, Suppositories, Pallets etc.

Advantages of Natural Lubricants

- Natural lubricants are widely used in pharmaceutical formulation.
- Easy availability of natural lubricants from many sources.
- Natural lubricants have no effect on environment as well as human beings.
- They are very compatible with all ingredients of formulations.
- Natural lubricates are very economical for use.

Disadvantage of Synthetic Lubricants

The major limitation of synthetic lubricants that they are synthesized through many processes because of which, they have high costs in comparison to natural. A synthetic lubricant shows some minimal effect and toxicity²⁰.

Table 4: List of some natural excipients used as lubricants:

S.no	Name of excipients	Sources
01	Stearic acid	Animals
02	Castor oils	Seeds of castor
03	Sodium chloride	Minerals (sea)
04	Paraffin oil	Paraffin plant

Coating agents

Coating agents have various benefits in pharmaceutical solid dosage forms and also equally beneficial for humans. Coating agents are used to coat or to make a film over the dosage form. These coating techniques enhance the drug protection and also modified the drug release. According to the specific site of drug release coating agents are used such as to avoid the stomach and to absorb the drug from intestines coating agents play important role. Coating agents also ensures the product safety from outer environments and they enhance the product effectiveness. Coating agents enhance the attractiveness of formulation²¹⁻²².

Examples of dosage form in which coating agents are used:

- Tablets, Pills, Capsules etc.

Advantages of Natural Coating agents

- Natural coating agents enhance the efficiency of dosage form.
- They do not show any toxic effect to the human beings as well as environment.
- They are easily biodegradable and easily digested & excreted from body.
- Natural coating agents are easily available.
- They are also economic²³.

Disadvantages of Synthetic Coating agents

- Synthetic coating agents are used in pharmaceutical but they are not easily digestive and biodegradable.
- They show bitter taste therefore for hiding the bitter taste various sweetening and flavoring agents are used.
- Many coating agents have unacceptable appearances so coloring agents are also used.
- The uses of synthetic coating agents are costly.
- These disposal are also damages the environment²⁴⁻²⁵.



Table 5: List of some natural excipients used as natural coating agents.

S.no	Name of excipients	Sources
01	Gelatin	Animals
02	Xanthan gum	Secreted from bacterium <i>Xanthomona scampestris</i>
03	Guar gum	Seeds of <i>Cyamopsistetra gonolobus</i> L. Taub.
04	Pectin	Inner portion of citrus fruits and vegetables.

Flavoring agents

Flavors are the mixed sensation of taste, touch, smell & sight. Nowadays, many artificial flavors are manufactured with the help of technology in flavoring industries. Many pharmaceutical industries use flavors in many formulations like: cough syrups, sedatives, anti-malarial and anti-biotic. Flavors are also widely used in food industries. Flavoring agents comes under the category of organoleptic agents. Flavors are used as taste masking agents which hides the unpleasant taste or order of dosage form. A flavor enhances the likelihood of medicine and makes them more compatible for patient's administration. Due to the use of flavors in dosage form children take medicines without any problem²⁶. Flavoring agents may be artificial or natural. Artificial flavoring agents are synthesized in laboratories while natural flavoring agents are extracted from plants. There are various types of flavoring agents such as sweetening agents, ordering agents (aromatic oils). Aromatic oils are also known as volatile oils which are extracted from various flowers and plants by using specific separation technique. Sweetening agents also separated from plants and also manufactured synthetically²⁷.

Example of dosage form in which flavoring agents are used are as follow:-

- Tablets, Pills, Pallets, Capsules, Pastes, Syrups, Emulsions, Suspensions, Mouth washes etc.

Advantages of Natural Flavoring agents

- Natural flavoring agents are used widely today in pharmaceutical and food industries because, they give the realistic flavor.
- Natural flavor are also have good order and have no effect on human as well as environment.
- Natural flavors are generally extracted from various fruits and vegetables by using appropriate method through which natural extract are not contaminated or degraded.

Disadvantages of Synthetic Flavoring agents

The major disadvantages of synthetic flavoring agents that they are highly concentrated so used in minimum volume.

- They are also toxic in nature at high use. And also effect the environment because they are not easily biodegradable^[28].
- But synthetic flavor are economic comparison to naturals because the extraction process of flavors form plants are costly²⁹.

Table 6: List of some natural excipients used as natural flavoring agents.

