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CHEMISTRY AND HUMAN HEALTH DIVISION*
SUBCOMMITTEE ON MEDICINAL CHEMISTRY AND DRUG DEVELOPMENT**

GLOSSARY OF TERMS RELATED TO PHARMACEUTICS

(IUPAC Recommendations 2009)

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Glossary of terms related to pharmaceutics

(IUPAC Recommendations 2009)

Abstract: This Glossary of Terms Related to Pharmaceutics is needed by practitioners in the field of pharmaceutics as this field fulfills an important and crucial role, different from the roles of other scientific disciplines involved in the drug-making process. The glossary contains 168 definitions used in pharmaceutics. These are related to various aspects of this discipline, such as: (1) physicochemical characterization of pharmaceutical preparations and the active ingredients they contain; (2) unit operations used in the practice of pharmaceutics; (3) terms related to the various dosage forms; (4) terms related to the various modes and routes of drug delivery; (5) terms used in pharmacokinetics and biopharmaceutics in general; and additional miscellaneous terms. The field of pharmaceutics itself is of a multidisciplinary nature as its practitioners come from a variety of disciplines, such as chemistry or various biological sciences, thus a glossary containing authoritative definitions would be useful for them. The terms used in pharmaceutics are rarely covered by existing glossaries, and in the cases they are, their definitions are often inappropriate for the field of pharmaceutics and require new or modified definitions to better fit the new context.

Keywords: pharmaceutics; medicinal chemistry; drugs; glossary; dosage form; sustained release; drug delivery; pharmacokinetics; IUPAC Chemistry and Human Health Division.

INTRODUCTION

The idea of constructing a glossary of terms related to pharmaceutics was raised first at the meeting of the Section on Medicinal Chemistry of the Chemistry and Human Health Division in 1999, and became a recognized project in 2001. Prior to this glossary, the Chemistry and Human Health Division did not deal with the areas of pharmacy and pharmaceutics, although the Section on Medicinal Chemistry has dealt with closely related subjects such as toxicology, drug metabolism, pharmaceutically acceptable drug salts, training and research in medicinal chemistry in developing countries and the Glossary of Terms used in Medicinal Chemistry, as well as some other topics**.**

Pharmaceutics is defined in this glossary as the science of preparation of drugs, dosage forms. and drug delivery systems, taking into account the pharmacokinetics and pharmacodynamics of the drug as well as its physical and chemical properties. Thus, many branches of chemistry such as organic, inorganic, solid-state, colloid, and surface chemistry, as well as nanotechnology and others, play roles in pharmaceutics. Even the more biologically oriented branch of pharmaceutics, i.e., biopharmaceutics, draws on chemical concepts such as (pharmaco)kinetics, absorption, dissolution, diffusion, and others. Therefore, it appears timely for IUPAC to publish recommendations in this area.

The glossary was first given the title "Glossary of Terms in Pharmaceutical Technology". Over the years, this title underwent a few changes until it has become the present one. During the review process, a communication from the U.S. Pharmacopoeia (USP) indicated concern regarding some definitions that differ from those of the Pharmacopoeia. The Subcommittee on Medicinal Chemistry and Drug Development has considered these concerns and recommended to incorporate the Pharmacopeia's definitions into the glossary in cases where they are clearly superior. However, in instances where the

IUPAC definition was considered to be more suitable for chemists, the IUPAC definitions were retained. During the time in which this glossary was already in production, a proposed glossary was received from USP, but it was too late to make any use of it in the present version. Its recommendations will be reserved for consideration in a future update.

Considerable effort was made to make all terms in the glossary compatible with similar terms (where they exist) in the online IUPAC "Gold Book". Readers are invited to point out any errors or inconsistencies to the authors.

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GLOSSARY OF TERMS

absolute bioavailability
Fraction of the administered dose of a drug from a *dosage form* absorbed intact into the *systemic* circulation.

See also *bioavailability*, *relative availability*.

absorption (in pharmaceutics)
Process by which a *drug* moves from its site of *administration*, usually across biological membranes, to the *systemic* circulation or its site of action in the body.
[1]

Note: Systemic absorption: uptake to the blood and transport via the blood of a substance to an organ or compartment in the body distant from the site of absorption.

active transport of drugs
Carriage of a solute across a biological membrane, which requires a suitable carrier and the expenditure of energy.
[2]

adjuvant
1. Additive with no intended pharmacological action, used in the *formulation* of *dosage forms.*
2. In pharmacology, a substance added to a drug to speed or increase the action of the main component.
3. In immunology, a substance (such as aluminum hydroxide) or an organism (such as killed mycobacterium) that increases the response to an antigen.

[3]
See *excipient*.

administration (of a substance)
Introduction of a substance to an organism by a defined route [3].

administration of drugs, ocular route
Administration of drugs through the *eye*.

Note 1: Drugs used to treat *eye* disorders can be administered as liquid or semi-solid *dosage forms*. Solid inserts, which release the drug in slow-release pattern, are also available.

Note 2: Ocular drugs are almost always used for their local effects. Some drugs produce a local effect after they are absorbed through the cornea and conjunctiva. Some of these drugs then enter the bloodstream and may have unwanted or wanted *systemic* effects.

See also *administration*.

administration of drugs, oral route
Administration of drugs through the mouth to swallow.

Note 1: This is the most convenient and popular administration route.

Note 2: Per-oral products can be *powders*, *granules*, un*coated* or *coated tablets*, *capsules*, and liquids (solutions, *emulsions*, and suspensions). Liquids for oral use may contain antimicrobial preservatives and are supplied in multi- or single-dose containers.

Note 3: It differs from intraoral *administration*.

See also *administration*.

administration of drugs, parenteral route
Method of introducing substances into an organism, avoiding the gastrointestinal tract [1].

Note 1: *Parenteral* routes may be employed whenever enteral routes are contraindicated or inadequate.

Note 2: Parenteral administration includes some conventional (*intravenous, intramuscular*, *subcutaneous*) and some special (intradermal, intraventricular, etc.) routes.

Note 3: Parenteral products can be solutions, suspensions, and *emulsions*. They are presented as *sterile* products. It is commonly used to imply administration by *injection* or infusion.

