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Physicochemical Characteristic of Aerosols in Variety of Situation

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They are pressurized dosage forms that upon actuation emit a fine dispersion of a liquid and/or solid materials containing one or more active ingredients in a gaseous medium.

Consideration required in aerosols: 1. Proper function of the container and valve assembly. 2. The propellant. 3. Physical delivery of the medication in proper form. Aerosol products may be designed to expel their contents as a fine mist, a coarse wet or dry spray, a steady stream or a stable or fast breaking foam. The physical form of aerosol is depend on the intended use: For inhalation therapy (like in treatment of asthma or emphysema) the product must be fine liquid mist or as finely divided solid particles (< 6µm for respiratory bronchioles) and (< 2µm reach alveolar ducts and alveoli). For dermatological purpose the particle size is coarser and less critical in therapeutic efficacy. Space sprays: are aerosols used to provide an airborne mist, the particle size of the released product quite small below 50 µm. Surface sprays: are aerosols which are intended to carry the active ingredients to a surface such as to the skin.

Types of aerosols: Inhalation aerosols: commonly known as metered dose inhalers (MDSIs), are intended to produce fine particles or droplets for inhalation through the mouth and deposition in the pulmonary tree. The design of system intended to release measured quantities of API with each actuation. Nasal aerosols: commonly known as nasal MDIs, produce fine particles or droplets for delivery through nasal vestibule and deposition in the nasal cavity. Lingual aerosols: they are intended to produce fine particles or droplets for deposition on the surface of the tongue. Topical aerosols: produce fine particles or droplets for application

Advantages of aerosols: 1. A portion of medication easily withdrawn from the package without contamination or exposure to the remaining material. 2. Aerosol container protects medicinal agents from atmospheric oxygen , moisture and from light. 3. Topical medication may be applied in a uniform thin layer to the skin without touching the affected area. 4. Physical form and P.S of the emitted product may be controlled by proper formulation and valve control. 5. Aerosol process is a clean process requiring little or no wash up by the user.

The aerosol principle: Aerosol formulation consist of two components: Product concentrate: is the active ingredient of the aerosol combined with the required additives such as antioxidants, surfactants, and solvents to prepare a stable and effective product.

Propellant : it is of two types: -A liquefied gas or mixture of liquefied gasses that serve as a dual role the propellant and solvent or vehicle for the product concentrate mostly used are chlorofluorocarbons (CFCs) such as dichlorodifluoromethane, dichlorotetrafluoroethane and trichloromonofluoromethane. -Compressed gas propellants such as nitrogen, nitrous oxide and carbon dioxide. Fluorinated hydrocarbons are gases at room temperature, they may be liquefied by cooling below their boiling point or by compression at room temperature. When a liquefied gas propellant is sealed within an aerosol container with the product concentrate, equilibrium is quickly established between portion of the propellant that remains liquefied and that which vaporizes and occupies the upper portion of the aerosol container. The vapor phase exerts pressure in all directions against the walls of the container, the valve assembly and the surface of the liquid gas which is composed of the liquefied gas and the product concentrate. It is the pressure that upon actuation of the aerosol valve, forces the liquid phase up the dip tube and out of the orifice of the valve into the atmosphere. As the propellant meets the air, it expands and evaporates because of the drop in pressure, leaving the product concentrate as airborne liquid droplets or dry particles depending on the formulation. As the liquid phase is removed from the container, equilibrium between the propellant remaining liquefied and that in the vapor state is reestablished.

Aerosol system: The pressure of an aerosol is critical to its performance and it can be controlled by: a. The type and amount of propellant. b. The nature and amount of product concentrate. Space sprays generally contain a greater proportion of propellant than do aerosols intended for surface coating.

1.Two-phase system aerosol: it consists of the liquid phase containing the liquefied propellant and product concentrate and the vapor phase.

2.Three-phase system: it consist of a layer of water immiscible liquid propellant, a layer of highly aqueous product concentrate and the vapor phase. Because the liquefied propellant usually has a greater density than the aqueous layer , it generally resides at the bottom of the container with the aqueous phase floating above it. To avoid expulsion of the reservoir of liquefied propellant, the dip tube must extend only with in the aqueous phase (product concentrate) and not down into the layer of liquefied propellant.

3. Compressed gas system: compressed rather than liquefied gases used to prepare aerosols, the pressure of the compressed gas in the headspace of the container forces the product concentrate up the dip tube and out of the valve e.g is nitrogen gas, carbon dioxide and nitros oxide which is insoluble in the product concentrate.