S.no	Name of excipients	Source (Plants)	Family
01	Lemon	Peel of <i>Citrus limon</i>	Rutaceae
02	Orange	Peel of <i>Citrus sinensis</i>	Rutaceae
03	Raspberry	Fruit of <i>Rubusrosi folius</i>	Rosaceae
04	Peppermint	Leaf of <i>Menthas picata</i>	Lamiaceae
05	Ginger	Roots of <i>Zingiber officinale</i>	Zingiberaceae

Coloring agents

Coloring agents comes under the category of organoleptic agents. Coloring agents are widely used in pharmaceuticals, cosmetics and food industries. Coloring agents promotes the appearance in pharmaceutical formulations. If any dosage form has unacceptable color, the consumers avoid the dosage form for administration. Coloring agents give the attractiveness to the dosage form³⁰. Coloring agents are also used for differentiate of dosage form or for easy identification of dosage forms. Due to the use of coloring agents in dosage forms psychologically patients are attracted towards the dosage forms. Coloring agents are also used as dyes and widely used in cosmetics industries. All coloring agents used in pharmaceutical industries is approved or certified by FDA³¹.

Example of dosage forms in which coloring agents are used:-

- Tablets, Pills, Pallets, Capsules, Pastes, Ointments, Syrups, Emulsions, Suspensions etc.

Advantages of Natural Coloring agents

- As natural coloring agents obtained from the natural sources, they do not show any toxic effect on humans or do not cause any disease.
- Manufactures use natural colors more than synthetic because they are easily degradable, maintains stability and ecofriendly.
- Natural coloring agents also show some medicinal properties³².



Disadvantages of Synthetic Coloring agents

- Synthetic coloring agents show allergies like symptoms on use.
- They are carcinogenic in nature.
- They show toxic effects on human health.
- They also cause teratogenic effects due to the presence of azo groups or aromatic rings in their chemical structures.
- According to the research report of WHO, synthetic dyes and coloring agents cause many problem like immune system problems, ADHD, low temperature to frustration, impulsivity³³.

Table 7: List of some natural excipients used as coloring agents:

S.no	Color of excipients	Part	Sources
01	Brown/Black	Bark	<i>Acacia catechu</i>
02	Yellow	Leaf	<i>Adhato davisica</i>
03	Red	Whole plant	<i>Aloe barbadensis</i>
04	Orange/Red	Seeds	<i>Bisca orellena</i>
05	Blue	Leaf	<i>Indigo ferotinctoria</i>
06	Brown	Bark	<i>Azadirachta indica</i>
07	Orange	Leaf	<i>Lowsonia inersuio</i>

Preservatives

Preservatives are chemical substances that are used in all Pharmaceutical, Cosmetics and food industries. They are added in formulation to prevent the decomposition of products by microbial growth. They also stop the undesirable chemical changes. Generally preservatives are of two types first one is anti-microbial preservatives and second one is anti-oxidants³⁴.

An anti-microbial preservative prevents the product form degradation by inhibiting the growth of micro-organism. This is very ancient technique such as pickling and adding honey to prevent microbial growth by altering the pH level of formulation. Anti-microbial preservatives used to increase the shelf life of formulation. Anti-microbial preservatives work by denaturation of enzymes and protein constituents of microbes, by hydrolyzing the microbes, by modifying microbial membrane permeability and by oxidizing the cellular constituents of micro-organisms³⁵⁻³⁶.

Anti-oxidants preservatives are widely used in various industries. The oxidation process damages the most pharmaceutical as well as food materials especially those who contains large amount of fatty acids. Anti-oxidants inhibit the oxidation process. The functioning of anti-oxidants is done by blocking the oxidation chain reactions or by acting as reducing agent and anti-oxidants get itself oxidized and prevent oxidation process³⁷.

Example of dosage forms in which preservatives is used:-

- A preservative is used in all most whole formulations such as solid, liquid, semi-solid dosage forms.

Advantages of Natural Preservatives

- Natural preservatives have been used widely for various purposes since ancient time.
- Generally they are used in houses for preserving some food materials.
- They are also used in many ayurvedic formulations.
- Nowadays natural preservatives also used in various formulations to inhibit the degradation of products.
- They are non-toxic to human beings.
- There is no side-effects or adverse effects seen on human as well as environment because they are biodegradable and also economical³⁸.

Disadvantages of Synthetic Preservatives

- Synthetic preservatives have high toxicity level because they are synthesized chemical so they are more toxic in nature.
- The disposal of synthetic preservatives are also very dangerous to the environment.
- Side effects of synthetic preservatives are also seen in many cases. Some preservative like E249-E250 are used in meat to prevent botulism toxin. They also damage the living organisms when comes in contact³⁹.

