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ROLE OF EXCIPIENT IN NANO-SUSPENSION

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Abstract:

Excipients play an important role in formulate a dosage form. These are the ingredients which along with Active Pharmaceutical ingredients build up the dosage forms. Excipients act as suspending agents, stabilizing agents and can also be used to improve bioavailability of drugs in some instances, the following review discuss the different types and sources of excipients along with their uses, role and these can be used for different activities. Specific excipients are best suitable for a exacting dosage form; the selection criterion for excipients and various interactions that an excipient can suffer through its course of stay in formulation has been discuss in this review. Some excipient interactions can be harmful and need to be avoid. This has been complete out in the interaction section. Excipients as like other active pharmaceutical ingredients need to be stabilized and homogeneous.

Keywords: *Excipients, Role, Suspending Agents, Excipient interaction, Bioavailability, function.*

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INTRODUCTION

Excipients play significant part in Nano-suspension. A excipient is a material prepare along the effective component of a medicament included for the design of a continuing the stabilization, round up solid formulations so as to include potent active component in minute quantity or to compare therapeutically increasing on the active component in the absolute dosage form, such as simplify drug absorption, decreasing viscosity, or increasing solubility. Excipients also advantageous in the manufacturing process to help in the management of active component affected such as by simplify powder flow-ability or non-stick properties. In that to assist in in-vitro stability such as obstruction of denaturation or accumulation ended the expected shelf-life. The alternative of suitable excipients also depending upon their routes of administration, dosage form, active component and other elements.[1]

Many dosage form formulated today are composite method contain many additional components alongside with the active pharmaceutical ingredient (API); these compounds are usually added along with the active pharmaceutical ingredients in order to:-[2] (I)Protect, support or increase stability of the formulation. (II)Bulk up the formulation in case of potent drug for supporting in formulation of an precise dosage form. (III)Improve patient acceptance. (IV)Help to develop bioavailability of active drug. (V)Increase in general safety and effectiveness of the formulation during its storage and use.[3]

Purposes Assisted Through Excipients:-
1.They afford mass to the formulation.
2.To accelerate drug absorption or solubility & other pharmacokinetic deliberations.
3.Help in handling of "API" while manufacturing.
4.They afford stability and nullify from denaturation.[4]

Requirements of Excipient:-
1. They are pharmacologically inert.
2. They are stable for handling.
3. Excipients are cost effective.
4. No contact with the drug and other components.
5. Feasible. [5]

ORIGIN AND SOURCES OF EXCIPIENTS

Excipients are derived from various sources:-
Mineral sources e.g. Talc, Calcium silicate, Silica, etc.[6]
Animal sources e.g. Shellac, gelatin, Magnesium stearate, Lactose etc.
Vegetable sources e.g. Starches, Cellulose, sugar, alginates, etc[7]
Semi synthetic origin e.g. Cellulose derivative like Hydroxypropylmethylcellulose (HPMC), etc
Synthetic origin e.g. polyvinylpyrrolidone, polyethylene glycol, Cross povidone etc. [8]

SELECTION OF EXCIPIENTS

Formulation of nanosuspension requires a careful selection of stabilizers. Stabilizers are needed to stabilize the nanoparticles against inter-particle forces and prevent them from aggregating. At the nanometer domain, attractive forces between particles, due to dispersion or van der Waals forces, come into play. This attractive force increases dramatically as the particles approach each other, ultimately resulting in an irreversible aggregation. To overcome the attractive interaction, repulsive forces are needed to cost of materials, morphology at room temperature, digestibility of the excipients shown in fig;-1. There are two modes of imparting repulsive forces or energetic barriers to a colloidal system steric stabilization and electrostatic stabilization. Steric stabilization is achieved by adsorbing polymers on to the particle surface. As the particles approach each other, the osmotic stress created by the encroaching steric layers acts to keep the particles separate. Electrostatic stabilization is obtained by adsorbing charged molecules, which can be ionic surfactants or charged polymers, on to the particle surface. Charge repulsion provides an electrostatic potential barrier to particle aggregation.