See also *administration*.

administration of drugs, rectal route
Administration of drugs into the rectal cavity or through the rectum.

Note 1: Products may be solid (*suppositories*) or liquid unit dosage preparations, or *creams*, *ointments*, and *gels*.

Note 2: This is an important way of administering a medicinal product that may not be tolerated orally, especially in pediatrics and geriatrics or when the patient has an infection of the gastrointestinal tract; or when the drug is less suited for oral administration because of side effects, bad taste, or enzymatic degradation.

Note 3: The *rectal* route has several drawbacks. These can be, in addition to psychological aversion, slow and incomplete *absorption*, and inadequacy where rapid absorption and high plasma levels are required.

See also *enemas*, *administration*.

administration of drugs, respiratory route
introduction of drugs by inhalation
Delivery to the lower *respiratory* tract in order to obtain a local or *systemic* effect.

Note: Products usually deliver the active substance in the form of *aerosol* droplets or solid particles (*powders*).

See also *inhalation therapy*, *administration*.

administration of drugs, topical route
Administration of drugs on surfaces of the body.

Note: *Topical* products usually produce pharmacological effects at or near the point of application, such as the skin, eyes, nose, throat, ears, and vagina, etc., but sometimes may also have *systemic* effects.

See also *administration*.

administration of drugs, transdermal route
diadermic administration
percutaneous administration
transcutaneous administration
transdermic administration
Introduction of products through unbroken skin by means of a specific *drug delivery system* (such as a patch containing a semi-solid *formulation* of the drug) for *systemic* and/or prolonged drug effect.
See also *administration*.

administration of drugs, vaginal route
Introduction of products into the vagina normally for local effect.

Note: *Vaginal* preparations may be liquid dispersions (solutions, foams), semi-solid (*gels*, *creams*, *ointments*), and solids (*tablets*, *capsules*, *pessaries*, tampons, sponges).

See also *administration*.

adsorption
Accumulation of gases, liquids, or solutes on a solid surface, e.g., powder, polymer, glassware, syringes, etc.

Process by which a compound, solid, liquid, or gas becomes loosely held by weak attraction to the surface of a solid. The attraction forces in adsorption are much weaker and less permanent than those of absorption.

Note 1: In *pharmaceutics*, it mainly refers to the binding of a therapeutic agent or an impurity or a toxic material to a solid surface, or to modification of release in pharmaceutical formulations, and in analysis.

Note 2: In contrast to *absorption*, which is a transport phenomenon, adsorption is a surface phenomenon. In other words, it refers to accumulation of gases, liquids, or solutes on a solid surface, e.g., glassware, syringes, etc.

Note 3: The main application of adsorption is NOT to modify release, but rather in *formulation* of *dosage forms*, purifying, charcoal adsorption (as treatment), analytics, etc.

[3,4]

aerosol
Mixture of small particles (solid, liquid, or a mixed variety) and a *carrier* gas (usually air).

Note 1: Owing to their size, these particles (usually less than 100 μm and greater than 0.01 μm in diameter) have a comparatively small sedimentation velocity and hence exhibit some degree of stability in the earth's gravitational field.

Note 2: An aerosol may be characterized by its chemical composition, its radioactivity, the particle size distribution, the electrical charge, and the optical properties [3,5].

agglomeration
Adherence of particles into a larger mass due to moisture, static charge, or chemical or mechanical binding [5].
See also *aggregation*.

aggregation
Accumulation or collection of particles into larger units.
See also *agglomeration*, *coagulation*, *flocculation*, orthokinetic *aggregation*, perikinetic *aggregation*.
[5,6]

amorphous
Solid substances that are not *crystals*. Amorphous solids consist of randomly oriented molecules. Solids without definite shape consist of randomly oriented molecules.

Note 1: Used to describe substances that are solids but not crystals.

Note 2: Frequently they are more soluble than *crystalline* solids.

amphipathic, amphiphilic
Molecules that contain groups with characteristically different properties, e.g., both *hydrophilic* and *lipophilic* (*hydrophobic*) properties.

Note: The property of surface activity is usually due to the fact that the molecules of the substance are amphipathic or amphiphilic, meaning that each contains both a hydrophilic and a hydrophobic (lipophilic) group.

[3,6]

angle of repose
Characteristic angle of slope formed with the horizontal by the side of a static conical mound of *powder*.

Note 1: Angle of repose is determined by a balance of gravitational force and the frictional forces caused by interparticulate interactions.

Note 2: A measure of cohesiveness in powders. The smaller the angle of repose the greater the ability of the powder to flow. A particle will begin to slide on a slope when the angle of

inclination is sufficiently large to overcome the frictional forces, and conversely the particle will not move when the angle is below that required to overcome cohesion and adhesion.

Note 3: The angle of repose depends on the method of measurement.

appertization
Process by which food is rendered free from pathogenic, toxigenic, and spoilage organisms.

Note 1: A term used in the food industry.

Note 2: Appertization will not necessarily kill thermophilic spores, and thus products subjected to the process may not be *sterile*.

See also *sterilization*, *disinfection*.

binder
Substance that acts as adhesives to bind together *powders* for making *tablets* (direct *tableting*) or *granules* (*granulation*) that are mainly used in tableting.

bioassay
Procedure for estimating the concentration or biological activity of a substance by measuring its effect on a living system compared to a standard system [3,12].

bioavailability
1. Ratio of the *systemic* exposure from extravascular (ev) exposure to that following intravenous (iv) exposure as described by the equation:

$$F = \frac{A_{ev} D_{iv}}{B_{iv} D_{ev}}$$

where F is the bioavailability, A and B are areas under the (plasma) concentration-time curve following ev and iv *administration*, respectively, and D_{ev} and D_{iv} are the administered ev and iv doses.
2. Relative amount of the administered dose of a *drug* that reaches systemic circulation from a certain *dosage form* in comparison to the amount that reaches the systemic circulation by iv *administration*.

See also *relative bioavailability.*
[7,12]

bioequivalence
1. Relationship between two preparations of the same drug in the same dosage form that have a similar *bioavailability*.
2. Dosage forms containing the same drug are said to be bioequivalent if they do not differ significantly in the bioavailability (e.g., AUC, c_{max}., t_{max}.) of the active constituent/ingredient, when administered in the same dose under similar experimental conditions.