Table 8: List of some natural excipients used as natural preservatives.

S.no	Name of excipients	Sources (plants)	Family
01	Clove oil	Buds of <i>Myrtaceae syzygium</i>	Myrtaceae
02	Neem oil	Fruits of <i>Azadirachta indica</i>	Meliaceae
03	Cumin seeds	Seeds of <i>Cuminum cyminum</i>	Apiaceae
04	Cayenne pepper	Fruits of <i>Piper nigrum</i>	Piperaceae
05	Turmeric	Roots of <i>Curcuma longa</i>	Zingiberaceae
06	Cinnamon	Bark of <i>Cinnamomum verum</i>	Lauraceae

Applications of natural excipients

The uses of natural excipients in various industries express the biological active agent that has been hampered by the synthetic materials. The advantages of natural excipients are that they are non-toxic in nature, less expensive (economic) and easily available. The



functions of the excipients directly proportional to the quality of the formulated product. Excipients are the substances other than therapeutically active compound which is inner in nature and enhances the functioning of active compounds. Similarly natural excipients are any component other than the active substances intentionally mixed with formulation of a dosage form and obtained from the natural resources. This article gives an overview of natural excipients which are used in general dosage forms as well as novel drug delivery systems⁴⁰⁻⁴².

Natural compounds had been used since ancient times. In India, the traditional medicine system is Ayurveda in which direct plant parts and extracts of different parts medicinal plants are used for treatments of many diseases. Before coming the synthetic compounds herbal medicines are used like churn, baati, bhasma etc. Due to major toxicity or side effects of synthetic compounds they used in a limited range under special guidelines. Today scientists also prefer the use of natural excipients as more as possible or the use of semi synthetic compounds to enhance the potency of compounds. All most whole medicinally active compounds are found from nature or derivatives are also made from naturally occurring active compounds. Consumers also uses more of natural or herbal products because of their less or non-toxic nature⁴³⁻⁴⁴.

CONCLUSION

The aim of this review was to accumulate the knowledge or information about different pharmaceutical natural excipients which are obtained from natural sources such as plant, microbes, marines, animal, and mineral. As the natural excipients are biodegradable compounds, these can be chemically compatible with other excipients in drug delivery system. In addition natural excipients are non-toxic, easily available, and less expensive (economic) compared to the synthetic compounds. Natural excipients have an important role to play in pharmaceutical, cosmetic and food industries. They are becoming the better materials for drug delivery systems. Natural polysaccharides are extensively used for the development of solid dosage forms. The polymers of mono-saccharides (sugars) are inexpensive and available in a variety of structures with a variety of properties. Modifications in such can be used to formulate novel delivery system formulations. Therefore its not wrong if we say that “ Natural Excipients have remarkable contribution in FPPs.”