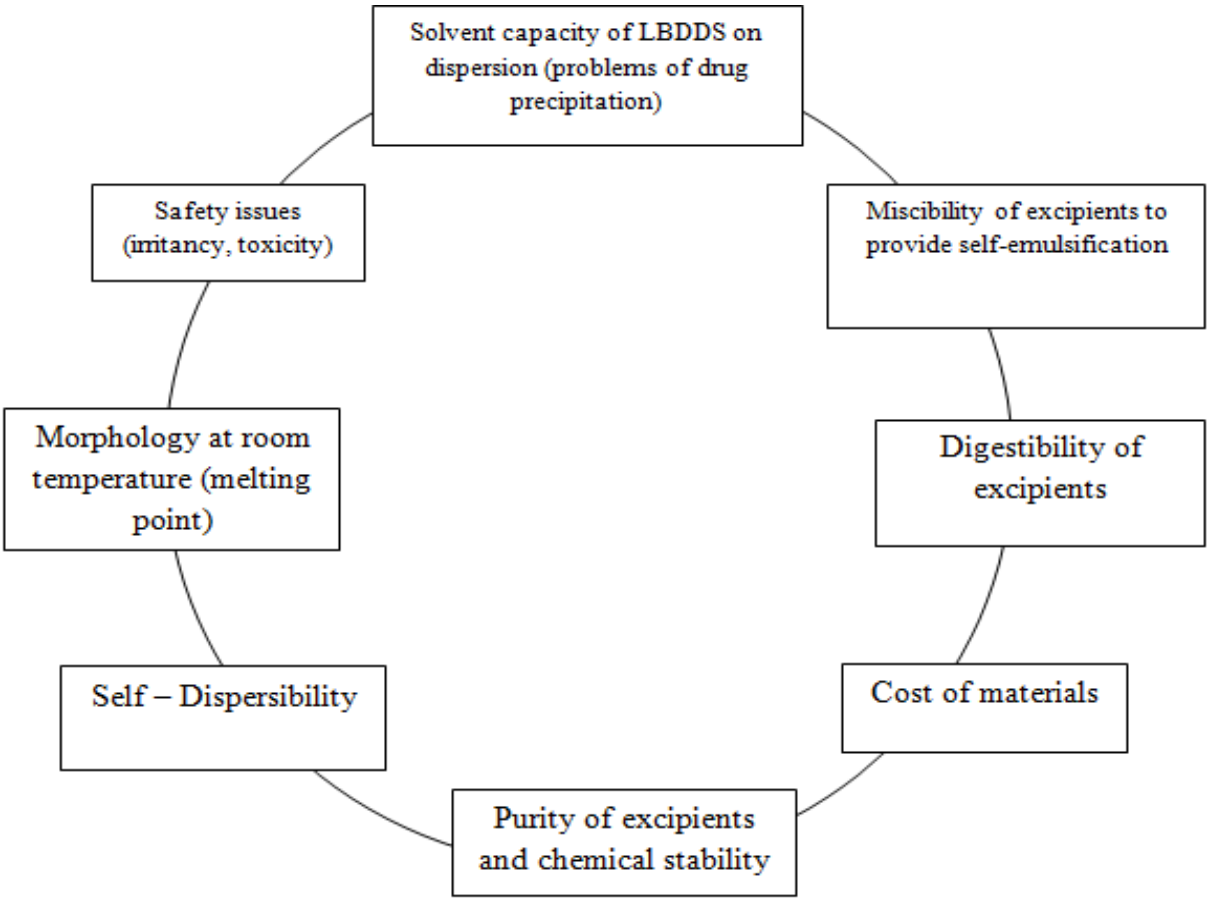

Fig Selection of Excipients

EXCIPIENT INTERACTION

Physical Interactions:-

Physical interactions alter the rate of dissolution, dosage uniformity, etc. physical interactions do not involve chemical changes thus permitting the components in the formulation to retain their molecular structure. Physical interactions are difficult to detect. Physical interactions can be either beneficial or detrimental to the product performance which is dependent on its application.[9]

Chemical Interactions:-

Active pharmaceutical ingredients and excipients react with each other to form unstable compounds. Several chemical drugs-excipient interactions have been reported in literature. Generally chemical interactions have a deleterious effect on the formulation hence such kind of interactions must be usually avoided.[10]

Bio-pharmaceutical Interactions:-

These are the interactions which are observed after administration of the medication. Interaction within the body is between medicine and body fluids which influence the rate of absorption. All excipients interacts in physiological way when they are administered along with active pharmaceutical ingredients.[11]

Excipient-Excipient Interactions:-

Excipient-Excipient interactions though observed very rarely, these are of prime importance in determining the stability of the dosage forms. Excipient-Excipient interactions can be undesirable as well as some interactions are used in the formulations to get the desired product attributes. [12]

EXCIPIENT USED IN NANO-SUSPENSION [13]