[12]

biological half life
For a substance, the time required for the amount of a *drug* or a substance in a biological system to be reduced to one-half of its value by biological processes when the rate of removal is approximately exponential.

Note 1: This is an important consideration in determining the proper amount and frequency of dose of a drug to be administered.

Note 2: Often the rate of removal of a drug (e.g., by metabolism, excretion and/or decomposition) is not exponential.

Note 3: Normally, the longer the biological *half life*, the longer is the drug present in the body. However, even a substance with an estimated short biological half life may sometimes have a significant fraction which persists in the body

[3,8]

biological product
Virus, therapeutic serum, toxin, antitoxin, or analogous product applicable to the prevention, treatment, or cure of diseases or injuries in humans and/or animals.

Note: The term "analogous product" may include essentially all *biotechnology*-derived products and procedures including *gene therapy*, transgenics, and somatic cell therapy.

biopharmaceutics
Branch of pharmaceutical science that deals with the fate of drugs in the living system; particularly the release of the drug from its *dosage form* into a biological medium, its passage across membranes into the *systemic* circulation, metabolism, and elimination, and the application of this knowledge to obtain the desired therapeutic effect.

biotechnology
1. Technique that uses living organisms (or component(s) of organisms) to make or modify products, to improve plants or animals, or to develop microorganisms for specific uses.
2. More recent usage refers to the industrial and pharmaceutical use of DNA, cell fusion, novel bioprocessing techniques, and *gene therapy*.
3. The integration of life sciences with chemical, physical, and engineering sciences in order to achieve the application of organisms, cells, parts thereof, and molecular analogs for products and services [3,6,9].

buccal tablet
Usually a small, flat, and soft *tablet*, which is designed to be placed inside the cheek to be directly absorbed through the mucosa for *systemic* effect.

bulk density
Characteristic of a *powder* rather than of individual particles given by the mass of powder occupying a known volume.

Note 1: Characteristics of importance in *tablet* production.

Note 2: The bulk density is always lower than the true density of its component particles.

Note 3: A powder can have only one true density, but it can have many different bulk densities, depending on how tightly the particles are packed.

capsule
Small edible package made usually from gelatin or other materials that can be filled with *drugs* (solids or liquids) to produce a unit dose, mainly for *oral* use. Hard capsules consist of two pieces that fit one inside the other which are produced empty and filled in a separate operation, and soft, liquid-filled capsules, which are manufactured and filled in one operation.

carrier-mediated drug transport
Transfer of a drug across a membrane by a transporter (often a protein) constituent of the cytosol membrane. Also known as *active transport* as opposed to passive *diffusion/absorption*.

coacervation
Separation of colloidal systems into two liquid phases. The phase more concentrated in colloid component is the coacervate, while the other phase is the equilibrium solution [6].

coagulation
Close, tight *aggregation* (see also *flocculation*) of colloid particles, *emulsion* droplets, *suspension* particles, which are difficult to redisperse. Clotting: the process of changing from a liquid to a solid, said especially of blood (i.e., blood coagulation). Transformation of a sol into a gel or semi-solid mass; e.g., the coagulation of the white of an egg by means of boiling.

Note: When a *sol* is colloidally unstable (i.e., the rate of aggregation is not negligible) the formation of aggregates is called coagulation or flocculation.

[6,7]

coating
Technological process consisting of the application of a substance, which forms a layer (e.g, to protect the *drug* and/or the *tablet*, to mask taste, to control the rate of drug release (e.g., film coating, sugar coating).

Note: Sugar coating is used to mask bad taste without altering release profile.

compressed tablet
A solid dosage form prepared to a desired shape, usually in large-scale production, by means of high pressure in a punch and die.

Note: Most compressed *tablets* consist of the active ingredient and a diluent (filler), binder, disintegrator, and lubricant.

controlled-release dosage form
Medication, which due to its special technological construction provides for drug release having predefined kinetics (zero order, $t^{1/2}$, 1st order, etc.) at a sufficient rate to maintain the desired therapeutic level over an extended period of time.

Note: Also used to denote *sustained-release* products with zero-order release kinetics.

cosolvent
Vehicle (often ethanol) used in combination to increase the solubility of *drugs*. Frequently, the solubility of a drug in a mixed solvent system is greater than can be predicted from its solubility in each solvent component separately.

cream
Semi-solid *emulsion* for external application. Oil-in-water emulsions are most useful as water-washable bases, whereas water-in-oil emulsions are emollient and cleansing [3,6].

critical micelle concentration (cmc)
Threshold detergent concentration at which *micelle* formation begins in the bulk phase. This means that all effective molecules are present as monomers at a concentration below their cmc.

Note 1: There is a relatively narrow range of concentrations separating the limit below which virtually no micelles are detected and the limit above which virtually all additional *surfactant* molecules form micelles.

Note 2: Many properties of *surfactant* solutions, if plotted against the surfactant concentration (usually the log of concentration), appear to change at different rates above and below this range. By extrapolating the locus of such a property above and below this range until they intersect, a value may be obtained known as the *critical micellization concentration* (*critical micelle concentration*), symbol C_M, abbreviation *cmc* (or c.m.c.) [3].

See also *inverted micelle*.

critical moisture content
A stage in the drying of solids, above which the drying rate (derived from the plot of the loss of moisture content against time) is linear, at which the drying rate ceases to be linear, until it reaches the *equilibrium moisture content*.
[10]

crossover study
Type of comparative *bioavailability* study designed in such a way as to take into account differences in bioavailability arising from differences between patients suffering from disease, participating in the study.

Note: The differences between the subjects may be in age, stage or severity of the disease, and prior drug treatment that some may have received. In such a crossover study, the patients are divided into two equal size groups, uniform with respect to age, body weight, sex, etc. The first group is given a specific dose of the product studied, while the second group is given a second product of proven clinical efficacy, containing the same active ingredient. After taking an appropriate number of blood samples from each individual and a washout period, the groups are reversed and the first group is given the product of proven clinical efficacy and the second is given the product being studied. This way each patient serves as his or her own control.

[11]

crystalline
Term that describes a solid of regular shape and the presence of three-dimensional order on the level of atomic dimensions, for a given molecule.

