

CLAIMS

1. A method for inactivating a microorganism in an aqueous solution, the method comprising:
passing bubbles of a gas through the aqueous solution, wherein the gas comprises at
5 least 10% CO₂ by volume and has a temperature of at least 18 °C when the gas first
contacts the aqueous solution.
2. The method of claim 1, wherein the microorganism is algae, protozoa, fungi, spore,
virus or bacteria.
3. The method of claim 1, wherein the microorganism is a virus or bacteria.
- 10 4. The method of any one of claims 1 to 3, wherein the bubbles are passed through the
aqueous solution while the aqueous solution is exposed to atmospheric pressure.
5. The method of any one of claims 1 to 4, wherein the bubbles have a diameter of
0.1 mm to 7 mm.
6. The method of any one of claims 1 to 5, wherein the gas comprises from 50% to
15 100% CO₂ by volume.
7. The method of any one of claims 1 to 6, wherein the gas comprises from 10% to
50% CO₂ by volume.
8. The method of any one of claims 1 to 7, wherein the gas has a temperature in excess
of 100 °C.
- 20 9. The method of any one of claims 1 to 7, wherein the gas has a temperature from
18 °C to 100°C.
10. The method of any one of claims 1 to 9, wherein the bubbles are formed by passing
the gas through a porous material in contact with the aqueous solution.
- 25 11. The method of any one of claims 1 to 10, wherein the gas bubbles occupy from 10%
to 60% of the total volume of the combination of the aqueous solution and the
bubbles as the bubbles pass through the aqueous solution.

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12. The method of any one of claims 1 to 11, wherein the aqueous solution has a bulk temperature of from 18 °C to 80 °C.
13. The method according to any one of claims 1 to 11, wherein the aqueous solution has a bulk temperature of from 18 °C to 55 °C, and wherein the gas has a
5 temperature higher than the bulk temperature of the aqueous solution.
14. A system for inactivating microorganisms present in an aqueous solution, the system comprising:
- a gas supply configured to supply gas comprising at least 10% CO₂ by volume, the gas having a temperature of above at least 18 °C;
10 - a gas-delivery apparatus, the gas-delivery apparatus configured to receive the supply of gas and to deliver the gas into the aqueous solution in the form of bubbles.
15. The system according to claim 14, wherein the gas-delivery apparatus is a bubble column evaporator.
- 15 16. The system according to claim 14 or 15, wherein the gas supply comprises a heater to heat a gas to thereby form the gas having a temperature of above at least 18 °C.
17. The system according to any one of claims 14 to 16, wherein the gas supply further comprises a gas source, the gas source adapted to provide the gas that
20 comprises at least 10% CO₂ by volume.
18. An apparatus for inactivating microorganisms present in an aqueous solution, the apparatus comprising:
- a gas-permeable material, the material having a flow surface at one side thereof that is configured to enable the flow of the aqueous solution across the
25 flow surface,
- a chamber arranged at an opposite side of the gas-permeable material to supply a gas that inactivates the microorganisms present in the aqueous solution such that the gas is able to pass through the gas-permeable material and into the aqueous solution flowing across the flow surface as gas bubbles.

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19. The apparatus according to claim 18, wherein the flow surface is in the form of a channel.
20. The apparatus according to claim 18 or 19, wherein the flow surface is configured such that gas bubbles pass through the aqueous solution in a direction transverse
5 to the direction of flow of the aqueous solution as it flows across the flow surface.
21. The apparatus according to any one of claims 18 to 20, wherein the gas-permeable material is selected such that the gas bubbles passing into the aqueous solution have a diameter of from about 0.1 mm to about 7 mm when the aqueous solution is under about 0.9 to 1.5 bar of pressure.