Sr no.	Excipient category	Function in formulation	Working principle	Example
1	**Solvents** - A solvent is a substance that dissolves a solute, resulting in a solution. Common uses for organic solvents are in dry cleaning, as paint thinners, as nail polish removers and glue solvents, in spot removers, in detergents and in perfumes.	Dissolving solute/Active pharmaceutical ingredient.	Breaking of bonds and reducing effective charge on ions thus increasing Solute-Solvent forces of attraction which are eventually greater than Solute-Solute and Solvent-Solvent forces of attraction.	Water, alcohol, acetic acid, acetone, ethyl acetates, syrups, etc.
2	**Co-solvents** - Co-solvents improve solubility between non-miscible phases, as demonstrated by a solute dissolved in organic solvent but insoluble in water (left). A co-solvent miscible in both phases and able to dissolve the solute is added to form a homogeneous solution of water, organic solvent, and compound.	Increase the solubility of solute in solvents.	Co-solvent system works by reducing the interfacial tension between predominantly aqueous solutions and hydrophobic solutes	Ethanol, Sorbitol, Glycerin, Propylene glycol etc.
3	**Buffers**- A buffer solution is an aqueous solution consisting of a mixture of a weak acid and its conjugate base, or vice versa. Its pH changes very little when a small amount of strong acid or base is added to it. Buffer solutions are used as a means of keeping pH at a nearly constant value in a wide variety of chemical applications. In nature, there are many systems that use buffering for pH regulation.	Maintain pH of the formulation.	Act by binding hydrogen ions in acids and donating hydrogen ions in bases.	Phosphate buffers, Acetate buffers, Citric acid Phosphate buffers etc.
4	**Antimicrobial preservatives**- A preservative is a substance or a chemical that is added to products such as food, beverages, pharmaceutical drugs, paints, biological samples, cosmetics, wood, and many other products to prevent decomposition by microbial growth or by undesirable chemical changes.	Prevent microbial growth in formulations.	Bacteriostatic action.	Butyl paraben, Benzyl alcohol.
5	**Anti-oxidents**- Antioxidants are compounds that inhibit oxidation. Oxidation is a chemical reaction that can produce free radicals, thereby leading to chain reactions that may damage the cells of organisms.	Control oxidation.	Act by getting preferentially oxidized or by blocking an oxidative chain reaction.	Ascorbic acid, Sodium bisulphate, Thiourea, Butyl Hydroxy Toluene (BHT), Tocopherols. Etc.

6	**Wetting agents** - A **substance** is referred to as a wetting agent if it **lowers the surface tension of a liquid** and thus allows it to spread more easily.	Aid wetting and dispersion of hydrophobic active pharmaceutical ingredients.	Act by reducing interfacial tension between solids and liquids in suspensions.	Sodium Lauryl Sulphate (SLS), Tween 80, Spans, Lecithins etc.
7	**Anti-foaming agents**- A defoamer or an **anti-foaming agent** is a chemical additive that reduces and hinders the formation of **foam** in industrial process liquids. The terms **anti-foaming agent** and defoamer are often used interchangeably.	Discourage formation of stable foam.	Lowers surface tension and cohesive binding of liquid phase.	Simethicone, Organic phosphates, Alcohols, Paraffin oils, Sterates and glycols.
8	**Thickening agents**- A thickening agent or thickener is a substance which can increase the viscosity of a liquid without substantially changing its other properties. Thickeners may also improve the suspension of other ingredients or emulsions which increases the stability of the product.	Prevent settling/sedimentation, modify viscosity.	Work by entrapment of solid particles. Methyl cellulose.	Hydroxyethyl cellulose.
9	**Humectants** - A humectant is a hygroscopic substance used to keep things moist; it is the opposite of a desiccant because it is wet. In pharmaceuticals and cosmetics, humectants can be used in topical dosage forms to increase the solubility of a chemical compound's active ingredients.	Retard evaporation of aqueous vehicles from dosage forms.	They are hygroscopic in nature which helps in prevent evaporation of solvent.	Propylene glycols, Glycerol, Polyethylene glycol etc.
10	**Chelating agents**– Many essential biological chemicals are chelates. Chelates play important roles in oxygen transport and in photosynthesis. Furthermore, many biological catalysts (enzymes) are chelates. In addition to their significance in living organisms, chelates are also economically important, both as products in themselves and as agents in the production of other chemicals.	Protect drug from catalysts that accelerate the oxidative reaction.	Chelating agents form complexes with metal ions inactivating their catalytic activity in oxidation of medicaments.	Disodium EDTA, Dihydroxy ethyl glycine, Citric acid and Tartaric acid.
11	**Emulsifying agents**- Emulsifying agents Substances that are soluble in both fat and water and enable fat to be uniformly dispersed in water as an emulsion.	Prevent coalescence of the dispersed globules.	Forms barriers at interface, and reduces interfacial tension.	Sodium Lauryl Sulphate, Cetrimide, Macrogol esters, Sorbitan esters etc
12	**Flocculating agent**- Clarifying agents are used to remove suspended solids from liquids by inducing flocculation (the solids begin to aggregate forming flakes, which either precipitate to the bottom or float to the surface of the liquid,	Prevent caking	Addition of an electrolyte reduces the magnitude of zeta potential of dispersed particles.	Starch, Sodium alginate, Carbomer.etc.