Note 1: Crystallinity may be detected by diffraction techniques, heat-of-fusion measurements, etc.

Note 2: Crystalline forms are often preferred, over *amorphous* forms, in pharmaceutical *dosage forms*, due to uniformity, reproducibility, and sometimes lack of hygroscopicity.

deflocculation
Reversal of *coagulation* or *flocculation*, i.e., the dispersion of *aggregates* to form a stable colloidal *suspension* or *emulsion*.
See also *flocculation*.
[3,5]

delayed-release dosage form
Pharmaceutical preparation that releases the drug(s) at a time other than promptly after administration.

Note: Typically, this is related to *enteric coated tablets*.

deliquescence
Process that occurs when the vapor pressure of the saturated aqueous solution of a substance is less than the vapor pressure of water in the ambient air.

Note: When water vapor is collected by the pure solid compound, a mixture of the solid and liquid or an aqueous solution of the compound forms until the substance is dissolved and is in equilibrium with its environment; at this time the vapor pressure of water over the aqueous solution will equal the partial pressure of water in the atmosphere in contact with it. A *crystalline* salt *aerosol* particle will deliquesce in the atmosphere when the relative humidity surpasses a characteristic value, the so-called deliquescence point [3].

deliquescent
Substance that absorbs sufficient moisture from the atmosphere to dissolve itself.

depot
Deposit of a *drug* in a body created by injection or by a similar mode of introduction to form a source of slow release.

detergency
Property, which serves as basis for the process whereby *surfactants* are used for the removal of foreign matter from surfaces (including dirt from clothes or body surfaces).
See also *detergents*, *solubilizing*, *surface-active agent*, *surfactant*.

detergent
Surfactant (or a mixture containing one or more surfactants) having cleaning properties in dilute solutions (soaps are surfactants and detergents) [3].

diffusion barrier
Obstacle such as *coating* or *embedding*, which acts as a factor controlling the rate of *drug* release.

Note: Body fluids or membranes can also act as barriers.

disperse system
Dosage form in which the active ingredient is insoluble in the carrier; includes *aerosols* (solids or liquids in gas), suspensions (solids in liquids), *emulsions* (liquids in liquids), and foams (gas in liquid), or *ointments/creams* (solid in solid or in semi-solid, or liquid in solid).

Note: These systems are thermodynamically unstable and need to be stabilized by suspensifying or emulsifying agents.

divided granule
Formulation in which individual doses of a *granulated dosage form* are separated (e.g., gelatin *capsule*s).

divided powder
Powder formulation in which individual doses of a powdered *dosage form* are separately wrapped (e.g., sachets, envelopes, or gelatin *capsules*).

dosage form
Formulated preparation of molecules/*drugs* that are rarely if ever suitable for administration to patients without additives.
See also *tablet*, *syrup*, *solution*, *cream*, *suppositories*, etc.

Note: They can be designed for *administration* by all possible administration routes to achieve the desired therapeutic response.

dosage regimen
Dose and dosing interval of a *drug*.

drug
Biologically active substance, which when biodistributed in the body is expected to modify one or more of its functions.

Note 1: Frequently used synonyms from formulated drugs (see *dosage forms*) are: medicine, medication, remedy.

Note 2: The term is generally accepted for a substance taken for a therapeutic purpose, but is also commonly used for abused substances [3,12].

drug delivery system
Sophisticated *dosage form*, which, by its construction, is able to modify/control the availability of the *drug* substance to the body by temporal or spatial considerations.
controlled release
extended release
delayed release
delayed action

dosage form
depot
embedding
gradual release
fast release or *immediate release*, i.e., conventional *dosage form*
implants
liposome
long-acting
modified release
prolonged action
pulsatile release
slow release

drug-eluting stent
Refers to a *stent* with an active *drug* that is intended to produce a therapeutic effect (e.g., reduction of restenosis) [13].

dusting powder
Usually intended for external use.

Note 1: Usually contains ingredients used for therapeutic, prophylactic, or lubricant purposes.

Note 2: Normally dispensed in containers with perforated lids.

Note 3: The *powder* must flow well so that it can be dusted over the required area.

Note 4: Examples are antibacterial and antifungal products.

effervescent tablet
Solid preparation that on contact with water breaks apart by the effect of gas (usually CO_2) evolution, resulting commonly from the reaction of hydrogen carbonate with citric or tartaric acid, in order to facilitate dissolution or dispersion of the active ingredient before ingestion.

efflorescence
Opposite of *deliquescence*; the drying of a salt solution when the vapor pressure of water in the saturated solution of a substance is greater than the partial pressure of water in the ambient air. Also refers to the loss of water of crystallization from a solid salt such as $Na_2CO_3 \cdot 10H_2O$ [3].

efflorescent
Substance that loses water to form a lower hydrate or becomes anhydrous spontaneously.

elixir
Sweet (often colored) dilute alcohol-based, "hydroalcoholic", liquid used in the compounding of *drugs* to be taken by mouth in order to improve palatability.

Note: Elixirs are among the most common types of medicinal preparations taken orally in liquid form.

elutriation
The process of separating the lighter particles of a *powder* from the heavier ones by means of an upward-directed stream of fluid (gas or liquid).
[3,7]

embedding
Technological process, which consists of mixing or inclusion of the therapeutic substance with an *excipient* or their mixtures, typically as a *matrix dosage form*, in order to change the rate of release.

emulsion
Fluid *colloidal* dispersion system in which liquid droplets and/or liquid crystals are dispersed in a liquid.

Note 1: The droplets often exceed the usual limits for *colloids* in size.

Note 2: An emulsion is denoted by the symbol o/w if the continuous phase is an aqueous solution and by w/o if the continuous phase is an organic liquid (an "oil").

Note 3: More complicated double emulsions such as o/w/o (i.e., oil droplets contained within aqueous droplets dispersed in a continuous oil phase) are also possible [3].

encapsulation
Process of enclosing a *drug* in a (micro or nano) particle (*capsule*, *liposome*, polymer).

enemas
Solutions (aqueous or oily), *emulsions*, or *suspensions* for *rectal administration* of *medicaments* for cleansing, diagnostic, or therapeutic purposes.

enteric coating
Used on *tablets*, *granules*, *pellets*, and *capsules* to make them resistant to gastric fluids but designed to disintegrate, disrupt, or dissolve when the preparation enters the duodenum.

