CLAIMS

That which is claimed is:

1. A dry composition, comprising a bioactive material, at least one matrix forming agent and at least two glass forming agents, wherein the composition is prepared in accordance with a method for preparing the dry composition without boiling or foaming, said method comprising:

   (a) combining said bioactive material, said matrix forming agent and two glass forming agents in an aqueous solvent to form a viscous slurry;

   (b) snap-freezing the slurry in liquid nitrogen to form solid frozen particles in the form of beads, droplets or strings;

   (c) primary drying the frozen particles by evaporation, under vacuum, at a temperature above the freezing temperature of the frozen particles, whereby a primarily dried formulation is formed; and

   (d) secondary drying the primarily dried formulation at full vacuum and a temperature of 20°C or higher for a time sufficient to reduce the water activity of the formulation to Aw - 0.3 or lower.

2. The composition of claim 1, wherein the composition is a dry glassy composition comprising a bioactive material

3. The composition of claim 1, wherein the formulation comprises total solids ranging from about 30 weight percent to about 70 weight percent.

4. The composition of claim 1, wherein the bioactive material comprises a cell, a microbe, a virus, a cell culture, a bacteria, a probiotic bacteria, a plant and soil probiotic bacteria, a yeast, a protein, a recombinant protein, an enzyme, a peptide, a hormone, a vaccine, a drug, an antibiotic, a vitamin, a carotenoid, a mineral, a microbiocide, a fungicide, a herbicide, an insecticide or a spermicide.

5. The composition according to claim 1 wherein the matrix forming agent is a polysaccharide selected from the group consisting of: cellulose acetate phthalate (CAP), carboxy-methyl-cellulose, pectin, sodium alginate, salts of alginic acid, hydroxyl propyl methyl cellulose (HPMC), methyl cellulose, carrageenan, guar gum, gum acacia, xanthan gum, locust bean gum, chitosan

and chitosan derivatives, starches and modified starches, cyclodextrins, inulin, maltodextrins, dextrans, and combinations thereof.

6. The composition of claim 1, wherein the matrix forming agent is present in the formulation in an amount ranging from about 1 weight percent to about 20 weight percent.

7. The composition according to claim 1, wherein the glass forming agents are readily soluble in a solution and do not thicken or polymerize upon contact with water and do not form crystals during drying.

8. The composition according to claim 1, wherein the glass forming agents are; proteins, such as human and bovine serum albumin, egg albumen, gelatin, immunoglobulins, isolated soya protein, wheat protein, skim milk powder, caseinate, whey protein, pea protein and any protein hydrolysates; carbohydrates including, monosaccharides (galactose, D-mannose, sorbose, etc.), disaccharides including lactose, trehalose, sucrose, etc.; an amino acid such as lysine, monosodium glutamate, glycine, alanine, arginine or histidine, as well as hydrophobic amino acids (tryptophan, tyrosine, leucine, phenylalanine, etc.); a methylamine such as betaine; a polyol such as trihydric or higher sugar alcohols, e.g. glycerin, erythritol, glycerol, arabitol, xylitol, sorbitol, mannitol and isomalt; propylene glycol; polyethylene glycol; surfactants such as sugar fatty acid esters and phospholipids such as lecithin; and combinations thereof.

9. The composition of claim 1, wherein the glass forming agents are present in the formulation in an amount ranging from about 1 weight percent to about 80 weight percent.

10. A method for preparing a ~~stable~~ dry composition without boiling or foaming~~powder formulation of claim 1~~, said method comprising:

(a) combining a bioactive material, a matrix forming agent and two glass forming agents in an aqueous solvent to form a viscous slurry;

(b) snap-freezing the slurry in liquid nitrogen to form solid frozen particles in the form of beads, droplets or strings;

(c) ~~purging the solid frozen particle under vacuum and temperature below the formulation freezing point;~~ primary ~~liquid~~ drying the frozen particles ~~step of the formulation~~ by evaporation, under vacuum, at a ~~formulation~~ temperature above ~~its~~ the freezing temperature of the frozen particles, whereby a primarily dried formulation is formed; and

(d) secondary drying ~~of~~ the primarily dried formulation at full vacuum and a temperature of 20°C or higher for a time sufficient to reduce the water activity of the formulation to Aw - 0.3 or lower, whereby the composition is prepared.

11. The A method of preparing composition of claim 10, wherein the primary drying step is carried out at a temperature greater than -10°Csaid method comprising: preparing a viscous slurry comprising the bioactive material, at least one matrix forming agent and at least two glass forming agents; snap-freezing the slurry in liquid nitrogen to form an amorphous structure of frozen particles in a form of strings, droplets, beads or microbeads; reducing the pressure on the frozen particles to lower than <2000 mTOR for less to <30 minutes; raising the pressure to more than >2000 mTORR and applying heat from 20°C to 70°C to accelerate the dehydration the of formulation.

12. The method of claim 11 10, wherein the primary drying step is carried out at a temperature between -5°C and +5°C composition is snap-frozen before drying to a temperature below its freezing temperature.

13. The method of claim 11 10, wherein the primary drying is primary drying step is carried out under a vacuum pressure greater than 2,000 mTORRdone by evaporation.

14. The method of claim 11 10, wherein the primary drying is carried out under a vacuum pressure between 2,000 and 10,000 mTORRdone by lyophilization.

15. The method of claim 11 10, wherein the secondary drying step is accelerated by increasing the temperature and/or vacuum pressure is increased during the secondary drying step.

16. The method of claim 11, wherein the formulation is dried for a time sufficient to reduce the formulation to a water activity of Aw = 0.3 or less.

1716. The method of claim 11 10, wherein the dried formulation dry composition is cut, crushed, milled or respectively pulverized into a free flowing powder.

1817. The method of claim 1716, wherein particle size of the dried formulation powder is less than about 1000 μm.

1918. The method composition of claim 11 1 for administration , further comprising administering the formulation to animals and or plants as a reconstituted liquid or as a ground powder and as incorporated into a food or feed product.

2019. The method of claim 11 10, for further comprising mixing the formulation dry composition with a component selected from the group consisting of infant formula, functional

beverages, and pet food~~; and administering to human infants, human adults, animals or plants~~.