Validation and Characterization of the TiO₂ NP-Enhanced Solar Disinfecting Capabilities of Puralytics' SolarBag[™] Technologies

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The SolarBag[™] Technology



Photocatalysis by TiO₂ NPs



<u>Photolysis</u>



Heat Inactivation



Goal for SolarBag Improvement

Double Reaction Rates



Goal for SolarBag Improvement

Achieve WHO Highly Protective Status

Table 2. WHO and EPA Purifier targets to protect human health.

Rating	Required Bacteria LRV	Required Virus LRV	Required Protozoa LRV
WHO Highly Protective	≥ 4	≥ 5	≥ 4
EPA Purifier Guidelines	≥ 6	≥ 4	≥ 3
WHO Protective	≥ 2	≥ 3	≥ 2

Goal for SolarBag Improvement

Outperform the SODIS Process





Use clean PET bottles

Fill bottles with water, and close the cap



Expose bottles to direct sunlight for at least 6 hours (or for two days under very cloudy conditions)



Drink SODIS water directly from the bottles, or from clean cups





High UV Intensity 5.6 mW UVA/cm²

Low UV Intensity 3 mW UVA/cm²





Low Temp with High UV Intensity 5.6 mW UVA/cm²



WHO Test Media

Rating	WHO General Test Water	WHO Challenge Test Water	Adjustment Materials (CAS#) and supplier
рН	7-8	7-8	Inorganic acid or base: hydrochloric acid (7647-01-0) or sodium hydroxide (1310-73-2)
Total Organic Carbon (TOC) mg/L	0.1 – 2	10-20	Humic acid (6813-04-4) Alfa Aesar
Turbidity NTU	<1	30-50	ISO spec. 12103-A2 fine test dust
Temperature deg C	20C	10C	
Total Dissolved Solids (TDS)	50-500	1350-1650	Sea salt (7732-18-5) Sigma Aldrich
Alkalinity (mg/L)	60-100	80-120	Sodium bicarbonate (144-55-8)
Bacteria (count/100 mL)	≥ 10 ⁵	≥ 10 ⁵	<i>E. coli</i> (ATCC 11229) (WHO)
Virus (count/L)	≥ 10 ⁸	≥ 10 ⁸	MS-2 coliphage (ATCC 15597-B1), <i>E. coli</i> host (ATCC 13706) (WHO)
Protozoa (count/L)	≥ 5x10 ⁵	≥ 5x10 ⁵	Cryptosporidium parvum (WHO)

WHO Test Media



Test Methods



<u>Bacteriophages</u> MS-2 Phi X174



E. coli



The SolarBag Plastic Blocks 1 mW UVA/cm² 20-33% of the potential UVA

The SolarBag Insert Blocks All UVA 100% of the potential UVA



Temperature Profiles



Temperature Profiles



Temperature Profiles



SolarBag



SolarBag+





































<u>Phi X174 Bacteriophage Removal</u>















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