REFERENCES

1. Dr.Anarthe Raju, Dr. Mani Amit, Dr.KalePreeti, Dr.Maniyar Shalakha, Dr.Anuraga Sekharmantri. Herbal Approaches in Periodontics. Galore International Journal of Health Sciences and Research; Vol. 2(1), 2017, Page no. 18-25.
2. Singh Prashant, Mahmood Tarique, Shameem Arshiya, Bagga Paramdeep, Ahmad Nesar. A review on Herbal Excipients and their pharmaceutical applications. Sch. Acad. J. Pharm; Vol. 5(3), 2016, Page no. 53-57.
3. Singh Shalini. Advantages and application of natural excipients – A Review. Asian J. Pharm. Res; Vol. 2(1), 2012, Page no. 30-39.
4. Bhor Neha. J,BhusareSnehal. EandKarePallavi. T. Multifunctional Excipients: The Smart Excipients. Int. J. Pure App. Biosci.; Vol. 2(5), 2014, Page no. 144-148.
5. Jain Abhishek, Radiya Pinky, Wadekar Raju, Pawar Chetan. Natural Excipients-An Alternative to Synthetic Excipients: A Comprehensive Review. Int. J. Pharm. Med. Res.; Vol. 2(4), 2014, Page no. 123-127.
6. Patel Hardik, Shah Viral and Upadhyay Umesh. New pharmaceutical excipients in solid dosage forms – A review. Int. J. of Pharm. & Life Sci.; Vol. 2(8), Page no. 1006-1019.
7. Chavhan Sarin. A,Shinde Sushilkumar. A, Sapkal Sandip. B and Shrikhande Vinayak. N. Herbal excipients in novel drug delivery system. IJP; Vol. 4(7), 2017, Page no. 208-216.
8. S.Dharmendra, J.K. Surendra, M.Sujata, S. Shweta. Natural Excipients- A Review. International Journal of Pharmaceutical & Biological Archives; Vol. 3(5), 2012, Page no. 1028-1034.
9. Patel Vasantrao K Sachin, Ghatage Laxman Sangramsinh, Navale Shankar Sachin, Mujawar Kadar Nigar. Natural Binders in Tablet Formulation. International Journal of PharmTech Research; Vol. 6, 2014, Page no. 1070-1073.
10. Patel Shailendra, Agrawal Shikha, Lodhi Singh Bhikam. Natural Binding Agents in Tablet Formulation. International Journal of Pharmaceutical & Biological Archives; Vol. 3(3), 2012, Page no. 466-473.
11. Kumar Shobhit, Gupta K Satish. Natural polymers, gums and mucilages as excipients in drug delivery. Polim. Med; Vol. 42, 2012, Page no. 191-197.
12. G. Rajiya begum, MA. Aleemuddin, T. Gowtham, B. Thrishala, Nagaprashanti.CH. Effect of natural gums on formulation of oral sustained release matrix tablet of chlorzoxazone. International Research Journal of Pharmacy; Vol. 3(4), 2012, Page no. 426-431.
13. Choudhary P. Dinesh and Pawar H. Ashok. Recently Investigated Natural Gums and Mucilages as Pharmaceutical Excipients: An Overview. Journal of Pharmaceutics; Vol. 1, 2014, Page no. 1-9.
14. Batra V, Bhowmick A, Behera BK, Ray AR. Sustained release of ferrous sulfate from polymer-coated gum arabica pellets. J Pharm Sci; Vol. 83, 1994, Page no. 632-635.
15. Prabakaran. L, Sendhil.D. Formulation development of patients friendly dosage form: all in one natural excipients as binders, diluents and disintegrants. International Journal of Pharmacy and Pharmaceutical Sciences; Vol. 3(2), 2011, Page no. 97-102.
16. Osabohien. E, Egboh. SHO. Utilization of bowstring hemp fibers as a filler in natural rubber compounds. Journal of Applied Polymer Science; Vol. 107 (1), 2008, Page no. 210-214.
17. Te-Wierik GH, Eissens AC, Bergsma J, Arends-Scholte AW, Bolhuis GK. A new generation starch product as excipient in pharmaceutical tablets, III: Parameters affecting controlled drug release from tablets based on high surface area retrograded pregelatinized potato starch. Int J Pharm.; Vol. 157, 1997, Page no. 181-187.



