Suspended Agents

Pharmaceutical formulations vary widely depending on the site of application and the solubility of the active ingredients. Examples of common formulations are oral solids (tablets/capsules), oral liquids or topical applications such as creams, ointments, gels and lotions.

When preparing any pharmaceutical formulation, choosing the right excipient is crucial in maintaining the integrity and stability of the medicament. Of these excipients, it is the addition of suspending agents and or stabilizers to ensure the homogenous distribution of the active ingredient, and ultimately the chemical and physical stability of the formulation. However, it remains essential to add a preservative or antimicrobial to prolong the shelf-life and prevent the microbial growth in the preparation. In addition, some of these formulations may contain flavouring and colouring agents to make the medication more acceptable and palatable for the patient.

A number of excipients have been used over the years as suspending agents either for oral or topical applications. Below are few examples that are commonly used in practise:

Methylcellulose
Methylcellulose occurs as a white, fibrous, hygroscopic powder or as granules. In water, methylcellulose swells and produces a viscous colloidal suspension; hence it is widely used as a suspending agent in topical and oral formulations. Its advantage is to delay settling of suspensions and to increase contact time of drugs, such as antacids in the stomach. Also, in oral formulation, methylcellulose is a good substitute to sugar-based syrups. The highly viscous forms of methylcellulose are usually used to thicken topical products such as creams and gels.

To prepare methylcellulose mixture, the powder should be dispersed in hot water at high shear and high temperature (80-90°C), once the powder is finely dispersed, the rest of the water is added cold or as ice with moderate stirring to cause prompt dissolution.

Guar gum
Guar gum is an odourless, white to yellowish-white powder with a bland taste. It is generally used in solid dosage forms as a binder or disintegrant, and in liquid oral and topical products as a viscosity-enhancing and stabilising agent. If left in water for 2-4 hours and ideally at pH 7.5-9, Guar gum swells and forms a viscous solution, hence its use as a viscosity-increasing and thickening agent.
Suspending Agents

**Xanthan gum**
Xanthan gum (corn-sugar gum) is a cream or white, odourless, free-flowing fine powder. It is used as a stabilizing agent and as a suspending/viscosity-increasing agent.

Xanthan gum is an anionic material, therefore, its use may be limited when cationic surfactants, polymers and preservatives are used, due to risk of precipitation. Also, calcium and other polyvalent metal ions may result in Xanthan gum gelation or precipitation under very alkaline conditions.

Most synthetic and natural viscosity increasing agents are compatible with xanthan gum and this can be used to advantage for enhanced viscosity of the combination.

**Carboxymethylcellulose Sodium**
Carboxymethylcellulose sodium CMC-Na is a hygroscopic, whitish powder or granules. It is easily dispersed in water to form colloidal solutions. CMC-Na is used as a coating agent, stabilizing agent and viscosity-increasing agent. It is generally commonly used both in oral and topical formulations. It is also used as one of the ingredients in wound care and dermatological patches. Carboxymethylcellulose sodium is soluble in water at all temperatures. Its sodium salt can be dispersed with high shear in cold water before the particles can agglomerate into lumps. Once the powder is well dispersed, the solution can be heated with moderate shear to about 60°C for fastest dissolution. This dispersion is sensitive to pH changes, where its viscosity is decreased markedly below pH 5 or above pH 10. CMC-Na is incompatible with strongly acidic solutions and possibly incompatible with heavy metals, such as aluminum, zinc, mercury, silver and iron salts.

**Gelatin**
Gelatin is a mixture of purified fractions of proteins obtained from animal collagen by partial acid/alkaline hydrolysis. It is a number of amino acids linked together by amide linkage to form linear polymers. Gelatin can be used as a coating agent, gelling agent, suspending agent or a viscosity increasing agent. Although gelatin is insoluble in water, it swells in gastric fluid and releases the active ingredient. Hence, it is used in the formulations of soft capsules that are designed to dissolve in the stomach.

**Conclusion**
Thanks to the diversity of suspending agents and their characteristics, the desired pharmaceutical product can be designed depending on the solubility of the active ingredient and its stability within the formulation.