DISINFECTANT DRINKING BOWL

SUMMARY OF THE INVENTION

Disclosed is a germicidal UV radiation device for disinfecting pathogens in drinking water without electricity using a hand-held bowl provided with a nanoscale silver coating that produces UV radiation powered only by body heat from the palm of the hand. The source of UV radiation embodies a bowl with a 100 nm silver coating at the water interface that converts body heat produces UVC radiation having a wavelength of about 254 nm that disinfects the water in the bowl of pathogens.

FIELD OF THE INVENTION

This invention relates to a water disinfection of water in a drinking bowl held in the palm of the hand disinfecting pathogens with UVC radiation source powered only by body heat.

BACKGROUND OF THE INVENTION

Contaminated drinking water is Universal. WHO/UNICEF estimates (WHO/UNICEF, 2012) almost 1 billion people do not have access to safe drinking water. Even if bottled water is available, the consumer never knows if it is indeed safe. The most direct water disinfection is by boiling, but except for water boiling units in restaurants is not available to the individual consumer at the point of use.

Unequivocally, water purification by filtration at the point of use is desirable. Water purifiers require pumping through ceramic or resin filters coated with silver NPs. NP stands for nanoparticle. Silver NPs are known to provide antimicrobial action by damaging the DNA of bacteria, but NPs that come off the filter and enter the body also damage human DNA that if not repaired, leads to cancer.

In contrast, UVC disinfection of drinking water outside the body avoids the danger of cancer posed by NPs in filters. Currently, LEDs in the UVC are thought (Ferrero 2014) to provide the individual with point of use disinfection of drinking water, but still require a source of electrical power. LEDs stand for light emitting diodes.

UVC radiation can deactivate pathogens such as anthrax, smallpox, viral hemorrhagic fevers, pneumonic plague, tularemia and drug resistant tuberculosis. Table I gives the dose of UVC radiation required to deactivate various pathogens (Eccleston et al., 1998). The dose is based on the average flux used in the experiment not the actual absorbed energy.

However, filters and LEDs require sources of electricity that are not always available, especially in the developing world. Therefore, it is desirable to invent a device that produces UVC radiation to disinfect drinking water without an external source of electricity. In the instant invention, a photograph of the hand-held drinking bowl is shown in Figure 1.

The theory of the drinking bowl is based on QED induced UV radiation. QED stands for quantum electrodynamics, but is a simple form of the complex relativistic light-matter interaction advanced by Feynman and others. QED disinfection is a consequence of QM that precludes the atoms in nano-coatings to have the heat capacity to conserve body heat by an increase in temperature. QM stands for quantum mechanics. Instead, the heat is induced by QED to produce UV radiation.

Classically, the atoms in coatings always have the heat capacity to increase in temperature upon the absorption of heat irrespective of their thickness. QM by the Planck law differs (Planck, 1900) in that the heat capacity of the atom vanishes in nanocoatings, and therefore heat cannot be conserved by an increase in temperature. Figure 2 shows the Planck law at 300 K. The thermal kT energy (or the heat capacity) of the atom depends on the wavelength λ of EM confinement. For nanocoating having EM confinement wavelengths λ < 100 nm, the heat capacity of the atom vanishes. However, for heat capacity to vanish, the nanocoating atoms must somehow be placed under nanoscale EM confinement. But nanocoatings have high S/V ratios that confine body heat almost entirely to their surfaces, the surface heat thereby providing the necessary EM confinement of nanocoating atoms over nanoscale wavelengths. S/V stands for surface-to-volume. QED then conserves the surface heat by creating EM radiation standing between nanocoating surfaces.

QED here differs from the complex relativistic QED by Feynman and others. Briefly stated: QED conserves heat supplied to a nanocoating absent heat capacity by creating EM radiation having half-wavelength $\lambda/2 = d$, where d is the nanocoating thickness. The Planck energy E of the standing EM radiation is:

$$E = h\left(\frac{c}{n}\right)/\lambda = \frac{hc}{2nd}$$

where, the velocity of light c is corrected for the slower speed in the solid state by the refractive index n of the nanocoating.

The wavelength of QED radiation emission from the conservation of heat in nanoscale coatings having refractive index n = 2 and 4 is shown in Figure 3. Most indices vary from, 1.5 to 3. For a silver the nanocoating having = 1.35, the QED emission from 100 nm coating thicknesses produces EM radiation at 270 nm close to UVC to at 254 nm. The UVC may be transmitted over distances comparable to the size of the drinking bowl without any absorption.

