CLAIMS:

1. An apparatus for generating fine bubbles comprising:

a vessel containing a liquid and having a liquid inlet;

a plate comprising a plurality of orifices positioned in an upper portion of the vessel and below the liquid inlet wherein the orifices are sized to accelerate at least a portion of the liquid in the vessel;

at least two gas supplies each gas supply comprising three or more spargers positioned within the vessel with a surface of the spargers positioned from about 50 mm to about 1000 mm from a bottom of the plate and the spargers sized to inject from about 7 mm to about 13 mm diameter bubbles into the liquid; and

the spargers positioned within the vessel to create a first zone for the bubbles to rise within the vessel, and to create a second zone for the accelerated liquid to break the bubbles into fine bubbles and for fluid having the accelerated portion of the liquid and fine bubbles to flow through the vessel.

2. The apparatus of claim 1, wherein the spargers are sintered spargers or orifice spargers.

3. The apparatus of claim 1, wherein a thickness of the plate is about 1 mm to about 25 mm.

4. The apparatus of claim 1, wherein the spargers are positioned perpendicular to the plate.

5. The apparatus of claim 1, wherein the plate comprising the plurality of orifices is sized to accelerate at least 90% of the liquid in the vessel.

6. A bioreactor apparatus comprising:

a vessel having a liquid inlet;

a plate comprising a plurality of orifices positioned in an upper portion of the vessel and below the liquid inlet, wherein the orifices are sized to accelerate at least a portion of a liquid contained in the vessel;

at least one gas source connected to at least one sparger manifold;

at least two gas supplies each gas supply comprising three or more spargers positioned within the vessel with a surface of the spargers positioned from about 50 mm to about 1000 mm from a bottom of the plate and the spargers sized to inject from about 7 mm to about 13 mm diameter gas bubbles into the liquid;

the spargers positioned within the vessel to create a first zone wherein bubbles to rise within the vessel, and to create a second zone wherein the accelerated liquid breaks the bubbles into fine bubbles;

wherein each gas supply is connected to a corresponding sparger manifold.

7. The apparatus of claim 1, wherein the gas supplies are in an arm configuration.

8. The apparatus of claim 1, wherein the gas supplies are annular.

9. The apparatus of claim 6, wherein the gas supplies are in an arm configuration.

10. The apparatus of claim 6, wherein the gas supplies are annular.