Note: Enteric coating is used for one of the following reasons:
- To protect the *drug* from degradation by the acid in the stomach (e.g., erythromycin).
- To protect the stomach from the irritant effect of the drug (e.g., aspirin).
- To facilitate absorption of a drug distally to the stomach.

See also *delayed release dosage form*.

equilibrium moisture content (EMC)
Final stage reached after drying of a solid, beyond the critical moisture content.

excipient
additive
ingredient
Pharmacologically inactive carrier (vehicle or basis) or a component of the carrier of the active substance(s) in the dosage form. It may contribute to shape, appearance, patient acceptability, stability, biopharmaceutical profile, and improvement of the manufacturing process.

Material added to a dosage form to fulfill various functions, e.g., to act as filler for purposes of bulk, disintegrant, lubricant, color, etc.

Note 1: Vehicle, refers to liquids only.

Note 2: Excipients are intended to be without any biological effects and detrimental interactions with other ingredients in the *dosage form*.

See *adjuvant*.
[3,14]
See also *adjuvant*, *dosage forms*, *absorption*, *lubricant*.

extended release
See *sustained release*.

fast-dissolving tablet
A *tablet formulation* intended for a rapid release of its active agent.
See also *immediate-release tablet*, and in contrast, *sustained-release tablet*.

flocculation
Process of contact and adhesion whereby particles in dispersion form larger-size clusters.
See also *aggregation*, *coagulation*.
[3]

formulation
Summary of operations carried out to convert a pharmacologically active compound into a *dosage form* suitable for *administration*.
See also *drug delivery systems*, *excipient*, *solubilizing agents*.

gargle
mouthwash
Aqueous solution used for the prevention and treatment of mouth and throat infections.

Note 1: May contain antiseptics, antibacterials, analgesics, and/or astringents.

Note 2: Usually diluted with water before use.

gastric emptying rate
Pace at which a *drug* along with the stomach content leaves and enters the duodenum.

Note 1: Often, gastric emptying rate is also expressed as gastric emptying time.

Note 2: Gastric emptying rate (or time) is expressed typically in units of time or $t_{1/2}$. It is also expressed as the amount of a given substance emptied per the total mass in the stomach, at a given time; or as the amount emptied, at a given time, of a given substance.

Note 3: Since most drugs are optimally absorbed from the small intestine, the onset of drug action depends on the gastric emptying rate. Thus, the rate of gastric emptying determines the timing but not the extent of *oral drug absorption*.

Note 4: The gastric emptying rate depends on several factors, e.g., stomach calorie content, pH, hunger, anxiety, the nature of the drugs and body posture. High-calorie foods (e.g., fats) usually retard gastric emptying and delay *drug absorption*.

[15]

gel
Colloidal system with a finite, usually rather small yield stress.
Non-fluid colloidal network or polymer network that is expanded throughout its whole volume by a fluid.
[5,6]

gene therapy
Use of products containing genetic material (e.g., pDNA, antisense DNA, siRNA) to treat a disease or condition, or to modify or manipulate the expression of genetic material or to alter the biological properties of living cells.

generic(s)
Drug(s) or formulation(s) of drug(s) or *dosage forms*, which no longer have patent protection.

Note 1: Generic or nonproprietary drugs that may enter the market after the expiry of the basic patent covering the original drugs.

Note 2: Nonproprietary drugs are required to meet the same bioequivalency test as the original brand name drugs.

Note 3: Generic products may themselves bear brand names.

gradual release
See *sustained release*.

granules
Powder particles, which have been aggregated to form larger irregular particles, usually of 0.5–2 mm diameter.

Note 1: Granules are also used as intermediates in *tableting*. These are typically of smaller sizes.

Note 2: May also be used rarely as independent *dosage form* for *oral administrations*.

See also *tablet*.

granulation
Process in which *powder* particles are made to aggregate to larger particles called *granules*.

Note 1: In the majority of cases, granulation is required in the production of *tablets* or *capsules*, when granules are made as an intermediate product.

Note 2: Granulation is preceded by mixing the necessary powdered ingredients to assure their uniform distribution in the granules.

Note 3: Granulation may be carried out by two methods: wet granulations which utilize non-toxic volatile liquids, like water or low alcohols; or dry methods in which high pressure is applied.

See also *binders*, *granules*.

half life, $t_{1/2}$
half time
Time required for the concentration of a reactant in a given reaction to reach a value that is the arithmetic mean of its initial and final (equilibrium) values. For a reactant that is entirely consumed, it is the time taken for the reactant concentration to fall to one-half of its initial value.

Note: The half life of a reaction has meaning only in special cases:

1. For a first-order reaction, the half life of the reactant may be called the half life of the reaction.
2. For a reaction involving more than one reactant, with the concentrations of the reactants in their stoichiometric ratios, the half life of each reactant is the same, and may be called the half life of the reaction. If the concentrations of reactants are not in their stoichiometric ratios, there are different half lives for different reactants, and one cannot speak of the half life of the reaction.

See also *biological half life*.
[3,12]

hydrate
Crystalline form of a compound in which water molecules are part of the *crystal* structure.

Note 1: Association of water molecule(s) in a crystal can be of different strength.

Note 2: The term "hydrate" may mean different things in different contexts. Common to all contexts is the content of water, which may be part of crystal structure or part of a molecule to which water has been added reversibly (e.g., chloral hydrate) or the elements of water incorporated covalently (e.g., carbohydrates).

See also *solvate*.

hydrophile–lipophile balance system (HLB system)
Empirical scale (of 0–20) used to classify *surfactants* and *emulsifying* agents.
Ionic surfactants such as sodium lauryl sulfate have, e.g., an HLB of 40.

Note 1: The numerical value is determined by the expression (HLB = 20 * M_h/M) where M_h is the molecular mass of the *hydrophilic* portion of the molecule, and M is the molecular mass of the whole molecule, giving a result on an arbitrary scale of 0–20.

Note 2: An HLB value of 0 corresponds to a completely *hydrophobic* molecule, while a value of 20 corresponds to a molecule made up completely of hydrophilic components.