	and then they can be removed or collected).			
13	**Sweetning agent**- Substances that sweeten food, beverages, medications, etc. such as sugar, saccharine or other low-calorie synthetic products.	Impart sweetness.	Substance that sweeten food,beverages,medications.	Sucrose, Sorbitol, Saccharin, Aspartame, Sucralase.
14	**Coloring agent** - A color additive is any dye, pigment or substance which when added to a food, drug or cosmetic, or to the human body will impart a color.	Impart color.	It is additive is in any dye, pigment, or substance which when added to food drug or cosmetics.	Amaranth, Erythrosine, Eosin, Tartarazine etc.
15	**Flavoring agent** - Flavoring agents are key food additives with hundreds of varieties like fruit, nut, seafood, spice blends, vegetables and wine which are natural flavouring agents. Flavors are used as additives to enhance, modify the taste and the aroma in natural food products which could have got lost due to food processing.	Impart flavor.	A flavor is a quality of something that affects the sense of taste.	Aromatic waters, Syrup etc

EXCIPIENT PROFILE [14]

Excipient Name	**Poloxamer 188, 407 [15]**	**Tween 80**	**Lecithin [16]**	**Sodium lauryl sulfate**	**Docusate sodium**	**Poly ethylene glycol 200 [17]**	**Polyvinyl alcohol [18]**
Synonym	Pluronic f-68	Polysorbates	Egg lecithin	Sodium salt	dioctyl sodium sulfosuccinate	Carbowax	Airvol, Gelvol
Molecular Weight	7680-9510, 9840-14600daltons	1,310 daltons	-	288.38 g/mol	444.56 g/mol	380-420 g/mol	20.000-200000
Category	Emulsifying agent	Suspending agent	Emolient	Anionic surfactant	Anionic surfactant	Ointment base	Lubricant
Description	White granules	Yellow oily liquid	Viscous semi liquids to powder	White or cream to pale yellow crystals, flakes	white or almost white, wax like, bitter tasting, plastic solid	White flakes	White colored granular powder
M.P	52–57^{0}C for poloxamer 188; 52–57^{0}C for poloxamer 407	236-237^{0}C	160-180^{0}C	204-207^{0}C	153–157^{0}C	37-40^{0}C (1000) 44-48^{0}C (1500)	228^{0}C fully hydrolyzed grades, 180-190^{0}C partially grades

Density	1.06g/cm3 at 25^0C	1.0305 at 24^0C	0.97g/cm3 for liquid lecithin; 0.5 g/cm3 for powdered lecithin.	1.07g/cm3 at 20^0C	1.16g/cm3	1.11–1.14g/cm3 at 25^0C for liquid PEGs; 1.15–1.21g/cm3 at 25^0C for solid PEGs.	-
Moisture Content	less than 0.5% w/w water and are hygroscopic only at relative humidity greater than 80%.	_	_	45%; sodium lauryl sulfate is not hygroscopic.	1.51%	Liquid polyethylene glycols are very hygroscopic, although hygroscopicity decreases with increasing molecular weight.	-
Refractive Index	_	_	_	_		nD 25 = 1.459 for PEG 200;	: nD 25 = 1.49–1.53
Solubility	Freely soluble ethanol and water	miscible with alcohol, cottonseed oil, corn oil, ethyl acetate, methanol, and toluene, but insoluble in mineral oil	soluble in aliphatic and aromatic hydrocarbons, halogenated hydrocarbons, mineral oil, and fatty acids, insoluble in cold vegetable and animal oils, polar solvents, and water.	Freely soluble in water, giving an opalescent solution; practically insoluble in chloroform and ether.	Soluble in acetone and vegetable oil	All grades of polyethylene glycol are soluble in water and miscible in all proportions with other polyethylene glycols.	soluble in water; slightly soluble in ethanol (95%); insoluble in organic solvents
Viscosity	1000mPas (1000cP) as a melt at 77^0C for poloxamer 188.	400-620 cps (25°C, neat)	_	_	_	3.9- 4.8	High viscosity 40.0–65.0 Medium viscosity 21.0–33.0 Low viscosity 4.0–7.0
Ph.Ceutical Application	Used in pharmaceutical	used in biochemical applications	used in pharmaceutical products	Sodium lauryl sulfate is	used as anionic surfactants	used in a variety of pharmaceut	Polyvinyl alcohol is used

