[0005] Protein-based pharmaceutical formulations are often lyophilized and stored in the solid state to help preserve the integrity of the protein, such as the antibody or bispecific antigen-binding molecule, in the formulation during storage. Many current methods of lyophilizing protein formulations, however, fail to result in solid state formulations that exhibit suitable stability over time and that are faster compared with known methods. Thus, there is a need for new accelerated methods of producing lyophilized protein formulations that exhibit improved storage stability.

SUMMARY

[0006] In one aspect, the disclosure provides a rapid method of preparing a lyophilized formulation, the method including (a) cooling a lyophilization chamber containing a liquid formulation comprising a protein, [a saccharide, and a surfactant] to a temperature ranging from about -35°C to about -50°C to produce a frozen formulation, and holding the chamber at a temperature ranging from about -40°C to about -50°C for a time period of about 1.0 hours to about 3.0 hours; (b) heating the chamber to a temperature ranging from about -35°C to about -20°C and a pressure ranging from about 75 mTorr to about 125 mTorr to produce a primary dried formulation, and holding the chamber at a temperature ranging from about -35°C to about -20°C and a pressure ranging from about 75 mTorr to about 125 mTorr for a time period of about 12 hours to about 24 hours; (c) heating the chamber to a temperature ranging from about 20°C to about 30°C to produce a secondary dried formulation, and holding the chamber at a temperature ranging from about 20°C to about 30°C and a pressure ranging from about 50 mTorr to about 100 mTorr for a time period of about 5 hours to about 12 hours to produce the lyophilized formulation; wherein the liquid formulation has a pH or about 3-7 and does not contain mannitol; and the method lacks an annealing step.

[0006a] In another aspect, the present disclosure refers to a method of preparing a lyophilized formulation, the method comprising: (a) cooling a lyophilization chamber containing a liquid formulation comprising a protein, a saccharide, and a surfactant to a temperature ranging from about -35°C to about -50°C to produce a frozen formulation, and holding the chamber at a temperature ranging from about -40°C to about -50°C for a time period of about 1.5 hours to about 5.0 hours; (b) heating the chamber to a temperature ranging from about -30°C to about -20°C and a pressure ranging from about 75 mTorr to about 125 mTorr to produce a primary dried formulation, and holding the chamber at a temperature ranging from about -30°C to about -20°C and a pressure ranging from about 75 mTorr to about 125 mTorr for a time period of about 12 hours to about 24 hours; (c) heating the chamber to a temperature ranging from about 20°C to about 30°C to produce a secondary dried formulation, and holding the chamber at a temperature ranging from about

20°C to about 30°C and a pressure ranging from about 50 mTorr to about 100 mTorr for a time period of about 5 hours to about 12 hours to produce the lyophilized formulation; wherein the liquid formulation has a pH of about 3-7 and does not contain mannitol; and the method lacks an annealing step.

[0007] In another aspect, the present disclosure refers to a lyophilized protein formulation prepared by the method as described herein.

[0008] Further aspects and advantages will be apparent to those of ordinary skill in the art from a review of the following detailed description. While the methods disclosed herein are susceptible of examples in various forms, the description hereafter includes specific examples with the understanding that the disclosure is illustrative and is not intended to limit the disclosure to the specific examples described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 shows dried product cakes, following completion of the cycle, that were assessed by visual inspection for any indication of macroscopic collapse and for overall