

Thesis Project Portfolio

Production Plant of Nanoparticle Mineral Oxide Sunscreen

(Technical Report)

The Social Construction of Reef-Safe Sunscreen Adoption in Hawai'i

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Elaina Lee

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Department of Chemical Engineering

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Sociotechnical Synthesis

My technical report and STS research paper both discuss the topic of mineral sunscreens. While my technical report outlines how to produce mineral sunscreen, my STS research paper analyzes how social perceptions of reef-safe and mineral sunscreens can change manufacturers that produce sunscreen.

The technical report details a plant to produce a broad-spectrum, mineral sunscreen using the active ingredient of zinc oxide and titanium dioxide nanoparticles. One challenge with mineral sunscreens is that they leave a white cast on the skin, which can be unappealing to consumers. In trying to eliminate this white cast and still use mineral oxides as our active ingredients, we designed the plant to produce zinc oxide and titanium dioxide on a nanoscale. The project encompasses the synthesis of zinc oxide nanoparticles, and titanium dioxide nanoparticles, the mixing and blending of our final sunscreen product, the management of reaction byproducts, and the economic feasibility of this plant. Our final products are a mineral sunscreen that is safe for sensitive skin and reef-safe and isopropyl alcohol which is a byproduct of our titanium dioxide synthesis. Our economic analysis concluded that a plant matching our design is feasible and should continue in the design process.

The STS research paper looks at Hawaii's Act 104, which bans specific ingredients in sunscreen to be sold in Hawaii. It explores how sunscreen manufacturers adjusted their formulations not only in response to legislation but also due to pressures from various social groups such as environmental advocacy organizations and hospitality businesses. The framework of the social construction of technology (SCOT) was used to analyze these relationships between manufacturers, consumers, environmentalists, and tourism businesses. These entities possess the power to change markets and product ingredients.