Table 24.5 Excipients used in pharmaceutical solutions

Excipients	Examples of excipients
Co-solvents	Ethanol, glycerol, propylene glycol. The concentration of ethanol should be limited as it exerts a pharmacological action following oral administration.
Flavouring Agents	Used to mask the taste of drugs, many of which have a very unpleasant taste. Synthetic or naturally occurring flavourings such as vanilla, raspberry, orange oil, lemon oil are used for oral solutions. Menthol is used in both oral and nasal solutions. Certain flavours appeal to certain patient populations and certain parts of the world; this must be borne in mind by the formulator. For example, fruit and bubble gum flavours are acceptable to children, whilst mint flavour is not.
Colouring Agents	A colouring agent should correlate with the flavouring agent, e.g. green with mint, red with cherry flavour. Like flavours, colour preference varies between cultures.
Sweeteners	Sucrose, sorbitol, mannitol, saccharin sodium, xylitol, high fructose corn syrup are used to improve the palatability of oral solutions. Sweetened, but sugar-free, preparations containing aspartame are suitable for diabetic patients and are not cariogenic.
Antimicrobial Preservatives	Used to preserve multidose preparations. Examples include benzalkonium chloride, benzyl alcohol, chlorobutanol, thimerosal, combinations of parabens (methyl, propyl, butyl).
Antioxidants	Sodium metabisulphite, sodium sulphite, sodium bisulfate ascorbic acid, used to stabilize solutions.
Chelating Agents	Disodium edentate, used to increase solution stability.
pH Adjusters	Acids, e.g. citric acid, buffers Alkali, e.g. sodium hydroxide, buffers.
Isotonicity Adjusters	Sodium chloride, potassium chloride, mannitol, dextrose, glycerol.
Viscosity Enhancers	Hypromellose, hydroxyethylcellulose, polyvinyl alcohol, povidone, dextran, carbomer 940.

Advantages of pharmaceutical solutions

Solutions have several advantages, and for many drugs, a solution is the only available dosage form. Advantages of solutions include:

- the drug is already dissolved in the solvent system, hence drug action can be rapid, allowing their use in emergencies, e.g. the use of adrenaline solution, as an injection, for the treatment of anaphylaxis
- when drug absorption is required prior to drug action, for example, following oral administration, the drug in a solution is already in a molecular form and thus, available for absorption
- solutions provide dose uniformity, and specific volumes of the liquid solutions that can be measured accurately; this allows a range of different doses to be easily administered
- oral solutions are easily swallowed and are beneficial for patients for whom swallowing may be difficult, e.g. children and older people
- solutions are easier to manufacture compared to other dosage forms.

Disadvantages of solutions

The disadvantages of solutions compared with other dosage forms include: