21 Practical Considerations for Freeze-Drying in Dual Chamber Package Systems

Dirk L. Teagarden, Stanley M. Speaker, and Susan W. H. Martin
Pfizer Biotherapeutics Pharmaceutical Sciences, Pfizer, Inc., Chesterfield, Missouri, U.S.A.

Thomas Österberg
Pfizer Product and Process Development, Global Manufacturing, Pfizer Health AB, Strängnäs, Sweden

INTRODUCTION

The market for injectable drugs is increasing due in large part to the development of biotherapeutics for previously untreatable ailments, such as rheumatoid arthritis and multiple sclerosis. Many biotherapeutics are administered parenterally and are lyophilized, due to low-intestinal absorption and poor physicochemical stability, respectively. An increased use of lyophilized dosage forms and the demand for more doses per unit have created a requirement for new package forms (1). Additionally, the growth of the home healthcare market has created an increased need for self-injection of subcutaneously delivered parenterals (2). Thus, patient convenience in drug delivery is important when developing self-administered parenteral drug products. A common mode to ensure ease-of-use by the patient is delivery of subcutaneous drugs in prefilled syringes/cartridges (3). These syringe/cartridge systems are available either "as is" or with a delivery device such as an autoinjector or pen injector (4). Recent evaluations of the parenteral drug market expect an 11% to 20% growth for prefilled syringes/cartridges (2,3,5,6). Prefilled syringes/cartridges enhance patient convenience by simplifying dosage preparation and administration. Other advantages of prefilled syringe packaging include increased patient safety due to decreased number of dose preparation steps, decreased administration errors (including inadvertent needle sticks), decreased costs due to smaller overfill, lack of need for a diluent vial and transfer syringe, less packaging, the extension of product exclusivity (i.e., life cycle management), and a unique branding opportunity for a product. These packaging systems also enable easier recruitment of patients for clinical trials in a crowded therapeutic area where the standard-of-care includes prefilled syringes and/or devices (e.g., diabetes and growth hormone–deficiency markets).

Many parenterals, especially biotherapeutics, are unstable in aqueous-based formulations for long periods of time and are, therefore, lyophilized. Lyophilized drug products must be reconstituted with sterile diluent prior to use. The reconstitution operation is an additional step the patient or caregiver must perform correctly to ensure safety and appropriate dosing to the patient. Lyophilizing in dual chamber packages [e.g., dual chamber vial (DCV), dual chamber syringe (DCS) syringe, or dual chamber cartridge (DCC)] eliminates