	formulation as emulsifying and solublizing agent	including: solubilizing proteins, isolating nuclei from cells in culture,5 growing of tubercle bacilli,6 and emulsifying and dispersing substances in medicinal and food products	as dispersing, emulsifying, and stabilizing agents, and are included in intramuscular and intravenous injections, parenteral nutrition formulations, and topical products.	an anionic surfactant employed in a wide range of nonparenteral pharmaceutical formulations and cosmetics.	in pharmaceutical formulations.	ical formulations, including parenteral, topical, ophthalmic, oral, and rectal preparations.	primarily in topical pharmaceutical and ophthalmic formulations; It is used as a stabilizing agent for emulsions (0.25–3.0% w/v).
Stability & Storage Condition	Aqueous solutions are stable in the presence of acids, alkalis, and metal ions. However, aqueous solutions support mold growth. The bulk material should be stored in a well-closed container in a cool, dry place.	Aqueous solutions of polysorbates as well as the neat liquid will undergo autoxidation over time, with changes being catalyzed by light, increased temperature, and copper sulfate.9 Solutions are reasonably stable at 2 - 8 °C for short periods. For special applications, storage under argon or nitrogen may be preferred.	They are also hygroscopic and subject to microbial degradation. When heated, lecithin's oxidize, darken, and decompose. Temperatures of 160–180C will cause degradation within 24 hours. All lecithin grades should be stored in well-closed containers protected from light and oxidation.	Sodium lauryl sulfate is stable under normal storage conditions.. The bulk material should be stored in a well-closed container away from strong oxidizing agents in a cool, dry place.	stable in the solid state when stored at room temperature. The solid material is hygroscopic and should be stored in an airtight container in a cool, dry place.	Polyethylene glycols are chemically stable in air and in solution, Polyethylene glycols and aqueous polyethylene glycol solutions can be sterilized by autoclaving, filtration, or gamma irradiation.	stable when stored in a tightly sealed container in a cool, dry place. Polyvinyl alcohol undergoes slow degradation at 1008C and rapid degradation at 2008C; it is stable on exposure to light.
Incompabilities	Depending on the relative concentrations, poloxamer 188 is incompatible with	incompatible with alkalis, heavy metal salts, phenols, and tannic acid. They may reduce the activity of	Incompatible with esterase owing to hydrolysis.	Sodium lauryl sulfate is incompatible with salts of polyvalent metal ions, such as	Docusate sodium is incompatible with acids at pH < 1 and with alkalis at pH > 10.	all grades can exhibit some oxidizing activity owing to the presence of peroxide	. It is incompatible at high concentration with inorganic salts, especially sulfates and

	phenols and parabens	many preservatives.8		aluminum, lead, tin or zinc, and precipitates with potassium salts.		impurities and secondary products formed by autoxidation. polyethylene glycol grades.	phosphates; precipitation of polyvinyl alcohol 5% w/v can be caused by phosphates.