Note 3: The more hydrophilic the surfactant the more it favors the formation of o/w over w/o *emulsions*.

[16]
See also *surfactant*, *emulsion.*

hydrophilicity
Tendency of a molecule to be solvated by water.
[3,17]

hydrophobicity
Property of being water-repellent; tending not to absorb water.

Note: Hydrophobic interaction could result from hydrophobicity; the thermodynamic tendency of molecules or groups to escape from an aqueous environment resulting in the association of nonpolar groups.

[3,17]

hygroscopicity
Tendency of a substance to absorb water from the atmosphere.

Note: A substance that absorbs moisture from the atmosphere is called hygroscopic.

immediate-release tablet
Dosage form that releases the *drug* immediately.
See also *fast-dissolving tablet*, in contrast to *sustained-release tablet*.

implantation
Insertion or grafting of a biological, living, inert, or radioactive material into the body.

implants
Small *sterile* usually polymeric matrices, pellets, or particles for insertion or implanting into the body by surgical means or by *injection* to help achieve *sustained release*.

inactivation factor (IF)
Number that expresses the reduction in the numbers of a microorganism, brought about by a sterilization process.

Note: The IF value is specific for a microorganism and a sterilization process.

inhalation therapy
Administration of drugs directly to the respiratory tract, mostly by *aerosols*.

Note 1: Since a *drug* is delivered directly to the site of action, lower dose is needed by this route than by other routes, e.g., the gastrointestinal or *parenteral* routes.

Note 2: The incidence and the intensity of side effects are generally lower when this route is used as compared to other routes of *drug administration*.

See also other entries under *administration*.

injection
Delivery of a generally *sterile* liquid medication into the body, or a vessel, tissue, or organ via syringe and needle.

Note 1: Epidural injections are given into the epidural space of the spinal cord.

Note 2: Intra-articular injections are made into the synovial fluid, which lubricates the articulating ends of bones in a joint.

Note 3: Intrabursal injections are given into the bursae, which are small sacks of fluids between the tendons and bones.

Note 4: Intracardial injections are given directly into the heart in emergencies.

Note 5: Intracutaneous or intradermal injections are made into the skin between the inner layer (dermis) and the outer layer (epidermis).

Note 6: Intramuscular injections are made by inserting the needle across the skin, subcutaneous tissue, and membrane enclosing the muscle.

Note 7: Intraspinal injections are made into or around the spinal cord.

Note 8: Intravascular injections (intra-arterial and -venous) are made directly into the blood stream for rapid effect.

Note 9: Intrathecal injection is the introduction of material for diffusion throughout the subarachnoid space by means of lumbar puncture.

Note 10: Ophthalmic injections include a variety of sites within the eye.

Note 11: Subcutaneous or hypodermic injections are made under the skin into the subcutaneous tissue.

Note 12: The same formulation cannot be used for all routes.

inverted micelle
Reversible formation of association colloids from *surfactants* in nonpolar solvents leads to *aggregates* termed inverted (or inverse, reverse, or reversed) *micelles*. Such association is often of the type: monomer $\leftrightarrows$ dimer $\leftrightarrows$ trimer $\leftrightarrows\cdots$n-mer, and the phenomenon of *critical micelle concentration* (or an analogous effect) is consequently not observed. In an inverted micelle, the polar groups of the surfactants are concentrated in the interior and the *lipophilic* groups extend toward and into the nonpolar solvent.
[3]
See also *micelle*.

liniment
Liquid intended for massaging into the skin.

liposome
Artificial spherical lipid bilayer droplet formed mainly from phospholipids having a core of water phase, small enough to form a relatively stable *dispersion* in aqueous media and with potential use in *drug delivery*.
[3]

loading dose
Initial, typically larger than the maintenance dose of a *drug* given to a patient at the start of pharmacotherapy.

Note: The objective is to reach quickly the therapeutically beneficial plasma level. This is followed by smaller (maintenance) doses in order to maintain the plasma concentration.

long acting
See *sustained release*.

lotion
Solution, *emulsion*, or *suspension* to be applied to the skin.

lozenge
Tablet, which does not contain a disintegrant and which is sucked to dissolve in the mouth to produce either a local (e.g., antiseptic) or *systemic* (e.g., vitamins) effect.

Note: Lozenges must be palatable and slowly soluble.

See also *troche*.

lubricant
Used as processing aid in *tablet* and *capsule* manufacturing, to facilitate the movement of the formulation into the dye and punch and to reduce the energy of compression.

lyophilic
Denotes a *dispersed* phase having a pronounced affinity for the dispersion medium.

Note: When the dispersed phase is lyophilic, the colloid is usually a reversible one.

[6]

lyophobic
Denotes a *dispersed* phase having but slight affinity for the dispersion medium.

Note: When the dispersed phase is lyophobic, the colloid is usually an irreversible one.

[6]

matrix formulation (e.g., matrix *tablet*)
Specific case of *drug* embedding in insoluble *excipients* (typically in a polymer) in order to achieve *extended release*.

Note 1: Matrices can be monolithic or heterogeneous, dissolved or dispersed, or both.

Note 2: This term also applies to a matrix made of *hydrophilic* substances, which, in contact with water, form a *gel* of high viscosity.

See *embedding.*

maximum additive concentration
Maximum concentration of a *drug*, which will form a clear solution with a given concentration of *surfactant*.

maximum safe concentration
Concentration of a *drug* in the plasma, above which side effects are likely to occur in a patient.

micelle(s)
Aggregates of colloidal dimensions (i.e., association of colloids) formed reversibly from *amphiphile* molecules.
[3]

Note 1: A micelle is thus a structural unit of the dispersed phase (*surfactant*) in an *emulsion*, *suspension*, or a *gel*; a unit whose repetition in three dimensions constitutes the micellar structure of the gel; it does not denote the individual particles in free suspension or solution, or the unit structure of a *crystal*.

Note 2: Arrangements of groups of molecules of *hydrophobic* liquids in aqueous environment, formed by *surface-active agents*.

[7]
See also *critical micelle concentration*.

micellization
Formation of *micelles*.

microemulsions
Emulsions in which the *dispersed* droplets are in the micron-size range.

