

Banknote Disinfection System (BDS-1000)

Product Specification

Spectra Systems' patent pending technology utilizes a combination of a heat and oxygen-free environment to neutralize ($> \text{Log}_{10} = -6$ reduction of viral load) SARS-CoV-2, and other viral and bacterial pathogens, while protecting the banknote's substrate, inks, and security features. The system is effective with both paper and polymer substrates.

The complete system has the capacity to disinfect between 4 million and 6 million notes in 1 - 2 hours with no consumables. Banknotes can remain in strapped or shrink wrapped form for efficient workflow.



Oxygen-free nitrogen supply



N₂ Generation System



Banknote Heating Oven

Strapped



Shrink wrapped



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The BDS-1000 is comprised of two primary subsystems:

- 1] a custom designed large scale oven unit with oxygen sensors and timing controls.
- 2] a pressure swing adsorption (PSA) nitrogen gas generator. The PSA extracts oxygen from the ambient air and produces a nitrogen atmosphere within the disinfection oven.

System Specifications

Nitrogen Gas Generation Sub-System	Supplies 98% N₂ from the ambient air to oven
Nitrogen Flow Rate (scfh)	1,500
Nitrogen Purity	98%
Delivery Pressure (psig)	90
Air Compressor	15 kW (20 HP)

Disinfection Oven Sub-System	Walk-in Cart Oven
Heated dimensions	4'-6" W x 10'-0" D x 6'-0" H. (interior)
Material handling	Manual Cart
Charge weight per chamber	Up to 10,000 lbs total
Thermal cycle	250 C (482°F) +/- 15 F
Max. oven temp.	525° F
Total heat input	Electric: 157 KW (4 hours ambient to temp- short cycle)
Total oven recirculated air	9,500 cfm, 10 HP, 3" SP w/VFD
Inert atmosphere process	Purge valve, and O ₂ sensor with alarms
Electrical	480 volts, 3 phase, 60 hertz 120 volt, 1 phase, 60 hz control

Work Space Requirements

24' x 11' – allows for easy workflow of incoming and movement of processed banknotes

11' ceiling height



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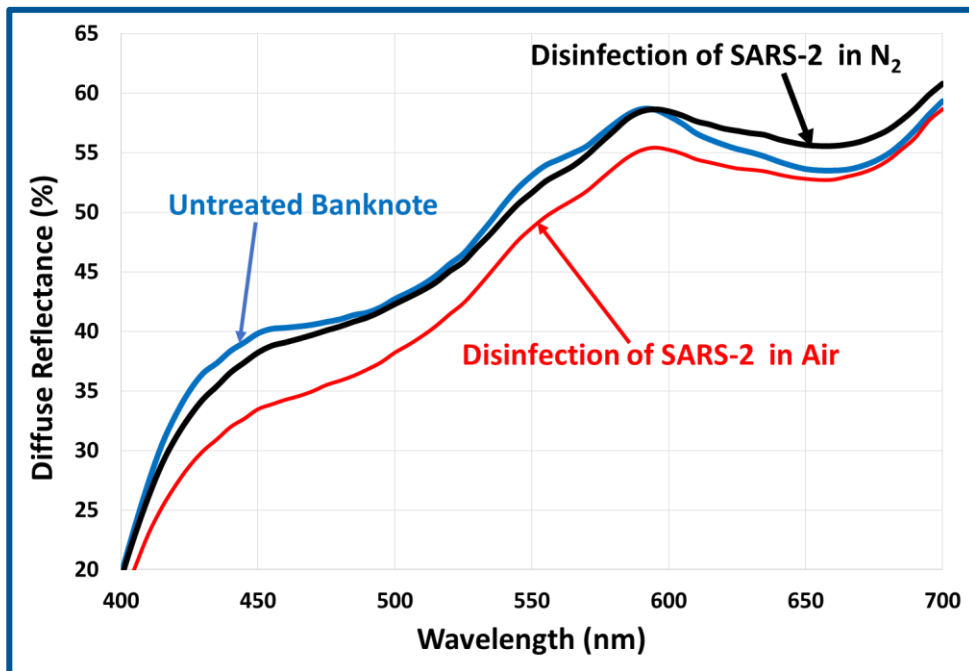
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The use of an oxygen-free atmosphere enables temperatures necessary for disinfection while preventing thermal damage to banknotes and their security features due to thermal oxidation.

Physical integrity of the treated banknotes remains intact including substrate, ink, and security features. Diffuse reflectance measurements at the note edges as well as watermarked and other critical regions of the note show that the substrate is not compromised for subsequent machine-readable fitness characterization.



Extreme Temperature Disinfection of SARS-2 in Air and Nitrogen Atmospheres



Diffuse reflectance comparison of untreated note vs. that of notes treated in air and N₂



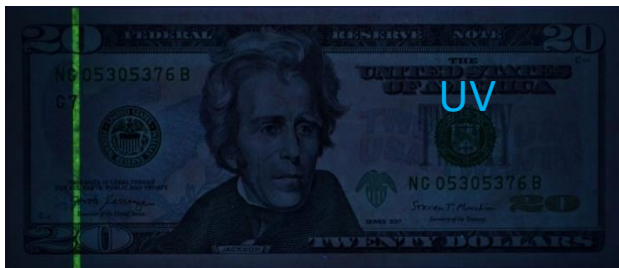
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When compared against untreated banknotes, the fluorescent, foil, security thread and print features of the banknotes remain intact after treatment in the BDS-1000 resulting in a $> \text{Log}_{10} = -6$ reduction of viral load as quantified by PCR methods.

Examples of Banknotes Post-Disinfection in N_2 Atmosphere



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