Excipient Name	**Poly vinyl pyrrolidone K-30 [19]**	**HPC [18]**	**HPMC K-15 [20]**	**Transcutol**	**Glycofurol[21]**	**Ethanol**	**Isopropanol**
Synonym	Povidone	Cellulose	Methocel ,tylopur	Carbitol	Tetraglycol	Ethyl alcohol	Rubbing alcohol
Molecular Weight	50,000daltons	50000–1250000 daltons		134.17356 g/mol	190.24g/mol	46.069 g·mol−1	60.1 g/mol
Category	Film former	Stabilizing agent	Stabilizing agent	solubilizer	Penetration agent	Organic solvent	Disinfectant
Description	White to creamy white fine powder	White to slightly yellow color powder	White to off white fibrous powder or granules	Colourless limpid liquid	Clear , colorless liquid	volatile, flammable, Colorless liquid	Clear, colorless, mobile, volatile, flammable liquid
M.P	Softens at 150^0C	Softens at 130^0C Chars at 260-275^0C	browns at 190–2008C; chars at 225–2308C. Glass transition temperature is 170–1808C.	-108°C	_	−114.14 ± 0.03°C (−173.45 ± 0.05 °F; 159.01 ± 0.03 K)	-88.5^0C
B.P	_	_	_	196to202° C	80-100^0C	78.24 ± 0.09°C (172.83 ± 0.16 °F; 351.39 ± 0.09 K)	82.4^0C
Density	1.180 g/cm3	0.5g/cm3	(bulk): 0.341g/cm3 (tapped): 0.557g/cm3 (true): 1.326g/cm	@ 20°C 8.24 lb/gal	_	0.7893 g/cm3 (at 20 °C)	2.07 (air = 1)
Moisture Content	povidone is very hygroscopic,	Typical equilibrium moisture	hypromellose absorbs moisture	< 0.10 %	0.2–5% at ambient temperature		0.1–13% w/w for commercial

	significant amounts of moisture being absorbed at low relative humidities.	content values at 25^0C are 4% w/w at 50% relative humidity and 12% w/w at 84% relative humidity.	from the atmosphere; the amount of water absorbed depends upon the initial moisture content and the temperature and relative humidity of the surrounding air.		and 30% relative humidity.		grades (13% w/w correspond s to the water azeotrope).
Refractive Index	_	n D 20 = 1.3353 for a 2% w/v aqueous solution.	_	_	nD 40 = 1.4545	(nD) 1.3611	nD 20 = 1.3776; nD 25 = 1.3749.
Solubility	freely soluble in acids, chloroform, ethanol (95%), ketones, methanol, and water; practically insoluble in ether, hydrocarbons, and mineral oil	freely soluble in water below 38^0C, forming a smooth, clear, colloidal solution.	soluble in cold water, forming a viscous colloidal solution; practically insoluble in chloroform, ethanol (95%), and ether.	Diethylene glycol monoethyl ether soluble in ethanol and water. Partially soluble in vegetable oils and insoluble in mineral oils.	Imiscible in arachis oil, petroleum ether.	Soluble in water. Soluble in ether. Soluble in acetone. Soluble in chloroform. Soluble in oils/fats. Soluble in methanol. Soluble in acids.	miscible with benzene, chloroform, ethanol (95%), ether, glycerin, and water. Soluble in acetone; insoluble in salt solutions.
Viscosity	Grade Dynamic viscosity (mPas) K-11/14 1.3–2.3 K-16/18 1.5–3.5 K-24/27 3.5–5.5 K-28/32 5.5–8.5 K-85/95 300–700	Viscosity of aqueous solutions of Klucel (Ashland Aqualon Functional Ingredients) at 25^0C	Aqueous solutions are most commonly prepared, although hypromellos e may also be dissolved in aqueous alcohols such as ethanol.	(@ 25°C, cP) 4.5	8–18mPas (8–18cP) at 20°C for Glycofurol 75.	1.2 mPa·s (at 20°C), 1.074 mPa·s (at 25°C)	(dynamic): 2.43mPas (2.43cP) at 20°C
Ph.Ceutical Application	Povidone is used as solubilizer in oral and parenteral formulations,	used in cosmetics and in food products as an emulsifier and stabilizer.	Hypromello se is widely used in oral, ophthalmic, nasal, and topical	Solubilizer of many active ingredients (i.e. trinitrine,	intravenous or intramuscula r injection in concentratio ns up to	Ethanol is used in medical wipes and most commonly	Isopropyl alcohol (propan-2-ol) is used in cosmetics

