# ABSTRACT

**PRESENTER:** Dr. Camille Martin

**COMPANY:** Seaspire Skincare

**JOB TITLE:** Chief Executive Officer

**Podium Title:** *A bioinspired, photostable UV-filter that protects mammalian cells against UV-induced cellular damage*

**Background information (Short introduction)**

Exposure to sunlight can present both beneficial and harmful effects on the human body, some of which can be readily perceived (e.g. sunburn) and others that are nonobvious (e.g. cellular DNA damage). Current methods of protection from sunlight involves the daily use of sunscreen. Commercially available sun care products are made up of light-scattering particles, UV-absorbing small molecules, or a combination of both that have been attributed to cytotoxic properties in humans and the environment.

**Objective**

While commercially available sun care products are effective at absorbing ultraviolet (UV)-light, recent studies indicate systemic toxicities associated with many traditional chemical and physical UV-filters, prompting a revaluation of their safety for humans. In this report, we demonstrate the application of Xanthochrome (Xa), a class of biochromes present in arthropods and cephalopods, as alternative broad-spectrum solar radiation filters with a tunable sun protection factor (SPF) range.

**Methodology**

In this study we explored the photoprotective properties and the cytocompatibility of Xa-based materials in vitro. The cytocompatibility of Xa was evaluated with a murine fibroblast cell line using cell viability assays and confocal microscopy. The photoprotective activity of Xa was measured by constructing Xa-films to protect fibroblast cells from solar simulated sunlight. Polydimethylsiloxane substrates with and without Xa were placed on top of each well prior to irradiation with 4.5 kJ/m2 UV-B, measured using a UVA/B radiometer, which is equivalent to approximately 11 minimal erythemal doses for skin type III according to the Fitzpatrick skin type classification scale. Upon irradiation, we measured the concentration of pyrimidine (6-4) pyrimidone photoproducts, a biomarker of UV-induced DNA damage by ELISA. The radical scavenging capacity of Xa was measuring using the DPPH assay.

**Results**

To test Xa's cytocompatibility, cells were exposed to the concentrations used to define the SPF range (0.03-1.00 mM) for a 24-hour incubation period where the cell viability was found to be 94% ± 6% and 96 ± 5%, quantified by fixable dead and AlamarBlue assays respectively. As expected, Xa-based coatings substantially reduced UV-induced cell damage as shown by the

46 ± 20% reduction of 6-4PPs when compared to unprotected cells. In the DPPH assay, the half maximal effective concentration of Xa was found to be 1.00 mM in comparison, ascorbic acid's EC50 was found to be 0.13 mM.

**Conclusion**

In this study, we found that synthesized Xanthochrome (Xa) is a photostable and a potent broad-spectrum UV-absorbing compound. When tested in vitro with fibroblasts, Xa is demonstrated to be safe and cytocompatible. Although, the antioxidant capacity of Xa is not as strong as ascorbic acid, it is higher than commercially available UV-filters, avobenzone and oxybenzone. This added antioxidant activity supports the use of Xa to prevent oxidative skin damage. Still, additional work is required to investigate safety and efficacy of Xanthochrome in a formulation. For now, our findings support the application of Xanthochrome in the design of next generation sun care and skincare products.

**Why is this important to the industry?**

Commercial sunscreens contain ingredients that are toxic to humans and negatively impact global marine ecosystems. Due to the regulatory induced global market shift there is an urgent need for safer and more effective sunscreens. In this study we describe the characterization of a novel bio-inspired broad-spectrum sunlight filter, Xanthochrome, that can not only protect against skin damage caused by sunlight but can also be used in preventative skin care.

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Camille Martin, Co-Founder and CEO of Seaspire Skincare, is a multi-faceted entrepreneur with experience transferring technology developed at the academic research scale through the pipeline towards commercialization. Martin completed her PhD in Biomaterials Chemistry at Northeastern University where she studied adaptive color in nature as a source of inspiration for designing novel skincare active ingredients. Her research journey began as an enthusiastic college freshman fascinated with cosmetic chemistry and fueled by her desire to blend the worlds of beauty and science. Throughout graduate school, she participated in the National Science Foundation Innovation Corps program which resulted in the formation of Seaspire Skincare! Since then, Martin has been engaged with the entrepreneurial ecosystem throughout the Greater Boston Area and is committed to the implementation of innovative technologies across various industries.