CLAIMS

1. An agitator tank for the homogeneous distribution of bubbles in a liquid, comprising:
   - a liquid container comprising a first and a second end defining the axial ends of the container and one or more sidewalls extending between the axial ends,
   - a gas injection system, located proximal to the first end of the container,
   - at least one impeller rotatable about at least one axis of rotation and comprising one or more blades extending to a maximum distance R from the axis of rotation of the corresponding impeller,
   - at least one baffle axially displaced from the at least one impeller and fixed relative to the container at an orientation for reducing azimuthal flow generated by the at least one impeller;

wherein one or more impellers of the at least one impeller are shaped and oriented to induce axial flow of the liquid towards the gas injection system and the minimum distance of the at least one baffle to at least one axis of rotation is at most 1.2 R of any of the at least one impeller; and

wherein the maximum diameter of the one or more impellers of the at least one impeller that are shaped and oriented to induce axial flow of the liquid towards the gas injection system is equal or lower than 0.75 times the square root of the vessel section perpendicular to the axis at the at least one impeller level.

2. The agitator tank according to claim 1, wherein the at least one baffle is folded or curved anywhere between the minimum distance of the at least one baffle and 1.2 R of any of the at least one impeller to at least one axis of rotation, such that azimuthal flow of the liquid is converted into axial flow .

3. The agitator tank according to claim 1 or 2, wherein the minimum distance of the at least one baffle to at least one axis of rotation is at most 1.1 R of any of the at least one impeller.

4. The agitator tank according to any one of claims 1 to 3, wherein a gap is provided between the at least one baffle and the one or more sidewalls.

5. The agitator tank according to any one of claims 1 to 4, wherein the at least one impeller is a single impeller, wherein the single impeller is shaped to induce at least axial flow of the liquid towards the gas injection system and radial flow from the axis of rotation of the single impeller to the one or more sidewalls.

6. The agitator tank according to claim 5, wherein one or more, of the blades of the single impeller comprise a surface having an average pitch angle between 10º and 60º, between 15º and 50º, wherein the average pitch angle is defined as the average angle formed between the chord line and the plane orthogonal to the axis of rotation of the impeller.

7. The agitator tank according to any one of claims 1 to 4, wherein the at least one impeller comprises a plurality of impellers axially displaced relative to one another, wherein the plurality of impellers comprises:

- a first impeller closest to the gas injection system, the first impeller shaped to induce at least radial flow of the liquid from the axis of rotation of the first impeller to the one or more sidewalls; and
- one or more second impellers farther from the gas injection system, the one or more second impellers shaped to induce at least axial flow of the liquid towards the first impeller.

8. The agitator tank according to claim 7, wherein one or more of the blades of the first impeller comprise a surface having an average pitch angle between 50° and 90° wherein the average pitch angle is defined as the average angle formed between the chord line and the plane orthogonal to the axis of rotation of the impeller on which the blade is located.

9. The agitator tank according to any one of the claims 7 or 8 wherein one or more of the blades of the one or more second impellers comprise a surface having an average pitch angle between 10º and 60º, between 15º and 50º; wherein the average pitch angle is defined as the average angle formed between the chord line and the plane orthogonal to the axis of rotation of the impeller on which the blade is located.

10. The agitator tank according to any one of the claims 7 to 9, wherein the minimum distance between two adjoining impellers is less than 3R of any of said impellers.

11. The agitator tank according to any one of the claims 7 to 10, wherein the minimum diameter of the second impellers is greater than 0.3 times the square root of the vessel section perpendicular to the axis at the second impeller level.

12. The agitator tank according to any one of the claims 1 to 11, wherein the at least one baffle is folded or curved such that azimuthal flow of the liquid is converted into axial flow.

13. The agitator tank according to claim 12, wherein the at least one baffle comprises a second plane with an angle with respect to a plane containing the axis of rotation and defines a curved surface with an average arch of between 10º and 45°.

14. The agitator tank according to claim 13, wherein the second plane forms an average angle of between 10º and 45° with the main plane of the baffle.

15. The agitator tank according to any of claims 1 to 14, wherein the minimum distance of the at least one baffle to at least one axis of rotation is less than R of any of the at least one impeller.

16. The agitator tank according to any of claims 1 to 15, wherein the gas injection system comprises injection orifices and wherein the average distance of the injection orifices to the first end is less than the distance R of the first impeller.

17. The agitator tank according to any of claims 1 to 16, wherein the gas injection system is a sparger comprising a plurality of orifices each located radially between the axis of rotation of the impeller closest to the first end of the container and the one or more sidewalls, wherein the average distance between the orifices of the sparger and the axis of rotation of the impeller closest to the first end of the container is larger than 0.7 R of the impeller closest to the first end of the liquid container.

18. The agitator tank according to any of the claims 1 to 17, wherein the agitator tank comprises more than one impeller when the ratio between the height (H) of the liquid the agitator tank is configured to contain inside the liquid container and the mean of the diameter (<D>) of the one or more sidewalls is greater than 1.5 and more than 2 impellers if said ratio (H/<D>) is greater than 2, wherein the liquid height (H) is the distance of such free liquid surface to the first end the agitated tank, and wherein the mean of the diameter (<D>) is the mean of the square root of the surface of the vessel section perpendicular to the axis along the liquid container.

19. The agitator tank according to any of the claims 1 to 18, wherein the at least one impeller comprises a hub with a radius greater than 0.2 R.

20. A method for homogeneously distributing bubbles in a liquid within an agitator tank, wherein the agitator tank is an agitator tank according to any one of the claims 1 to 19 the method comprising the following steps:

a) generating at least an axial flow towards the first end of the agitator tank by means of one or more impellers of the at least one impeller above the gas injection system, further generating a radial flow by means of the first impeller,

b) reducing the azimuthal flow generated by one or more of the impellers by the at least one baffle, and

c) injecting the gas into the fluid by means of the gas injection system proximal to the first end the container.