CLAIMS

1. A three-dimensional (3D) bioreactor for cultivating proliferating plant cells comprising:
    a. At least one packed bed chamber configured to confine said proliferating plant cells within it such that the proliferating plant cells become a three-dimensional stationary biomass phase; and
    b. At least one container comprising a fluid media, the fluid media is configured to flow through said proliferating plant cells stationary biomass phase;

    wherein, the flow of the fluid media through the proliferating plant cells stationary biomass phase allows transfer of compounds from the fluid media into the cells and vice versa in sheer forces within the at least one packed bed chamber thereby imitating natural growth environment of the proliferating plant cells within the 3D bioreactor.

2. The bioreactor of claim 1, further comprising at least one monitoring and/or a controlling unit/s for monitoring and/or controlling at least one parameter of culturing conditions and media parameters.

3. The bioreactor of claim 2, wherein said at least one parameter monitored and/or controlled is selected from the group consisting of: pH, temperature, stirring velocity, flow rate, gases concentration, amino acids levels, vitamins levels, minerals levels, growth factors levels, dissolved oxygen levels, glucose levels, lactate levels, lactate dehydrogenase levels, NH.sub.3 levels, glutamate levels, and combinations thereof.

4. The bioreactor of claims 1-3, wherein said fluid media is a growth media that provides nutrients to the proliferating plant cells, and uptakes plant cells metabolites and secreted compounds from the plant cells into the growth media.

5. The bioreactor of any one of the preceding claims, further comprising at least one inlet port to allow addition of gases and/or liquids and/or solid material into the 3D bioreactor during the cultivation of the proliferating plant cells.

6. The bioreactor of any one of the preceding claims, further comprising at least one outlet port to allow removal of fluid media out from the 3D bioreactor during the cultivation of the proliferating plant cells for collecting metabolites secreted by the proliferating plant cells stationary biomass phase during the cultivation process and/or for removing plant's secreted compounds /metabolites and/or for balancing the fluid media parameters.

7. The bioreactor of any one of the preceding claims, further comprising vibrating arms functionally connected to the packed bed chamber, so as to allow vibrating of the proliferating plant cells for minimizing channeling effect and improving contact between the fluid media and the proliferating plant cells stationary biomass phase, and/or for harvesting said proliferating plant cells stationary biomass phase for either collecting the cells or for lysing the cells to obtain their content.

8. The bioreactor of claim 7, wherein said harvesting of the plant cells is obtained by combining enzymatic reaction and applying vibration force on the plant cells so as to lyse the cells and collect their content from the media.

9. The bioreactor of any one of the preceding claims, wherein said packed bed chamber is either positioned within the container having the fluid media or positioned outside the container having the fluid media and connected thereto by tubes the flow the fluid media through said proliferating plant cells stationary biomass phase.

10. The bioreactor of any one of the preceding claims, wherein said packed bed chamber is divided into one or more sub-chambers by at least one perforated disk, such that each sub-chamber contains proliferating plant cells either in a similar size or in gradient sizes according to a hole dimensionof the at least one perforated disk.

11. The bioreactor of any one of the preceding claims, wherein said fluid media may be exchanged to either one of a differentiating media, a maturation media, and an elicitation media, and

combinations thereof in any order, so as to allow a consecutive development of the plant cells and imitate the natural growth process of plant cells within the 3D bioreactor.

12. The bioreactor of any one of the preceding claims, further comprising a stirring mechanism functionally connected to said packed bed chamber and configured to blend the proliferating plant cells stationary biomass phase within a basket, so as to rearrange the plant cells biomass and allow fluent flow of the media through the plant cells, wherein said stirring mechanism comprises at least a large gear attached to a stirrer, said stirrer is positioned within said packed bed chamber, and a small gear attached to a handle.

13. The bioreactor of any one of the preceding claims, wherein said packed bed chamber is a separated chamber from said fluid media container and said plant cells stationary biomass phase is configured to produce said plant cell stationary biomass suitable for use in agricultural seeding.

14. A method for cultivating proliferating plant cells in a 3D bioreactor comprising:
    a. Confining proliferating plant cells within at least one packed bed chamber such that the proliferating plant cells become a stationary biomass phase; and
    b. Flowing media through said proliferating plant cells stationary biomass phase, from at least one container comprising a fluid media;

    wherein, the flow of the fluid media through the proliferating plant cells stationary biomass phase allows transfer of compounds from the fluid media into the cells and vice versa in low sheer forces within the at least one packed bed chamber thereby imitating natural growth environment of the proliferating plant cells within the 3D bioreactor.

15. The method for cultivating proliferating plant cells according to claim14, further comprising: monitoring and/or controlling at least one parameter of culturing conditions and media parameters by at least one monitoring and/or a controlling unit/s.

16. A method for cultivating proliferating plant cell for usage of the plant cells and/or compounds produced by said plant cells for medical, cosmetic, food tech, agriculture, and industrial applications using the bioreactor according to any of claims 14-15, the method comprising:
    a) inputting proliferating plant cells onto at least one packed bed chamber in a bioreactor, wherein said packed bed chamber confines the proliferating plant cells within said packed bed chamber such that the proliferating plant cells create a stationary biomass phase; and
    b) flowing at least one fluid media from at least one container comprising a fluid media through the stationary biomass phase in a low-shear environment, allowing for efficient transfer of compounds between the fluid and the cells, wherein said fluid media contains one or more of nutrients, hormones, plant growth regulators (PGRs), vitamins, amino acids, trace elements, or combinations thereof.