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UV-C Wavelength Side-Emitting Optical Fibers Enabled by Surface Texturing

-Background Although chlorine remains one of the most widely used water disinfectants throughout the world, the toxicity of the chemical itself and of its by-products poses significant health risks. Non-chemical disinfectants such as ultraviolet (UV) irradiation has been an attractive alternative and is gaining acceptance in both large-scale and small-scale systems. Specifically, UV light in the germicidal wavelength range of 250 nm to 280 nm (in the UV-C band) is effective in destroying microbial DNA structure, preventing reproduction of pathogens (e.g., Giardia, Legionella) and bacteria or biofilm growth in water, air, or surfaces. Light Emitting Diodes (LEDs) can provide UV-C light to disinfect water. Unfortunately, LEDs have very small area to emit light, thus necessitating numerous LED units to cover a treatment reactor. Furthermore, LEDs require wiring and cannot be put into all reactor shapes or geometries. Invention Description Researchers at Arizona State University have developed a new method for effective delivery of LED UV-C light for fluid disinfection. This is accomplished by distributing light through flexible optical fibers that provide the bendability to reach less accessible areas while emitting light radially along the length of the fiber. These flexible glass optical fibers, about 0.5 mm in diameter, are chemically and/or mechanically "textured" to induce light scattering, and then coated with a layer of UV-C-transparent polymer. Potential Applications • Fluid disinfection in pipes, reaction vessels, and storage tanks • Water or air treatment • Biofilm mitigation • Integration with off-grid solar systems Benefits and Advantages • Practical – Flexible optical fibers can deliver light to previously unreachable areas • Adaptable – Light-scattering parameters can be tuned for desired wavelengths • Versatile – Chemical-free, compact, and energy-efficient design suits both small-scale and large-scale applications • Cost Effective – More efficient use of LED light means lower power consumption Laboratory Homepage of Professor Paul Westerhoff