PHARMACEUTICAL INGREDIENTS AND EXCIPIENTS

To produce a drug substance in a final dosage form requires pharmaceutical ingredients. For example, in the preparation of solutions, one or more solvents are used to dissolve the drug substance, flavors and sweeteners are used to make the product more palatable, colorants are added to enhance appeal, preservatives may be added to prevent microbial growth, and stabilizers, such as antioxidants and chelating agents, may be used to prevent decomposition, as previously discussed. In the preparation of tablets, diluents or fillers are commonly added to increase the bulk of the formulation, binders to cause adhesion of the powdered drug and pharmaceutical substances, anti-adherents or lubricants to assist smooth tablet formation, disintegrating agents to promote tablet breakup after administration, and coatings to improve stability, control disintegration, or enhance appearance. Ointments, creams, and suppositories acquire their characteristic features from their pharmaceutical bases. Thus, for each dosage form, the pharmaceutical ingredients establish the primary features of the product and contribute to the physical form, texture, stability, taste, and overall appearance.

EXAMPLES OF PHARMACEUTICAL INGREDIENTS

<table>
<thead>
<tr>
<th>INGREDIENT</th>
<th>DEFINITION</th>
<th>EXAMPLES</th>
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<tbody>
<tr>
<td>Acidifying agent</td>
<td>Used in liquid preparations to provide acidic medium for product stability</td>
<td>Citric acid, Acetic acid, Fumaric acid, Hydrochloric acid, Nitric acid</td>
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<tr>
<td>Alkalinizing agent</td>
<td>Used in liquid preparations to provide alkaline medium for product stability</td>
<td>Ammonia solution, Ammonium carbonate, Diethanolamine, Monoethanolamine, Potassium hydroxide, Sodium bicarbonate, Sodium borate, Sodium carbonate, Sodium hydroxide, Trolamine</td>
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<tr>
<td>Adsorbent</td>
<td>An agent capable of holding other molecules onto its surface by physical or chemical (chemisorption) means</td>
<td>Powdered cellulose, Activated charcoal</td>
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| **Aerosol propellant** | Agent responsible for developing the pressure within an aerosol container and expelling the product when the valve is opened | Carbon dioxide  
Dichlorodifluoromethane  
Dichlorotetrafluoroethane  
Trichloromonofluoromethane |
|-----------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| **Air displacement**  | Agent employed to displace air in a hermetically sealed container to enhance product stability | Nitrogen  
Carbon dioxide |
| **Antifungal preservative** | Used in liquid and semisolid preparations to prevent growth of fungi. Effectiveness of parabens is usually enhanced by use in combination | Butylparaben  
Ethylparaben  
Methylparaben  
Benzoic acid  
Propylparaben  
Sodium benzoate  
Sodium propionate |
| **Antioxidant** | Used to prevent deterioration of preparations by oxidation | Ascorbic acid  
Ascorbyl palmitate  
Butylated hydroxyanisole  
Butylated hydroxytoluene  
Hypophosphorous acid  
Monothioglycerol  
Propyl gallate  
Sodium ascorbate  
Sodium bisulfite  
Sodium formaldehyde  
Sulfoxylate  
Sodium metabisulfite |
| **Buffering agent**  | Used to resist change in pH upon dilution or addition of acid or alkali | Potassium metaphosphate  
Potassium phosphate, monobasic  
Sodium acetate  
Sodium citrate, anhydrous and dehydrate |
| **Chelating agent** | Substance that forms stable water-soluble complexes (chelates) with metals; used in some liquid pharmaceuticals as stabilizers to complex heavy metals that might promote instability. In such use, they are also called sequestering agents | Edetic acid  
Edetate disodium |
| **Colorant** | Used to impart color to liquid and solid (e.g., tablets and capsules) preparations | FD&C Red No. 3  
FD&C Red No. 20  
FD&C Yellow No. 6  
FD&C Blue No. 2  
D&C Green No. 5  
D&C Orange No. 5  
D&C Red No. 8  
Caramel  
Ferric oxide, red |
