CLAIMS

1. A method of adding a feed medium into a bioprocess, the method comprising:

(a) receiving a stream of CO_2-rich gas;

(b) treating the stream of CO_2-rich gas to remove impurities therefrom;

(c) preparing an aqueous mixture for absorbing carbon dioxide, the aqueous mixture comprises at least one inorganic nitrogen compound in a range of 5 - 10 wt% of the aqueous mixture, the at least one inorganic nitrogen compound is a nitrogen source for microorganisms;

(d) absorbing carbon dioxide from the stream of CO_2-rich gas into the aqueous mixture, the aqueous mixture with absorbed carbon dioxide forming a feed medium; and

(e) adding the feed medium into a bioprocess.

2. A method according to claim 1, wherein the absorption of carbon dioxide is carried out at temperature ranging from 0 to 35 °C and pressure ranging from 1 to 200 bars.

3. A method according to claim 1 or 2 further comprising filtering the feed medium to remove impurities selected from plurality of solid impurities.

4. A method according to any of the preceding claims, wherein filtering is sterile filtering.

5. A method according to claim 1, further comprising adding at least one of: hydrogen gas, oxygen gas, carbon monoxide, minerals, light into the bioprocess.

6. A method according to any of the preceding claims, wherein the CO_2-rich gas is obtained from an external source, and wherein the external source is a combustion plant.

7. A method according to claim 6, wherein the external source further comprises microbial fermentation process to obtain CO_2-rich gases.

8. A method according to claim 1, further comprising recycling a recycled gas stream back to step (a), wherein the recycled gas stream comprises at least one of selected from the carbon dioxide, water and one or more plurality of insoluble gases generated at step (d) or the carbon dioxide generated at step (e), and wherein the stream of CO_2-rich gas is supplemented by the recycled gas stream.

9. A method according to claim 8, wherein the CO_2 concentration of the total volume of the stream of CO_2-rich gas supplemented by the recycled gas stream is determined by equation:

$X = \frac{(A \times B + C \times D)}{B+C}$, wherein

X is concentration of CO_2 in the total volume of the stream of CO_2-rich gas supplemented by the recycled gas stream,

A is concentration of CO_2 in the stream of CO_2-rich gas,

B is flow rate of the stream of CO_2-rich gas,

C is flow rate of the recycled gas stream, and

D is concentration of CO_2 in the recycled gas stream.

10. A method according to any of the preceding claims, wherein treating the CO_2-rich gas comprises at least one of selected from filtering; pre-scrubbing; using a flash tank; desulphurisation; removal of hydrocarbons, oxygen, halogen, siloxanes; filtering as high-efficiency particulate absorbing filtering.

11. A system (200, 300) for adding a feed medium into a bioprocess, the system (200, 300) comprising:

- a first inlet (222) for providing a stream of CO_2-rich gas;
- a pre-filter (204, 304) for treating the stream of CO_2-rich gas to remove impurities therefrom;
- an absorption chamber (206, 306) for absorbing carbon dioxide from the stream of CO_2-rich gas, and a second inlet (208, 320) for receiving an aqueous mixture that absorbs the carbon dioxide to form a feed medium, the aqueous mixture comprises at least one inorganic nitrogen

compound in a range of –5 - 10 wt% of the aqueous mixture, the at least one inorganic nitrogen compound is a nitrogen source for microorganisms;

- a third inlet (224) for adding the feed medium into a bioprocess; and
- a bioreactor (210, 314) for facilitating the bioprocess.

12. A system (200, 300) according to claim 11, further comprising a filter (312) for filtering the feed medium by removing impurities selected from plurality of solid impurities.

13. A system (200, 300) according to claims 11 and 12, wherein the filter (312) is a sterile filter.

14. A system (200, 300) according to any of the claims 11 to 13, further comprising:

- at least one fourth inlet (316) for adding at least one of: hydrogen gas, oxygen gas, carbon monoxide, minerals into the bioprocess; and
- a light source coupled to the bioreactor (210, 314) for illumination thereof.

15. A system (200, 300) according to any of the claims 11 to 14, wherein the CO_2-rich gas is obtained from an external source, and wherein the external source is a combustion plant.

16. A system (200, 300) according to any of the claims 11 to 15, wherein the external source further comprises microbial fermentation process to obtain CO_2-rich gases.

17. A system (200, 300) according to any of the claims 12 to 16, wherein the bioreactor (210, 314) is configured for cultivating microorganisms selected from a group comprising autotrophic microorganisms, heterotrophic microorganisms, mixotrophic microorganisms, aerobic microorganisms, anaerobic microorganisms or facultative anaerobic microorganisms.

18. A system (200, 300) according to any of the claims 11 to 17, further comprising at least one recycle unit (310, 318), communicably coupled to the absorption chamber (306) or bioreactor (210, 314) and the filter (312), configured to recycle the carbon dioxide, water and one or more plurality of insoluble gases generated in absorption chamber (206, 306) or in the bioreactor (210, 314) back to the first inlet (222) of the aforementioned method.

19. A system according to any of the claims 11 to 18 further comprising at least one sensor element configured to measure at least one of selected from the concentration of carbon dioxide, water and one or more plurality of insoluble gases generated in the adsorption chamber (206, 306) or the carbon dioxide generated in the bioreactor (210, 314) for determining the concentration of CO_2 necessary at the first inlet (222).

20. A system according to any of the claims 11 to 19 further comprising at least one of selected from a pre-scrubber, a flash tank, an adsorber, a micro-aerator, a high-efficiency particulate absorbing filter.