

CLAIMS

1. A sterilisation device for generating a flow of hydroxyl radicals, the sterilisation device comprising:

5 a coaxial transmission line for conveying radiofrequency (RF) and/or microwave frequency electromagnetic (EM) energy, the coaxial transmission line extending in a longitudinal direction and comprising an inner conductor and an outer conductor located around and spaced away from the inner
10 conductor;

an end cap mounted on a distal end of the coaxial transmission line, wherein the end cap comprises a distally facing outlet aperture;

15 a fluid conduit extending in the longitudinal direction from a fluid inlet at a distal end of the coaxial transmission line through the end cap to the outlet aperture; and

a plasma generating region at a proximal end of the outlet aperture, wherein the plasma generating region contains a first electrode that is electrically connected to the inner
20 conductor, and a second electrode that is electrically connected to the outer conductor,

wherein the fluid conduit defines a longitudinal fluid flow path through the device that is aligned with a feed direction in which fluid is receivable through the fluid
25 inlet, and

wherein the first electrode and second electrode oppose each other in a transverse direction across the longitudinal fluid flow path in the plasma generating region.

30 2. The sterilisation device of claim 1, wherein the fluid conduit includes a passage between the inner conductor and outer conductor of the coaxial transmission line.

35 3. The sterilisation device of claim 1, wherein the fluid conduit includes a duct that runs parallel to the coaxial transmission line.

40 4. The sterilisation device of any preceding claim further comprising a water conduit arranged to deliver water to the plasma generating region.

5. The sterilisation device of claim 4, wherein the water conduit includes a longitudinal passageway formed within the inner conductor of the coaxial transmission line.

5 6. The sterilisation device of claim 4 or 5, wherein the water conduit includes a longitudinal passageway formed within the first electrode.

10 7. The sterilisation device of any one of claims 4 to 6 further comprising a spray unit at a distal end of the water conduit.

15 8. The sterilisation device of claim 7, wherein the spray unit comprises an aerosoliser configured to produce a cone-shaped spray of water mist.

20 9. The sterilisation device of any one of claims 4 to 8, wherein the water conduit has a proximal inlet, and wherein the water conduit defines a longitudinal flow path through the device that is aligned with a feed direction in which water is receivable through the proximal inlet.

25 10. The sterilisation device of any preceding claim, wherein the first electrode is a rod that protrudes in the longitudinal direction from a distal end of the inner conductor, the rod having a smaller diameter than the inner conductor.

30 11. The sterilisation device of any preceding claim, wherein the plasma generating region is located in a proximal region of the outlet aperture.

35 12. The sterilisation device of claim 11, wherein the second electrode comprises a plurality of radial tabs extending inwards from a side wall of the outlet aperture.

40 13. The sterilisation device of any preceding claim further comprising an insulating tube mounted in the outlet aperture distally from the plasma generating region.

14. The sterilisation device of any preceding claim further comprising a transverse coaxial feed connected to introduce the RF and/or microwave energy to the coaxial transmission line in a proximal region thereof.

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15. The sterilisation device of claim 14, wherein the transverse coaxial feed is configured to couple microwave energy into the coaxial transmission line, and wherein the transverse coaxial feed is connected to a point on the coaxial transmission line located at a distance $\frac{(2n-1)\lambda}{4}$ from a proximal end thereof, where n is a positive integer, and λ is a wavelength of the microwave energy conveyed by the coaxial transmission line.

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16. The sterilisation device of claim 14 or 15 further comprising a proximal transverse coaxial feed connected to introduce the RF energy directly to the plasma generating region.

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17. The sterilisation device of any preceding claim further comprises a choke mounted at a proximal end of the coaxial transmission line.

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18. The sterilisation device of any preceding claim configured as a handheld unit.

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19. A sterilisation apparatus comprising:
the sterilisation device of any preceding claim;
a water supply connected to supply water to the plasma generating region;
a gas supply connected to supply gas to the plasma generating region via the fluid conduit; and
a generator connected to supply radiofrequency (RF) and/or microwave frequency electromagnetic energy to the plasma generating region.

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20. The sterilisation apparatus of claim 19, wherein the water supply comprises a pump.

21. The sterilisation apparatus of claim 19, wherein the water supply comprises a mist generator.

5 22. The sterilisation apparatus of claim 21, wherein the mist generator comprises either:
an ultrasonic transducer, or
a heating element.

10 23. The sterilisation apparatus of claim 21 or 22, wherein the gas supply is connected to supply gas to the handheld sterilisation device via the mist generator.

15 24. A sterilisation apparatus according to any one of claims 19 to 23, wherein the gas supply is a supply of argon gas.

25. A sterilisation apparatus according to any one of claims 19 to 24, wherein the generator is powered by a battery.