Note 1: It is sometimes difficult to differentiate between a swollen *micelle* and a small *emulsion* droplet.

Note 2: Some microemulsions are in the submicron size.

microencapsulation
Formation of microparticles *encapsulating* a *drug*.

Note: Such coating protects the drug from chemical or enzymatic attack and/or prolongs drug release.

See *encapsulation*.

microfiltration
Pressure-driven, membrane-based separation process in which particles and dissolved macromolecules larger than 0.1 μm are rejected.

Note: Can be used for *sterilization* with 0.22-μm size filters.

[18]

microsphere
Solid spherical particles of micron-size range, used as matrix dosage forms.

minimum effective plasma concentration
Concentration of a *drug* that must be achieved in the plasma before any desired therapeutic or pharmacological effect can be obtained.

minimum inhibitory concentration (MIC)
Lowest concentration of an antibacterial *drug* necessary to inhibit the growth of a microorganism.

minimum therapeutic plasma concentration
See *minimum effective plasma concentration*.

modified release
Release of a *drug* from a *dosage form* that it is not immediate (e.g., *sustained release*, *retarded release*, *delayed-action preparations, controlled release, extended release*, etc.).

moistening agents
Usually water or low-molecular-weight alcohols or compounds, used in *topical* applications and in *wet granulation*, for the production of *tablets.*

multicompartment formulation
Dosage form (*capsule*, *tablet*) comprising several elements (e.g., *microspheres* or *coated* pellets) differing in the rate of *drug* release.

multilayer tablet
Consists of several different layers that are compressed on top of each other, to form a single *tablet* composed of two or more layers.

Note: Mainly used for incompatible substances and for *sustained release*.

nanoencapsulation
Formation of *nanoparticles encapsulating* a *drug*.

nanoparticles
Microscopic particle whose size is measured in nanometers, often restricted to so-called nanosized particles (NSPs; <100 nm in aerodynamic diameter), also called ultrafine particles.

Note 1: *Drug* may be embedded in (as in a *matrix*) or *adsorbed* or *encapsulated*.

Note 2: Particles containing drug of sizes less than 0.5 μm are often named as nanoparticles.

[3]

nebulizer
Device that disperses liquids to *aerosols* for therapeutic use by inhalation through a mask.

ointment
Greasy, semi-solid preparation for external application, often anhydrous, containing dissolved or *dispersed medicaments*.

one-compartment model
Kinetic model, where the whole body is thought of as a single compartment in which a substance is distributed rapidly, achieving an equilibrium between blood and tissue immediately.

Note: In pharmacokinetics, the substance is a *drug* component which is assumed to be released from a *dosage form* and distributed instantly after *absorption* to reach an equilibrium between blood and tissues.

[12]

onset of drug action
Time required to achieve the *minimum effective plasma concentration* following *administration* of the *dosage form*.

parenteral
See *administration of drugs*, *parenteral*.

paste
Ointment containing >0 % of *powder*, *dispersed* in a fatty base.

pellet
1. Very small *tablet* or pilule.
2. Implantable polymeric *matrix*.
3. Spherical *granule*.

pelletization
Process of *agglomeration* that converts fine *powders* or *granules* of bulk *drugs* and *excipients* into small, free-flowing, spherical, or semi-spherical units, referred to as *pellets*.

Note 1: *Pellets* range typically between 0.5 and 1.5 mm in diameter.

Note 2: The most widely used pelletization processes in the pharmaceutical industry are extrusion/spheronization, solution/suspension layering, and powder layering.

[19]

pharmaceutical equivalence
To be pharmaceutically equivalent, the *generic* and proprietary *formulations* must (1) contain the same amount of active ingredient; (2) contain the same active ingredient in the same *dosage form*; (3) be intended for the same route of *administration*; and (4) generally be labeled for the same conditions of use.

Note: It is not usually required that the generic and the reference *drug* contain the same *excipients*, or that the mechanism by which the active drug substance is released from the formulation be the same. But, the regulation authority approves the generic equivalent on the basis of certain in vitro and in vivo data.

See *bioequivalence*, *generic*, *nonproprietary*.

pharmaceutics
Science of preparation of *drugs*, *dosage forms*, and *drug delivery systems* taking into account the *pharmacokinetics* and *pharmacodynamics* of the drug as well as its physical and chemical properties.

polymorph
Solid material that exists at least in two different molecular arrangements, i.e., distinctly different *crystal* species.

Note 1: The differences between polymorphs disappear in solution or in the vapor phase.

Note 2: Solubility, melting point, density, crystal shape, crystal structure, and some other physical properties often differ from one polymorph to the other.

polymorphic transition
Transition of a solid *crystalline* phase to another phase having the same chemical composition but a different *crystal* structure.

Note: The transition may occur at a characteristic temperature and pressure, called the inversion point.

[3,20]

polymorphism
Existence of two or more different *crystal* structures for the same compound.

powder grades
Defined for *powders* used pharmaceutically, according to particle sizes.

Note: It is required that when the fineness of a powder is described by a number, all particles must pass through a sieve with aperture diameter in microns equal to that number.

powder(s)
Dry solid material consisting of many, usually free flowing, fine particles. Conventionally, the title "powder" should be restricted to powder mixes for internal use and alternative terms are used for other powdered *formulations* presented in this way, e.g., *dusting powders*, which are for external use.

Note : The term "powder", when used to describe a dosage form, however, describes a formulation in which a *drug powder* has been mixed with other powdered *excipient*s to produce the final product.

preformulation
Exploratory activity that begins early in *pharmaceutics*, involving studies designed to determine the compatibility of *excipients* with the active substance for a *biopharmaceutical*; physicochemical and bioanalytical investigation in support of promising experimental *formulations*.
[21]

prodrug
Chemically modified form of a pharmacologically active compound that has to undergo biochemical or chemical transformation before exhibiting its pharmacological effect.

Note: Prodrugs can be viewed as *drugs* containing specialized nontoxic protective groups used in a transient manner to alter or to eliminate undesirable properties in the parent drug molecule.

