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An UV-Blocking Antioxidant Product to Protect Ocular Tissues from UV Damage and Modulate Healing

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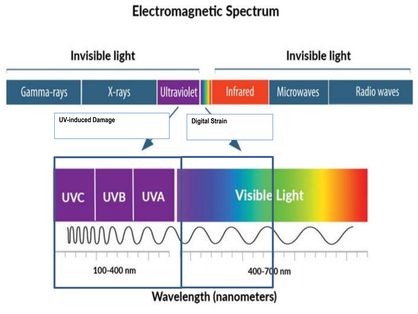
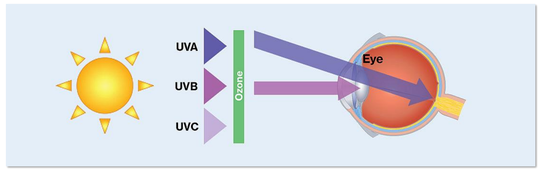
The Problem : UV Light is Absorbed by Ocular Tissues and is Correlated with a Multitude of Ocular Disorders

UV exposure leads to ocular disorders, such as corneal pterygia, cataracts, keratoconus, glaucoma, CNV and AMD. **UVR is categorized as: UVA (315-400 nm), UVB (280-315 nm) and UVC (100-280 nm).** >90% of UVB, 60% of UVA are absorbed by the cornea, whereas the retina absorbed UV light (UVA) and blue light in the range 300-800 nm.





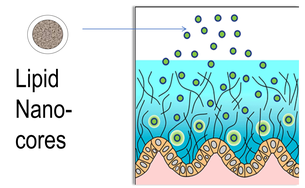
UVA and UVB cause damage to cellular DNA due to the production of reactive oxygen species (ROS), triggering tissue-damaging inflammatory cytokines.

We present data on OcuHeal-UV400+, a lipid nanoparticulate (LNP) eye-drop containing IB0108, a GRAS antioxidant, with decades of history of safe use as an oral supplement. IB0108 is biocompatible and blocks portions of UVA and UVB. *Encapsulated into LNP, the entire UV light wavelength range from 200-600 nm is blocked, thus enhancing the UV-blocking characteristics of IB0108*. It's anti-oxidant and anti-inflammatory properties renders a healing / protective effect to ocular tissues. The data demonstrate UV-blocking properties of the product, distribution of IB0108 throughout the eye and preclinical safety and tolerability.

Materials and Methods (Characterization and *In-Vivo*)

OcuHeal-UV400+ was prepared as a nano-dispersion using a proprietary process; IB0108 Analysis: was measured by a HPLC method, using a Shimadzu Prominence HPLC; Particle Size Distribution (PSD): Particle sizing was carried out using a laser diffraction method (Horiba 950V2). UV-light blocking studies were conducted using a Shimadzu UV-Vis Spectrometer. IB0108 incubation studies with HCEC in the presence of UV light (254 nm, UVB) was performed at the U Waterloo. Bioanalysis Analysis: Analysis was performed by LC/MS/MS, Thermo Scientific TSQ Quantum Ultra Mass Spectrometer with HESI-I electrospray probe, paired with Shimadzu Nexera-i LC-2040C 3D Plus and using a C-18 column. Ocular tissues (tears, sclera, conjunctiva, eyelids, conjunctiva, AH, VH, retina, lens, choroid/RPE, optic nerve, cornea); Blood was analyzed for systemic extraction. Safety and Tolerability: in NZW rabbits (PARF, MA) of the prototypes were measured by assessment of ocular tissue at predetermined timepoints.. Tolerability of the wafers were assessed by a SPOTS scoring system (Eaton et. al. 2017) at timepoints 1h, 2h, 4h and 6h. Tissues were analyzed, using a validated bioanalytical method at each timepoint. Each animal underwent gross examination of the eye observing structures such as the cornea, conjunctiva, lids, etc., for obvious signs of issue. Scores were given using the SPOTS scoring system. Both eyes were examined at baseline and just prior to euthanasia. Endpoints included conjunctival hyperemia, iridial hyperemia, cornea (haze or neovascularization), aqueous, chemosis, lid swelling, discharge, squinting, and pupillary light reflex (PLR). [Eaton, et. al. 2017. The SPOTS System: An Ocular Scoring System Optimized for Use in Modern Preclinical Drug Development and Toxicology, J Ocul . Pharmacol. Ther. 33(10):718-734.].

