CLAIMS

We claim:

1. A method of producing a liquid form *Trichoderma*-based product and a solid state *Trichoderma*-based product, the method comprising the steps:

(a) preparing an alginate-agar bead inoculant from a *Trichoderma* seed culture;

(b) cultivating the alginate-agar bead inoculant in liquid nutrient culture medium in a reactor to produce a desired scaled-up microbial density in the bead, wherein the desired scaled-up microbial density is at least 1×10^9 conidia per gram of the alginate-agar beads;

(c) harvesting the alginate-agar bead inoculant from the liquid culture medium; and

(d) preparing the liquid form *Trichoderma*-based product, wherein the cultivated alginate-agar bead inoculants are used to inoculate a submerged fermentation reactor, and preparing the solid-state *Trichoderma*-based product, wherein the cultivated alginate-agar bead inoculants are used to inoculate a solid-state fermentation reactor.

2. The method of claim 1, wherein the *Trichoderma* microorganism is selected from the group consisting of *Trichoderma reesei*, *Trichoderma harzianum*, *Trichoderma viride*, and *Trichoderma hamatum*.

3. The method of claim 1, wherein the step (a) comprises combining a 5% homogenous slurry of the seed culture with sterile nutrient medium, 1% agar and 2% sodium alginate to produce an inoculum solution; and using a dripping showering device to deposit drops of the inoculum solution into a mixing vessel containing 1% calcium chloride, wherein the drops form alginate-agar bead inoculants comprising nutrient components and particles of the microorganism embedded in alginate-agar mass.

4. The method of claim 1, wherein the step (b) comprises collecting the alginate-agar bead and then cultivating it in a reactor containing a sufficient volume of the liquid nutrient medium to permit a high concentration of *Trichoderma* mycelia to disperse inside and throughout the surface of the alginate-agar bead.

5. The method of claim 1, wherein the step (b) is performed for about 1 to about 10 days, under continuous aeration and agitation, at a temperature of about 28°C to about 30°C and pH of about 5.0 to about 6.5.

6. The method of claim 1, wherein
after the step (c) but before the step (d), the method comprises processing the alginate-agar bead inoculant for storage, wherein processing comprises collecting the alginate-agar bead inoculant from the reactor and placing the bead into a cryopreservation solution comprising glycerol and water at a ratio of about 50%.

7. The method of claim 6, wherein the cryopreservation solution is in a container selected from the group consisting of a flask, tube, vial and dish.

8. The method of claim 7, wherein the container comprises up to 50 bead inoculants.

9. The method of claim 7, wherein the container is placed into a freezer at a temperature of -80°C to -10°C.

10. The method of claim 7, wherein the container is placed into a refrigerator at a temperature of -10°C to 4°C.

11. The method of claim 1, wherein in step (d) the preparing of the liquid form *Trichoderma*-based product comprises cultivating the inoculant in the reactor for about 1 to about 10 days, under continuous aeration and agitation, at a temperature of about 28°C to about 30°C and pH of about 5.0 to about 6.5, wherein the reactor has a working volume of at least 200 gallons.

12. The method of claim 11, wherein the concentration of *Trichoderma* is increased in the liquid culture of at least 1×10^9 propagules per milliliter, and optionally preservatives, additives, and/or pH adjusters are added.

13. The method of claim 1, wherein in step (d) the preparing of the solid-state *Trichoderma*- based product comprises mixing the harvested alginate-agar bead inoculants with a liquid nutrient medium and a solid or semi-solid substrate to form a mixture; spreading the mixture thinly onto heat proof trays; cultivating the mixture on the trays in an incubator at 30°C for 3 to 10 days with constant aeration by ambient air.

14. The method of claim 13, wherein the incubator is a proofing oven.

15. The method of claim 13, wherein the substrate is vermiculite and the ratio of vermiculite to alginate-agar beads in the mixture is in the range of from 3:1 to 4:1.

16. The method of claim 13, wherein the substrate is foodstuff selected from the group consisting of corn flour, rice, beans and pasta.

17. The method of claim 13, further comprising increasing the temperature of the incubator to 40 °C; drying the trays for about 3 to about 4 days using dry air supplementation and vacuuming out moistened air to produce a dried product; grinding the dried product in a grinder to a desired particle size; and mixing the ground dried product with dry diatomaceous earth and commercial compost.

18. The method of claim 17, further comprising packaging the dried product mixed with diatomaceous earth and commercial compost in hermetically sealed bags for commercial use.

19. The method of claim 18, wherein the concentration of *Trichoderma* in the dried product after mixing with the diatomaceous earth and commercial compost is no less than 1×10^6 conidia per gram.