	and to enhance the dissolution of poorly soluble drugs from solid dosage forms.		pharmaceutical formulations. Hypromellose is also used as a suspending and thickening agent in topical formulations.	indomethacin nifedipine, hormones, sterols). Absorption enhancer. Transcutol P can be used in topical, transdermal and oral pharmaceutical preparations.	50% v/v.(1–5) It has also been investigated, mainly in animal studies, for use as a penetration enhancer and solvent in topical(6) and intranasal formulations .(7–10)	in antibacterial hand sanitizer gels as an antiseptic for its bactericidal and anti-fungal effects.	and pharmaceutical formulations primarily as a solvent in topical formulations. Therapeutically, isopropyl alcohol has been investigated for the treatment of postoperative nausea or vomiting.
Stability & Storage Condition	Povidone may be stored under ordinary conditions without undergoing decomposition or degradation. However, since the powder is hygroscopic, it should be stored in an airtight container in a cool, dry place	Hydroxypropyl cellulose powder is a stable material, although it is hygroscopic after drying, powder should be stored in a well-closed container in a cool, dry place.	Hypromellose powder is a stable material, although it is hygroscopic after drying. Solutions are stable at pH 3–11. Hypromellose powder should be stored in a well-closed container, in a cool, dry place.	Stored in its original hermetically closed container. The product is packed under nitrogen atmosphere and must be used shortly after opening.	Stable if stored under nitrogen in a well-closed container protected from light, in a cool, dry place.	Keep out of direct sunlight. Store in a dry area. Ventilation at floor level. Fireproof storeroom. Provide for an automatic sprinkler system. Provide for a tub to collect spills. Provide the tank with earthing. Meet the legal requirements.	Isopropyl alcohol should be stored in an airtight container in a cool, dry place.
Incompabilities	Povidone is compatible in solution with a wide range of inorganic salts, natural and synthetic resins, and	Hydroxypropyl cellulose in solution demonstrates some incompatibility with substituted	Hypromellose is incompatible with some oxidizing agents. Since it is nonionic,	Incompatible with Strong oxidizers (e.g. Chlorine, Peroxides, etc.).;	Incompatible with oxidizing agents	Incompatible with Strong acids. Strong bases.	oxidizing agents such as H2O2and nitric acid,. Isopropyl alcohol may be

	other chemicals.	phenol derivatives, such as methyl paraben and propyl paraben.	hypromellose will not complex with metallic salts or ionic organics to form insoluble precipitates.	Strong acids.			salted out from aqueous mixtures .

EXCIPIENT MECHANISM [22]

Sr no.	Excipients name	Mechanism of action
1	Poloxamer	Poloxamer seals stable defects in cell membranes induced by skeletal muscle cell membranes rupture induced by ischemia-reperfusion injury, electroporation, irradiation, and heat damage, In addition to the direct interaction with the membrane, P188 was shown to inhibit MMP-9 protein levels and activity, as well as the NF-κB signal pathway, in the model of acute cerebral ischemia, which is associated with increased BBB permeability leading to cerebral edema and increased penetration .
2	Tween 80	Polysorbate 80 is one of the primary components of protein formulations. This drug inhibits interfacial damage of the protein molecule that undergoes mechanical stress during shipping and handling. Polysorbate 80 also affects the formulation photostability. Exposure to light of polysorbate 80 aqueous solution results in peroxide generation, which in turn may lead to oxidation of the susceptible amino acid residues in the protein molecule.
3	Lecithines	Lecithin in supressing cholesterol absorption. *in vitro* studies were performed to investigate a possible mechanism by which lecithin supresses the intestinal cholesterol absorption. The hypothesis was further tested by determining if lecithin had any effect on the molecular weight of the micelles.
4	PVP K-30	Povidone-iodine is a water-soluble complex that mediates a bactericidal or virucidal action following the gradual liberation of free iodine from the complex at the application site to react with the pathogen. Please refer to the drug entry for Povidone-iodine for the full mechanism of action of the complex.
5	Sodium lauryl sulfate	Like other surfactants, SLS is amphiphilic. It thus migrates to the surface of liquids, where its alignment and aggregation with other SLS molecules lowers the surface tension. This allows for easier spreading and mixing of the liquid. SLS has potent protein denaturing activity and inhibits the infectivity of viruses by solubilizing the viral envelope and/or by denaturing envelope and/or capsid proteins.
6	Docusate sodium	The effects of docusate may arise from the direct laxative effects of the molecule on the intestinal mucosa, or the indirect action of local endogenous prostaglandins released from the intestine upon contact with docusate. Docusate may involve multiple mechanisms of action. It stimulates the net secretion of water, sodium, chloride, and potassium and inhibits the net absorption of bicarbonate in the small intestine in vivo. It also induces active electrolyte secretion by increasing mucosal cAMP concentrations, as cAMP inhibits coupled sodium chloride entry and stimulates active chloride secretion *in vitro*. *In vivo*, the actions of cAMP are involved in inhibiting bicarbonate absorption in the jejunum. These changes promote the passive secretion of water and potassium.
7	Polyethylene glycol	Polyethylene glycol functions as an osmotic agent, causing excess water to be retained in the stool, stimulating a bowel movement.
8	Polyvinyl alcohol	As a synthetic resin with hydrophilic properties, it increases the persistence of tear film and therefore lubricates and soothes dry/irritated eyes.
9	Hydroxy propyl cellulose	Hydroxypropyl cellulose is a derivative of cellulose that is soluble in both water and organic solvents. It is particularly good at trapping water and producing a film that serves as a barrier to water loss. Hydroxypropyl cellulose possesses good surface activity but does not gel as it forms open helical coils. In general Hydroxypropyl cellulose is a water-soluble thickener, emulsifier and film-former .
10	Hydroxy propyl	Promotes corneal wetting by the stabilization and thickening the pre-corneal tear film and prolonging the tear film breakdown time, which is usually shortened in dry eye conditions. Hypromellose also acts

