Investigating the synergy in the battle against UV between sea and plant-based extracts for bio-inspired cosmetics applications

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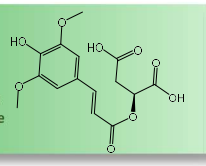
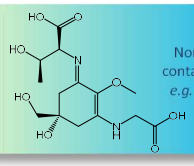
Introduction

- **Active ingredients inspired by nature** are increasingly being incorporated into cosmetics and beauty products.
- Molecules from nature, such **as Mycosporine-like Amino Acids (MAAs) from aquatic environments** and **Sinapoyl Malate (SM) from the plant kingdom**, have **individually** been shown to have **beneficial cosmetic properties**, including anti-ageing, antioxidant and UV absorption. (1-5)
- However, it is **unknown** whether combining ingredients from different natural sources can work together to **enhance their favourable qualities** with a **synergistic effect.**
- Identifying synergies **would increase the power of an ingredient**. This would benefit **both formulators and customers** alike. (6)

Land
Garden cress sprout contains **sinapoyl malate (7)**



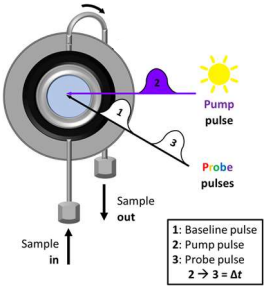
Sea
Nori seaweed contains MAAs, *e.g.* porphyra-334



Materials & Methods

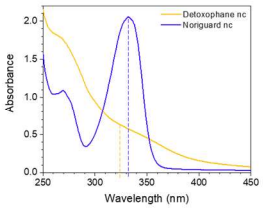
- The specialism of the team at Warwick is in **ultrafast Transient Electronic Absorption Spectroscopy (TEAS**, pictured**).**
- TEAS tracks **energy flow in molecules** following UV **radiation, from the instant that it is absorbed**, up to around 2 nanoseconds (ns, 10^{-9} s). This information can **inform on the long-term photostability**. This has been done **very successfully for UV filters** found in sunscreens. (8)

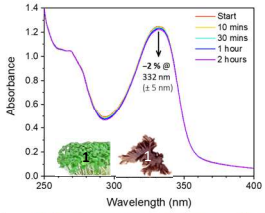
- TEAS uses femtosecond (fs, 10^{-15} s) laser pulses to do this. **A more detailed description of the working principles can be found in our full paper.**
- In addition to TEAS, **UV-visible spectroscopy** was also used **to track photostability** during **solar irradiation**.



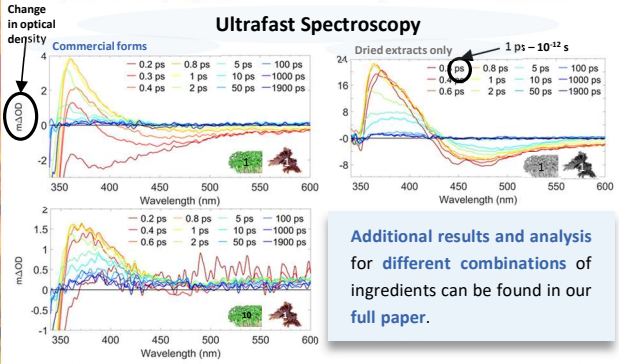
Results & Discussion

- The **UV-visible spectra (left)** shows the **absorption profiles of the commercial forms.** On the right, the two ingredients **are combined and irradiated, with only a 2% decrease in absorption** over two hours. This was **higher photostability than when in isolation** (each decreased by **6%**) - evidence of a **positive synergetic effect…**





- This was also the case for the **dried extracts alone, the photostability improved** when the two ingredients were **combined.**



Additional results and analysis for **different combinations** of ingredients can be found in our **full paper**.

- **Encapsulation** of garden cress sprout extract shows the **same spectral features as sinapoyl malate in a non-polar environment.**
- The dominant spectral features varied, depending on the **proportion of ingredients** in the mixture.

Conclusions

- The combination of ingredients from both the **land and the sea** is **highly innovative and unique.**
- The **irradiation results show very promising evidence** of a synergy between the two aspects of nature, as there was an **excellent improvement in photostability** when the two were combined. **Together**, they could also create a **broad-spectrum UV boosting effect**.
- The **excited-state lifetime** of the extract is **extremely short (a few ps),** therefore it can rapidly re-absorb UV and enhance boosting effect.
- **Future work** will study the extracts in more detail, e.g. *in vitro* SPF
- The scope of this study has been **widened** to investigate whether nature-based ingredients can be used as **a shield to protect traditional UV filters**, which are known to be photolabile.

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