| **Clarifying agent** | Used as a filtering aid for its adsorbent qualities | Bentonite |
| **Emulsifying agent** | Used to promote and maintain dispersion of finely subdivided particles of liquid in a vehicle in which it is immiscible. End product may be a liquid emulsion or semisolid emulsion (e.g., a cream). | Acacia  
Cetomacrogol  
Cetyl alcohol  
Glyceryl monostearate  
Sorbitan monooleate  
Polyoxyethylene 50 stearate |
| **Encapsulating agent** | Used to form thin shells to enclose a drug for ease of administration | Gelatin |
| **Flavorant** | Used to impart a pleasant flavor and often odor to a preparation. In addition to the natural flavorants listed, many synthetic ones are used | Anise oil  
Cinnamon oil  
Cocoa  
Menthol  
Orange oil  
Peppermint oil  
Vanillin |
| **Humectant** | Used to prevent drying of preparations, particularly ointments and creams | Glycerin  
Propylene glycol  
Sorbitol |
| **Levigation agent** | Liquid used as an intervening agent to reduce the particle size of a powder by grinding, usually in a mortar | Mineral oil  
Glycerin  
Propylene glycol |
|----------------------|-------------------------------------------------------------------------------------------------|-----------------|
| **Ointment base**    | Semisolid vehicle for medicated ointments                                                  | Lanolin  
Hydrophilic ointment  
Polyethylene glycol ointment  
Petrolatum  
Hydrophilic petrolatum  
White ointment  
Yellow ointment  
Rose water ointment |
| **Plasticizer**      | Component of film-coating solutions to make film more pliable, enhance spread of coat over tablets, beads, and granules | Diethyl phthalate  
Glycerin |
| **Solvent**          | Used to dissolve another substance in preparation of a solution; may be aqueous or not (e.g., oleaginous). Co-solvents, such as water and alcohol (hydro alcoholic) and water and glycerin, may be used when needed. Sterile solvents are used in certain preparations (e.g., injections) | Alcohol  
Corn oil  
Cottonseed oil  
Glycerin  
Isopropyl alcohol  
Mineral oil  
Oleic acid  
Peanut oil  
Purified water  
Water for injection  
Sterile water for injection  
Sterile water for irrigation |
| **Stiffening agent** | Used to increase thickness or hardness of a preparation, usually an ointment | Cetyl alcohol  
Cetyl esters wax  
Microcrystalline wax  
Paraffin  
Stearyl alcohol  
White wax  
Yellow wax |
| **Suppository base** | Vehicle for suppositories | Cocoa butter  
Polyethylene glycols  
(mixtures)  
PEG 3350 |
|---|---|---|
| **Surfactant (surface active agent)** | Substances that absorb to surfaces or interfaces to reduce surface or interfacial tension. May be used as wetting agents, detergents, or emulsifying agents | Benzalkonium chloride  
Nonoxynol 10  
Octoxynol 9  
Polysorbate 80  
Sodium lauryl sulfate  
Sorbitan monopalmitate |
| **Suspending agent** | Viscosity-increasing agent used to reduce sedimentation rate of particles in a vehicle in which they are not soluble; suspension may be formulated for oral, parenteral, ophthalmic, topical, or other route | Agar  
Bentonite  
Carbomer (e.g., Carbopol)  
Carboxymethylcellulose sodium  
Hydroxyethyl cellulose  
Hydroxypropyl cellulose  
Hydroxypropyl methylcellulose  
Kaolin  
Methylcellulose  
Tragacanth  
Veegum |
| **Sweetening agent** | Used to impart sweetness to a preparation | Aspartame  
Dextrose  
Glycerin  
Mannitol  
Saccharin sodium  
Sorbitol  
Sucrose |
<p>| <strong>Tablet anti adherents</strong> | Prevent tablet ingredients from sticking to punches and dies during production | Magnesium stearate |</p>
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<tr>
<th><strong>Tablet binders</strong></th>
<th>Substances used to cause adhesion of powder particles in tablet granulations</th>
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<tr>
<td></td>
<td>Acacia, Alginic acid, Carboxymethylcellulose sodium, Compressible sugar (e.g., Nu-Tab), Ethyl cellulose, Gelatin, Liquid glucose, Methylcellulose, Povidone, Pre gelatinized starch</td>
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</tbody>