The effectiveness of drinking bowl in disinfecting water depends on amount of body heat available in the palm of the hand. Total human body heat is about 100 W. Since the average surface area for adult men and women is about 1.75 m^2, the heat flow Q = 5.71 mW / cm^2 = 5710 μW/ cm^2. From Table I, the dose D to destroy most water pathogens is 16,000 to 38,000 μJ / cm^2 may be provided by keeping the water in the drinking bowl from 3 to 6 seconds.

SUMMARY OF THE INVENTION

In accordance with the present invention, a device for disinfecting water in a hand-held drinking bowl in the palm of the hand powered by body heat is disclosed, the device including a UVC radiation source comprising a nanocoating having a thickness d and refractive index n to produce radiation having a wavelength $\lambda = 2nd \cong$ 254 nm. The radiation source is powered by body heat of about 5710 $\mu W/cm^2$ of UVC radiation capable of disinfecting water of most pathogens in 3-6 seconds.

These and other aspects, features and advantages will be apparent from the following description of certain embodiments and the accompanying drawing figures.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention will be more readily apparent from the following description and drawings of the illustrative embodiments of the invention:

Drawing 1 illustrates a plan and elevation view of the drinking bowl in accordance with the present invention.

DETAILED DESCRIPTION OF CERTAIN PREFERRED EMBODIMENTS

The present invention comprises a device that can provide the rapid and effective disinfection of drinking water, in remote locations at points of use where a source of electricity is not available. The device contains a passive UVC radiation source having a wavelength of about 254 nm powered only by the body heat of the hand thereby disinfecting pathogens in the water of the drinking bowl.

With reference to Drawing 1, the drinking bowl device **100** is illustrated in accordance with one embodiment of the present invention. The UVC radiation source includes a thin-walled plastic bowl **110** held upright in the palm of the hand containing pathogens **120** in water **130** to be disinfected. The bowl **110** is provided with a 100 nm nano-coating **140** of silver and powered by body heat **150** from the palm of the hand.

While the invention is disclosed for a silver nano-coating **140**, it would be appreciated by one of skill in the art that other conductive metals such as aluminum and copper may be employed provided the thickness *d* and refractive index *n* are selected to achieve UVC radiation at 254 nm.

REFERENCES

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FIGURES

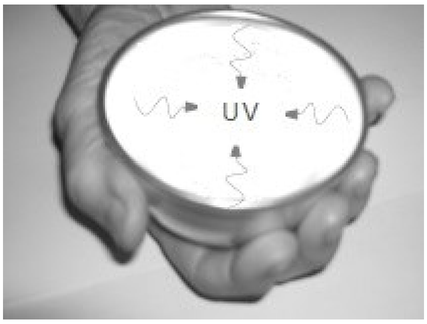


Figure 1. QED induced UV radiation from body heat disinfecting drinking water

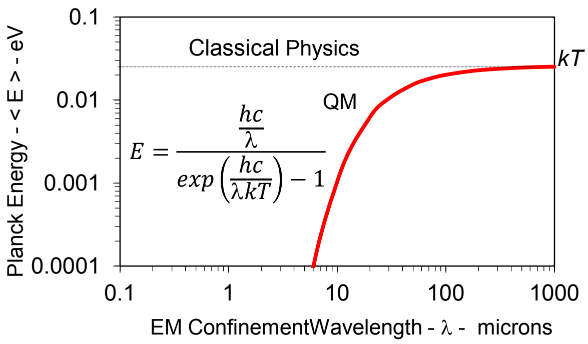


Figure 2. Heat Capacity of the Atom at 300 K

In the inset, *E* = Planck energy, *h* = Planck's constant,
c = speed of light, *k* = Boltzmann's constant, *T* - temperature, and λ = wavelength