[2]

prolonged action
See *sustained release*.

pseudopolymorph(s)
Different *crystalline* form(s) of a *solvated* compound that differ in the identity and/or the stoichiometry of the *solvating* molecule.

relative bioavailability
Measure of the fraction of a given *drug* that is absorbed intact into the *systemic* circulation from a *dosage form*, relative to a recognized, clinically proven, standard dosage form of that drug.

repeat action dosage form
Tablet or *capsule* distinguished from a *sustained-release dosage form*, by the fact that it releases the medicinal agent, or part of it, at any time other than promptly after administration as opposed to a slow, controlled manner.

Note: A repeat action tablet contains usually two doses of the *drug*, the first being released immediately following *per-oral administration*. The second dose is released later, when the layer of *enteric coating* is dissolved.

sieving
Process that differentiates or separates solid particles according to their size using a meshed or perforated device.

slow release
See *sustained release*.

slugging
Method by which *powder* particles are compressed into a large *tablet*, called a slug, which is subsequently dry-screened and compressed into a tablet.

sol
Fluid colloidal dispersion of a solid in a liquid.
Surfactant solution above the *critical micelle concentration* [5,6].

sol-gel transition
Transition of a suspension of solid, usually colloid, particles in a liquid (*sol*) to an apparent solid, jelly-like material (*gel*).
[3,20]

solubilizing agents
Additives making a substance soluble or more soluble, especially in water.

solvate
Crystalline form of a compound in which one or more solvent molecules are part of the *crystal* structure.
See also *hydrate*.

spheronization
Process of making dense, spherical *pellets* by means of special spheronizing or pelletizing equipment.

stent
Scaffold placed into narrowed, diseased vessels (mainly coronary arteries) or a device implanted in a vessel used to help keep it open.
[22]

sterility
Condition of being aseptic, or statistically free from living microorganisms and their spores.

sterilization
Destruction or removal of microorganisms in or about an object, e.g., by steam (flowing or pressurized), chemical agents (alcohol, phenol, ethylene oxide gas), high-velocity electron bombardment, gamma or ultraviolet light radiation or filtration.

sublingual tablets
Usually small, flat, and soft *tablets*, which are designed to be placed under the tongue to allow direct absorption of the active ingredient through the mucosa for *systemic* effect.

suppositories
Dosage form, semi-solid, used for the *administration* of *drugs* via the rectal route, for *systemic* or *local* effect. When application is via other routes (e.g., the *vaginal route*), suppositories are termed differently, inserts, *pessaries*, etc.

Note 1: The vehicles used in suppositories are of two types, i.e., fatty bases and water-soluble ones.

Note 2: An important requirement for suppositories is a melting point (or disintegration/dissolution) at around 36–37 °C so as to discharge the drug in the rectum.

surfactant (surface-active agent)
Substance that alters the conditions prevailing at an interface, causing, for example, a marked decrease in the surface tension of water or nonaqueous solvents.

Note 1: Such substances are of importance in a wide variety of fields as *emulsifying* agents, *detergents*, *solubilizing agents*, wetting agents, foaming and antifoaming agents, *flocculants* and *deflocculants*, and in *drug* stability and *drug absorption*.

Note 2: Surfactants are characterized by having two regions in their molecular structure: a *lyophobic* (or *hydrophobic*) group, such as a hydrocarbon chain, that has no affinity for water, and a *lyophilic* (or *hydrophilic*) group that has an affinity for water.

[3,6]

sustained release
Dosage form designed to release the *drug* contained therein at a continuous and controlled rate for a longer period of time that can normally be achieved with its conventional, nonsustained counterpart.

Note 1: Per-oral administration of a single dose of a sustained-release product increases the duration of therapeutic action of the drug, beyond that achieved normally with a single dose of the corresponding non-sustained conventional counterpart.

Note 2: Sustained-release injectables are also available.

Other terms used to describe the same concept include: "controlled release", "extended release", "long-acting", "gradual release", "modified release", "prolonged action", and "slow release".

syrup
Liquid preparation of high sugar concentration with or without medicinal and additional flavoring substances.

Note 1: Syrup is a highly concentrated solution of sugar. Other polyols, such as glycerol or sorbitol, may be present to retard crystallization of sucrose or to increase the solubility of added ingredients.

Note 2: When the syrup contains a medicinal substance, it is termed "medicated syrup"; and the syrup is diluted since USP syrup is close to a saturated solution. Although syrup tends (due to its very high [approximately 85 %] sucrose content) to resist mold or bacterial contamination, syrup may contain antimicrobial agents to prevent bacterial and mold growth.

Note 3: It is often required to add a cosolvent or water to the medicated syrup in order to dissolve the *drug*.

systemic
1. Effect, relating to the entire organism as distinguished from any of its individual parts.
2. Opposite of local (administration or pathology).

Note 1: To obtain a systemic effect, transfer of *drug* through the systemic circulation is required.

Note 2: *Intravenous* or *transdermal administrations* and *tablets* for *oral administration* are typically for *systemic* action.

Note 3: *Ear* or eye drops, *topical creams*, or *drug-eluting stents* are typically for *local action*.

tablet
pastille
pellet
pill
troche

Solid dosage form compressed into a specific shape containing medicinal substances with or without suitable diluents.

Note: Tablets may vary in shape, size, color and weight, and may be classified according to the method of manufacture, as molded tablet and compressed tablet.

See also: *buccal tablet*, *compressed tablet*, *enteric coating*, *lozenge*, *prolonged-action tablet*, *sublingual tablet*, *sustained-action tablet.*

tablet coating
Solid layers based typically on cellulose derivatives and may include plasticizers and pigments.
Employed usually for one or more of the following reasons:

1. Protection of the ingredients (from light or moisture).
2. Masking the bad taste of the drug.
3. Masking possible batchwise differences in the appearance of raw materials and hence allaying possible patient concern over tablets of differing appearance.
4. Coating confers mechanical strength and facilitates handling.
5. Colored coating aids in the rapid identification of a product.
6. Functional film coating is used to impart *enteric* or *controlled-release* properties to the tablet.

See *enteric coating*.

therapeutic index
Ratio between toxic and therapeutic doses (the higher the ratio, the greater the safety of the therapeutic dose).
[12]

transplantation
The removal of tissue from one part of the body or from one individual and its implantation or insertion in another.
See also *implantation*.

troche
Applied to compressed *lozenges*. In lay language, lozenge and troche are used interchangeably.

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