OcuHeal™: Sustained Release Lipid Nano-Depots



- Lipid Nanoparticles
- Enhanced Bioavailability
- Nano-core size (<200 nm) penetrates the ocular mucosal meshwork pores (500 nm)
- Patents All Granted in 14 global jurisdictions

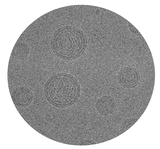
A GRAS Anti-inflammatory Antioxidant Eye-Drop Target Product Profile of OcuHeal-UV400+

IB0108

- FDA GRAS compound for daily oral consumption as a supplement
- Decades of safe use in humans and animals
- ROS quencher/anti-oxidant
- UV-protective
- Anti-oxidant, anti-inflammatory, immunoprotective, anti-aging

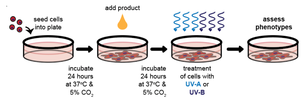
IB0108-in-lipid nanoparticles

Aqueous Continuous phase

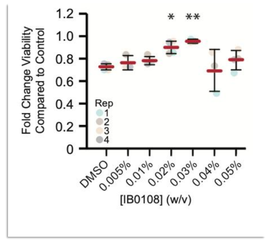


Cryo-Transmission Electron Microscopy of OcuHeal™ Dispersion

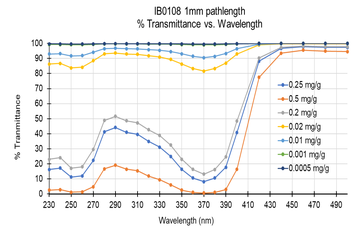
IB0108 Protects Human Corneal Epithelial Cells from UV-Damage



- IB0108-in-DMSO was used for initial study
- Acknowledgement: Study was performed at University at Waterloo, using a previously published protocol (

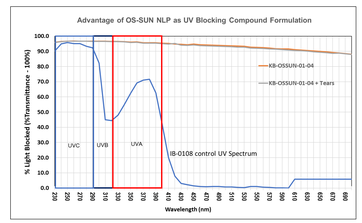


IB0108 Blocks UV-R in a Dose Responsive Fashion: Lower % Transmittance is Higher "UV-Blocking"

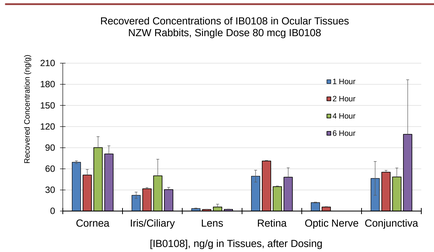


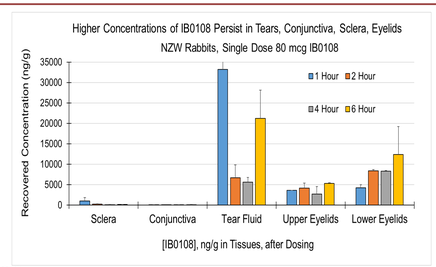
- Assuming a 40 microliter eye-drop of 1 mg/mL IB0108 and a 10 microliter tear volume, the concentration of IB0108 on the eye will be 0.8 mg/mL.

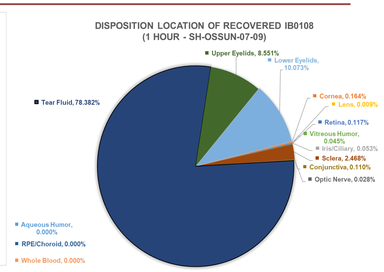
Novel IP: Encapsulation of IB-0108 in OcuHeal LNP Blocks Entire UVA, UVB, UVC Wavelengths



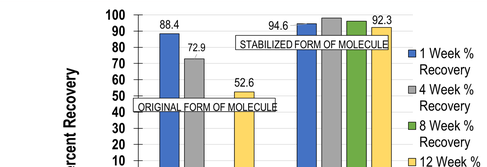
PK of IB0108-in-OcuHeal Eyedrops Demonstrate Enhanced Residence Time on the Ocular Surface







Novel IP: Stabilized Form of IB0108 Enables Short-Term Storage at 25°C/60%±5°C



Formulation ID	EC-OSSUN-04-62a	EC-OSSUN-06-27
1 Week % Recovery	88.4	94.6
4 Week % Recovery	72.9	98.1
8 Week % Recovery		96.1
12 Week % Recovery	52.6	92.3

OcuHeal-UV400+ is Tolerated In-Vivo

OcuHeal-UV400+ lipid nanoparticles were assessed for signs of non-biocompatibility on the ocular surface at all timepoints, including IOP testing, redness, eyelid swelling, discharge, hyperemia, corneal opacity, etc. using SPOTS scoring system. All scores were 0, at all timepoints.

Conclusions

OcuHeal-UV400+ is a well-tolerated UV-blocking anti-oxidant, with ocular surface residence time of 6 hours.

Contact PI

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