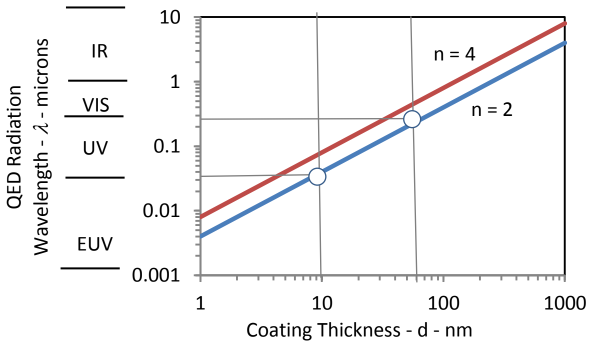
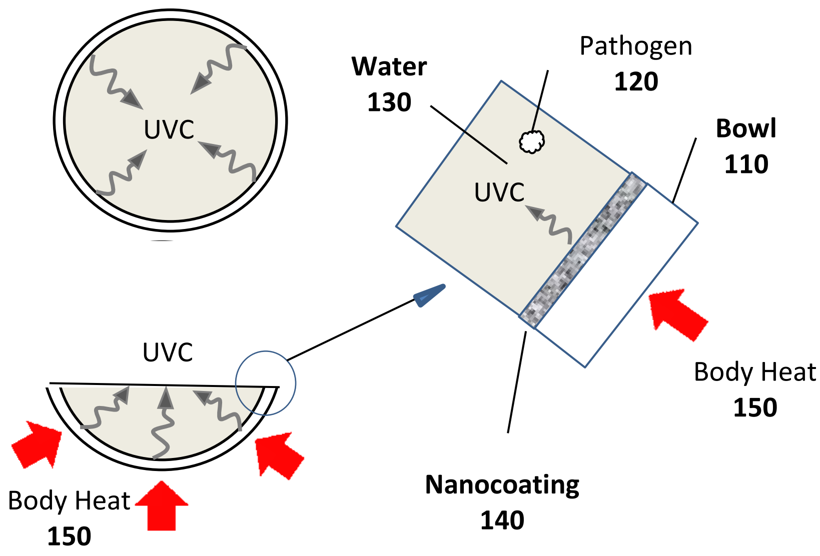


Figure 3. Wavelength of QED Emission v. Coating Thickness

DRAWINGS



Drawing 1. Device Plan and Elevation View

Ultraviolet Dosage Required
For 99.9% Destruction of Various Organisms
(µW-s/cm^2 at 254 nanometer)

Bacteria

Bacillus anthracis	8,700
B. enteritidis	7,600
B. Megatherium sp. (vegatative)	2,500
B. Megatherium sp. (spores)	52,000
B. paratyphosus	6,100
B. subtilis (vegatative)	11,000
B. subtilis (spores)	58,000
Clostridium tetani	22,000
Corynebacterium diphtheria	6,500
Eberthella typhosa	4,100
Escherichia coli	7,000
Leptospira interrogans	6,000
Micrococcus candidus	12,300
Micrococcus sphaeroides	15,400
Mycobacterium tuberculosis	10,000
Neisseria catarrhalis	8,500
Phytomonas tumefaciens	8,500
Proteus vulgaris	6,600
Pseudomonas aeruginosa	10,500
Pseudomonas fluorescens	6,600
Salmonella enteritidis	7,600
Salmonella paratyphi	6,100
Salmonella typhimurium	15,200
Salmonella typhosa (Typhoid)	6,000
Sarcina lutea	26,400
Serratia marcescens	6,200
Shigella dysenteriae (Dysentery)	4,200
Shigella paradysenteriae	3,400
Spirillum rubrum	6,160
Staphylococcus albus	5,720
Staphylococcus aureus	6,600
Streptococcus hemolyticus	5,500
Streptococcus lactis	8,800
Streptococcus viridans	3,800
Vibrio cholerae	6,500

Mold Spores

Aspergillus flavus	99,000
Aspergillus glaucus	88,000
Aspergillus niger	330,000
Mucor racemosus A	35,200
Mucor racemosus B	35,200
Oospora lactis	11,000
Penicillium digitatum	88,000
Penicillium expansum	22,000
Penicillium roquefortii	26,400
Rhizopus nigricans	220,000

Algae / Protozoa

Chlorella vulgaris (algae)	22,000
Nematode eggs	92,000
Paramecium	200,000

Virus

Bacteriophage (*E. coli*)	6,600
Hepatitis virus	8,000
Influenza virus	6,600
Polio virus	6,000
Rotavirus	24,000
Tobacco mosaic	440,000

Yeast

Baker's yeast	8,800
Brewer's yeast	6,600
Common yeast cake	13,200
Saccharomyces cerevisiae	13,200
Saccharomyces ellipsoideus	13,200
Saccharomyces sp.	17,600

Table I UVC Dosage for 99.9% Destruction of Various Pathogens