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<th><strong>Tablet and capsule diluent</strong></th>
<th>Inert filler to create desired bulk, flow properties, and compression characteristics of tablets and capsules</th>
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<tbody>
<tr>
<td></td>
<td>Dibasic calcium phosphate, Kaolin, Lactose, Mannitol, Microcrystalline cellulose, Powdered cellulose, Precipitated calcium carbonate, Sorbitol, Starch</td>
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<tr>
<th><strong>Tablet coating agent</strong></th>
<th>Used to coat a tablet to protect against decomposition by atmospheric oxygen or humidity, to provide a desired release pattern, to mask taste or odor, or for aesthetic purposes. Coating may be sugar, film, or thick covering around a tablet. Sugar-coated tablets generally start to break up in the stomach. Film forms a thin cover around a formed tablet or bead. Unless it is enteric, film dissolves in the stomach. Enteric coating passes through the stomach to break up in the intestines. Some water-insoluble coatings (e.g., ethyl cellulose) are used to slow the release of drug in the gastrointestinal tract</th>
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<td><strong>Sugar coating:</strong> Liquid glucose, Sucrose, <strong>Film coating:</strong> Hydroxyethyl cellulose, Hydroxypropyl cellulose, Hydroxypropyl methylcellulose, Methylcellulose (e.g., Methocel), Ethylcellulose (e.g., Ethocel), <strong>Enteric coating:</strong> Cellulose acetate phthalate, Shellac (35% in alcohol, pharmaceutical glaze)</td>
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<tr>
<td><strong>Tablet direct compression excipient</strong></td>
<td>Used in direct compression tablet formulations</td>
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<tr>
<td><strong>Tablet disintegrate</strong></td>
<td>Used in solid forms to promote disruption of the mass into smaller particles more readily dispersed or dissolved</td>
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<tr>
<td><strong>Tablet glidant</strong></td>
<td>Used in tablet and capsule formulations to improve flow properties of the powder mixture</td>
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<tr>
<td><strong>Tablet lubricant</strong></td>
<td>Used in tablet formulations to reduce friction during tablet compression</td>
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<tr>
<td><strong>Tablet or capsule opaquant</strong></td>
<td>Used to render a coating opaque. May be used alone or with a colorant</td>
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<tr>
<td><strong>Tablet polishing agent</strong></td>
<td>Used to impart an attractive sheen to coated tablets</td>
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<tr>
<td><strong>Tonicity agent</strong></td>
<td>Used to render solution similar in osmotic-dextrose characteristics to physiologic fluids, e.g., in ophthalmic, parenteral, and irrigation fluids</td>
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<tr>
<td><strong>Vehicle</strong></td>
<td>Carrying agent used in formulating a variety of liquids for oral and parenteral administration Generally, oral liquids are aqueous (e.g., syrups) or hydroalcoholic (e.g., elixirs). Solutions for intravenous use are aqueous, whereas intramuscular injections may be aqueous or oleaginous</td>
</tr>
</tbody>
</table>
| **Flavored, sweetened** | Acacia syrup  
Aromatic syrup  
Aromatic elixir  
Cherry syrup  
Cocoa syrup  
Orange syrup  
Syrup |
|-------------------------|--------------------------------------------------|
| **Oleaginous**          | Corn oil  
Mineral oil  
Peanut oil  
Sesame oil |
| **Sterile**             | Bacteriostatic sodium chloride injection |
| **Viscosity-increasing agent** | Used to render preparations more resistant to flow. Used in suspensions to deter sedimentation, in ophthalmic solutions to enhance contact time (e.g., methylcellulose), to thicken topical creams, etc. |
|                         | Alginic acid  
Bentonite  
Carbomer  
Carboxymethylcellulose  
Sodium  
Methylcellulose  
Povidone  
Sodium alginate  
Tragacanth |