What is claimed is:

1. A method of making a lyophilized vaccine comprising live attenuated *Bordetella* bacteria, the method comprising the steps of:

harvesting *Bordetella* bacteria from a culture at an $OD_{600}$ between 0.4 and 1.6;

mixing the harvested *Bordetella* bacteria with a lyophilization buffer comprising 5-65% by weight a cryoprotectant sugar and having a temperature between 2-35°C, wherein the ratio of harvested *Bordetella* bacteria to lyophilization buffer is between 5:1 and 1:5 by volume;

lyophilizing the mixture of the *Bordetella* bacteria and the lyophilization buffer; wherein the hold time between the harvesting and lyophilizing steps is less than 48 hours; and

collecting the lyophilized *Bordetella* bacteria.

2. The method of claim 1, wherein the *Bordetella* bacteria are a strain of *Bordetella pertussis*.

3. The method of claim 2, wherein the strain of *Bordetella pertussis* is a BPZE strain.

4. The method of claim 3, wherein the BPZE strain is BPZE1.

5. The method of claim 1, wherein the *Bordetella* bacteria from cultures at an $OD_{600}$ between 0.4 and 1.0.

6. The method of claim 1, wherein the *Bordetella* bacteria from cultures at an $OD_{600}$ less than 1.0.

7. The method of claim 1, wherein the cryoprotectant sugar is sucrose.

8. The method of claim 1, wherein the lyophilization buffer comprises a nutrient substrate.

9. The method of claim 8, wherein the nutrient substrate is glutamate.

10. The method of claim 1, wherein the hold time between the harvesting and lyophilizing steps is less than 36 hours.

11. The method of claim 1, wherein the lyophilizing step comprises a pre-crystallization hold step wherein the mixture of the *Bordetella* bacteria and the lyophilization buffer is held at 0.1 to 10°C above the crystallization temperature of the mixture for 0.5-10 hours prior to further cooling.

12. The method of claim 1, further comprising a step of concentrating the harvested *Bordetella* bacteria to an $OD_{600}$ of 1.0 – 30.0 prior to the mixing step.

13. A lyophilized vaccine product comprising live attenuated *Bordetella* bacteria made according to a method comprising the steps of:

harvesting *Bordetella* bacteria from cultures at an $OD_{600}$ between 0.4 and 1.6;

concentrating the harvested *Bordetella* bacteria from cultures to an $OD_{600}$ of 1.0 – 30.0;

mixing the concentrated *Bordetella* bacteria with a lyophilization buffer comprising 5-65% by weight a cryoprotectant sugar and a temperature between 2 - 35°C, wherein the ratio of concentrated *Bordetella* bacteria to lyophilization buffer is between 5 :1 and 1 :5 by volume;

lyophilizing the mixture of the *Bordetella* bacteria and the lyophilization buffer, wherein the hold time between the harvesting and lyophilizing steps is less than 48 hours; and

collecting the lyophilized *Bordetella* bacteria.

14. The lyophilized vaccine product of claim 13, wherein the product has a shelf life of at least two years when stored at 22.5°C, and at least 20% of the bacteria in the product remains viable after the lyophilizing step.

15. The lyophilized vaccine product of claim 13, wherein, after the lyophilizing step, the collected lyophilized bacteria are able to prevent or reduce infection of a subject's respiratory tract with a pathogenic strain of *Bordetella pertussis*.