History of Lyophilization

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Introduction

Lyophilization also known as freeze-drying is a process known from the ancient times, since 1250 BC, for preserving material by dehydrating the sample, which includes first freezing the sample and then drying under a vacuum (or low pressures) at very low temperatures [1–4]. The term lyophilization or lyophilisation literally means "solvent-loving process" or "process for loving dry state." The term has the origin from the ancient Greek root word, *λύω*/leo meaning "to break up, to dissolve," *φιλέω*/phileo meaning "to love, to kiss, to have tenderness for," and *πίλναμαι*/pilnamai meaning "contact, approach" [5]. The term lyophilization, as we know, is mostly attributed to Rey LR's work in 1976 described by taking into account the porous nature of the dried product and its "lyophil" characteristic to rapidly reabsorb the solvent and restore the substance [6]. Lyophilization (noun)/ly·oph·i·li·za·tion/(li-of″ĭ-lĭ-za′shun), transitive verb form is lyophilize, where lyophile or lyophilic in chemistry terms means—noting a colloid the particles of which have a strong affinity for the liquid in which they are dispersed. The suffix *–ize* or *-ise*, meaning—to cause to become [7].

Freeze-drying is in fact a sublimation process where the frozen liquid transforms to gaseous state directly without going through a liquid phase. Lyophilization is a dehydration process to preserve material and make lighter for transportation, a popular freeze-dried ice-cream treat for space astronauts [8]. Interestingly, lyophilization is also defined based on its applications [7]. For example, lyophilization (noun) is a method of drying food or blood plasma or pharmaceuticals or tissue without destroying their physical structure; material is frozen and then warmed in a vacuum so that the ice sublimes. Lyophilization also defined as the process of iso-

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