



Basic Principles Of Freeze Drying

ABSTRACT:

Freeze drying, also known as lyophilization, is a process used to remove water or other solvents from various products thereby rendering the product relatively inactive and able to be stored for some period of time, typically without being refrigerated.

Lyophilization requires the development of a unique recipe or cycle based on the thermal and physical characteristics of the product along with consideration of temperature and pressure relationships, phase changes and heat transfer. A basic understanding of the theory behind freeze drying is essential for the scientist to begin to design a working lyophilization process.

This paper provides an overview of all of the steps involved in freeze drying including product freezing, primary drying (sublimation) and secondary drying (desorption). Also introduced are the concepts of critical temperature (eutectic and glass transition), thermal treatment (annealing), vapor pressure of ice, product collapse, determination of completion of primary drying and cycle optimization. Common freeze dryer equipment designs are reviewed along with their typical components and sub-systems.