	methyl cellulose	to lubricate and protect the eye. The surface active properties of the vehicles found in artificial tears solutions act to stabilize the tear film and increase tear viscosity to prevent delay tear evaporation and delay tear drainage. Hypromellose has a physical-chemical action and leads to, in an aqueous solution, a reduced surface tension as well as an increased level of viscosity. Hypromellose adheres well to the cornea and conjunctiva and provides ample moisture.
11	Transcutol	Transcutol was enhanced the activity to the facilitation of the drug partioning and diffusion into the skin. Another mechanism is percutaneous penetration enhancement.
12	Glycofurol	Potentiation and inhibition of pharmacological actions of hexobarbital and zoxazolamine by glycofurol.
13	Ethanol	Ethanol affects the brain's neurons in several ways. It alters their membranes as well as their ion channels, enzymes, and receptors. Alcohol also binds directly to the receptors for acetylcholine, serotonin, GABA, and the NMDA receptors for glutamate. The sedative effects of ethanol are mediated through binding to GABA receptors and glycine receptors (alpha 1 and alpha 2 subunits). It also inhibits NMDA receptor functioning. In its role as an anti-infective, ethanol acts as an osmolyte or dehydrating agent that disrupts the osmotic balance across cell membranes.
14	Isopropanol	Isopropyl Alcohol is an isomer of propyl alcohol with antibacterial properties. Although the exact mechanism of isopropanol's disinfecting action is not known, it might kill cells by denaturing cell proteins and DNA, interfering with cellular metabolism, and dissolving cell lipo-protein membranes.

FUNCTIONS OF EXCIPIENTS IN A FORMULATION

The active drug substance in a dosage form. Like drug substances, excipients are also derived from natural sources or are synthesized either by chemical or any other means.[23]

In earlier days, excipients were considered as inactive ingredients but with passage of time pharmaceutical scientists learned that excipients are not inactive and have a substantial impact in dosage forms. [24]

There is variability in the performance of an excipient both from batch to batch within a single manufacturer as well as between batches from different manufacturers.[25]

Now a day's excipients are known to have well defined functional roles in pharmaceutical dosage form. [26]

Their various functions are modulating solubility and bioavailability of the API's, enhancing stability of the active ingredient in finished dosage from, maintaining pH and osmolarity of liquid formulation, acting as an anti-oxidant, emulsifying agent, aerosols, tablet binders, disintegrates, lubricants and diluents.[27]

Excipients also interacts with the active principle in a formulated dosage form and provides a matrix that can affect critical quality attributes of drug substance, including stability and bioavailability.

Excipients have a potential influence on finished dosage form, affect the safety and efficacy of a product. Thus, Pharmaceutical companies have to be careful consideration for excipients while incorporating into a dosage form.

CONCLUSION

This review may supply precious knowledge regarding the excipients which are the substances used in nanosuspension to improve stability, and bioavailability of drug. Excipients plays vital role in pharmaceutical dosage forms, it must be evaluated for their safety and stability. The various excipient interactions like drug-excipient interactions, excipient-excipient interactions may render the excipient harmful for use in formulation. In order to avoid the use of incompatible excipients and to assure that that the excipients are safe and stable for use in the designing of the formulation, various stability testing procedures are carried out where the excipients are subjected to extreme conditions of temperature, humidity etc.The safety assurance of excipients helps the formulator to design an effective and safe dosage form with the use of efficient and safe excipients. Thus, for an excipient to be in a formulation it must be highly stable, safe and efficacious, and above all it must comply with the expected performance in the formulation.

CONFLICT OF INTEREST

The author confirm that this review article content no conflict of interest

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