18. Jinjiang Li and Yongmei Wu. Lubricants in Pharmaceutical Solid Dosage Forms. Mdpi / Lubricants; Vol. 2, 2014, Page no. 21-43.
19. Wang. J, Wen. H, Desai. D. Lubrication in tablet formulations. Eur. J. Pharm. Biopharm; Vol. 75, 2010, Page no. 1-15.
20. Lu EX, Jiang ZQ, Zhang QZ, Jiang XG. A water-insoluble drug monolithic osmotic tablet system utilizing gum arabic as an osmotic, suspending and expanding agent. J Control Release; Vol. 92, 2003, Page no. 375–82.
21. Carien E. Beneke, Alvaro M. Viljoen and Josias H. Hamman. Polymeric Plant-derived Excipients in Drug Delivery. Mdpi / Molecules; Vol. 14, 2009, Page no. 2602-2620.
22. Gupta Akanksha, Sharma Natasha, Khinchi M.P, Agrawal Dilip. A Review on natural polymers. Asian Journal of Pharmaceutical Research and Development; Vol. 1(5), 2013, Page no. 134-145.
23. YanjunXie, Callum AS. Hill, Zefang Xiao, HolgerMilitz, Carsten Mai. Silane coupling agents used for natural fiber/polymer composites: A review. Composites Part A: Applied Science and Manufacturing; Vol. 41 (7), 2010, Page no. 806-819.
24. Rajinikanth PS, Sankar C, Mishra B. Sodium alginate microspheres of metoprolol tartrate for intranasal systemic delivery. Drug Deliv; Vol. 10, 2003, Page no. 21-28.
25. Fuchs-Koelwel B, Koelwel C, Gopferich A, Gabler B, Wiegrebe E, Lohmann CP. Tolerance of a new calcium-alginate-insert for controlled medication therapy of the eye. Ophthalmologe; Vol. 101, 2004, Page no 496-499.
26. Shalini Sharma and Shaila Lewis. Taste masking technologies: A-Review. International Journal of Pharmacy and Pharmaceutical Science; Vol. 2(2), 2010, Page no. 6-13.
27. Basu Debojyoti and Prof. Dr.SenDhruboJyoti. Organoleptic agents: adaptability, acceptability and platability in formulations to make it lucrative. World Journal of Pharmaceutical Research; Vol. 4(10), 2015, Page no. 1573-1586.
28. Dr.Sen DhruboJyoti. Esters, terpenes and flavours: make the mood cheers by three musketeers: World Journal of Pharmaceutical Research; Vol. 4(8), 2015, Page no. 01-40.
29. Shahare Hitesh.V, Kothari Lokesh.P., Kharabe Ganesh.P, MugdiyaYogesh.N, Gedam Shweta.S. An overview to some natural coloring agents used in pharmaceutical formulation. WJPR; Vol. 3(3), 2014, Page no. 3904-3916.
30. Khanal Dharma Prasad. Helping Ingredients (excipient) in Pharmaceutical formulation: Coloring Agents – use and health concern. A-systemic review. Journal of Manmohan Memorial Institute of Health Sciences; Vol. 1 (1), 2011, Page no. 40-48.
31. B.Chengaiah,RaoK.mallikarjuna,kumarK.mahesh,M.alagusundram,chettyC.madhusudhana. Medicinal importance of natural dyes A-Review; Vol. 2(1), 2010, Page no. 144-154.
32. Šuleková, M, Smrčová, M, Hudák, A, Heželová, M, Fedorová, M. Organic coloring agents in the pharmaceutical industries. FOLIA VETERINARIA; Vol. 61(3), 2017, Page no. 32-46.
33. Singh Anupama, Sharma k Pramod and Garg Garima. Natural Products as Preservatives. International Journal of Pharma and Bio Sciences; Vol. 1(4), 2010, Page no. 601-612.
34. A.B Archana, M.J.Varsha, S.RNikam and J.K.Vilasrao, Antibacterial potential of herbal formulation, Res J Microbiol;Vol 4 (4), 2009, Page no. 164-167.
35. Bashir A. K, Abdalla A. A, Alkaloids with antimicrobial activity from the root of RhazyastrictaDecn. Growing in United Arab Emirates, Arab Gulf Journal of Scientific Research;Vol. 12(1), 1994, Page no. 119-131.
36. Pawar H. A, Shenoy Ashwini V, Narawade Pranita D, Soni Pranay Y, Shanbhag Priyanka P, Rajal Vaibhav A. Preservatives from Nature: A Review. Int.J.Pharm.Phytopharmacol.Res; Vol. 1(2), 2011, Page no. 78-88.
37. Binutu O A, Adesogan K E, Antibacterial and antifungal compounds from kigeliapinnata”. Plantamedica;Vol. 62(4), 1996, Page no. 352-353.
38. Shaikh Sabir M, Doijad Rajendra C, Shete Amol S, Sankpal Pournima S. A Review on: Preservatives used in Pharmaceuticals and impacts on Health. PharmaTutor; Vol. 4(5), 2016, Page no. 25-34.
39. Sabne Prachi S, AvalaskarAmruta N, JadhavRashmi, and Sainkar Pooja S. Natural Excipients. Research Journal of Pharmaceutical, Biological and Chemical Sciences; Vol. 4 (2), 2013, Page no. 1346-1354.
40. Patel Dhara B and Patel Madhabhai M. Natural excipients in controlled drug delivery systems. Journal of Pharmacy Research; Vol. 2(5), 2009, Page no. 900-907.
41. Patil Priya S. Natural Excipients: Uses of Pharmaceutical Formulations. International Journal of PharmTech Research, CODEN (USA); Vol. 6(1), 2016, Page no. 21-28.
42. Kumar Tekeshwar, Gupta Shailendra Kumar, Prajapati Mukesh Kumar, Tripathi D. K,TripathiVikas and Jain Paridhi. Natural Excipients: A Review. Asian Journal of Pharmacy and Life Science; Vol. 2(1), 2012, Page no. 97-108.
43. Dutta Srijita. Natural polysaccharides as novel excipient for modified drug delivery system: A-review. World Journal of Pharmaceutical and Life Sciences; Vol. 1(1), 2015, Page no. 50-84.
44. Mishra K Abhaya, Sharma Aparna, Pillai K. Unnikrishna. Preservatives and their use in Ayurvedic Pharmaceutics. Anveshana Ayurveda Medical Journal; Vol. 2(1), 2016, Page no. 521-523.

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