Buffer and Media Preparation – How to Prepare a Solution

<u>Your Objectives:</u>

At the end of the lesson, you should be able to make a solution.

What is a solution?

A solution is a solvent (oftentimes a water-based one) into which one or more compounds/components are added (solutes) that are completely soluble.

If something is added to a solvent making it insoluble, it creates a **suspension**, a 2-phase system or an emulsion. If not, and they are the same, then: "creates a **suspension**, or what is called a 2-phase system, or emulsion."

At all stages of a biopharmaceutical manufacturing process, the components must remain soluble in the media and buffers employed. And the only insoluble components are the cells themselves, along with certain components of the cells released in the event that cells break apart.

Some terminology

- **Solubility**
  This is the maximum amount of a solute which can be dissolved in a solvent (saturation) before the solute separates, precipitates, (etc.)

- **Hydrophilic**
  This describes any substance which 'likes' water; namely, something that dissolves readily in water.

- **Hydrophobic** (lipophilic)
  This is a substance which is 'phobic' of water; in this case, it is something which either does not dissolve in water, or then, it is something that 'favours' lipids; hence, it readily dissolves in hydrophobic solvents.

- **Amphipathic**
  This means a substance (e.g. a protein) which, by its having both hydrophilic and hydrophobic parts, is both soluble in water but also hydrophobic (e.g. a detergent).

- **Density (specific gravity)**
  The specific gravity, or density, of a solution is the mass of a solution per unit volume; i.e. water has a density of 1.00 g/cm3 , or 1.00 kg/L, or 1000 g/L.
  NB: The density changes according to the temperature. e.g. water!
  If compounds are added to the water, the density increases; thus, if we added 20 g glucose to 1 litre of pure water, the density becomes 1020 g/L.

- **Making a solution**
  You prepare a solution by dissolving a known mass of solute (oftentimes a solid) into a specific amount of a solvent. One of the most common ways of expressing the concentration of the solution is as M (molarity), which is moles of solute per litre of solution.

Example of How to Prepare a Solution

Prepare 1 litre of 1.00 M NaCl solution.

Firstly, calculate the molar mass of NaCl, which is the mass of a mole of Na plus the mass of a mole of Cl, or 22.99 + 35.45 = 58.44 g/mol

1. Weigh out 58.44 g of NaCl;

2. Place the NaCl in a 1-litre volumetric flask;

3. Add a small volume of distilled, deionized water so as to dissolve the salt;

4. Fill the flask up to the 1-L line.

If a different molarity is required, then multiply that number times the molar mass of NaCl. So, for example, if you wanted a 0.5 M solution, you would use 0.5 x 58.44 g/mol of NaCl in 1-L solution, or 29.22 g of NaCl.

Molarity is expressed in terms of litre of solution, and *not* litres of solvent. To prepare a solution, the flask is filled to the mark. In other words, it is incorrect to add 1 litre of water to a mass of sample if you wanted to prepare a molar solution.

Helpful link: https://www.youtube.com/watch?v=0_CsM6br4PI