Impact of a commercial sunscreen on the ecophysiology of *Phaeodactylum tricornutum*: an ecotoxicological assessment

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INTRODUCTION

Microalgae play a crucial role in marine ecosystems as the basis of the marine trophic nets. The escalating production and application of sunscreens have raised scientific concerns regarding their potential ecological impact on marine microalgae.

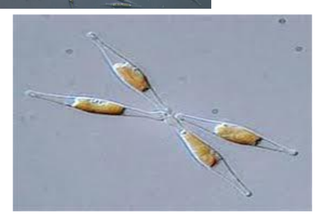
Objective: This study aims to evaluate ecotoxicological responses of marine microalgae *Phaeodactylum tricornutum* at different concentrations of a selected commercial sunscreen.

UVB /UVA

SP50

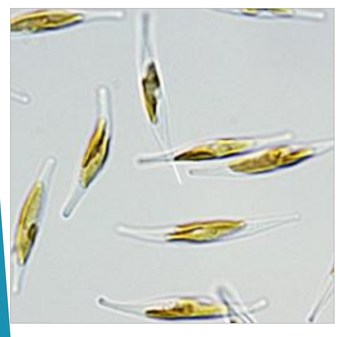
A commercial sunscreen was selected based on its active ingredients:

- **Chemical sunscreen filters: Octocrylene**
- **Physical sunscreen filters: Titanium dioxide, Zinc oxide**



METHODOLOGY

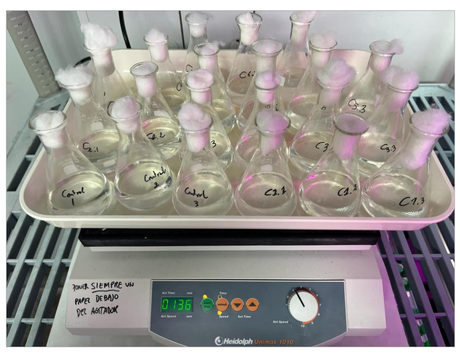
Flow cytometry (FCM): Cell density was analyzed using a BD Accuri C6 flow cytometer (Becton Dickinson), fixed with a 488 nm excitation laser, detectors of forward (FS) and side (SS) light scatter signal and four fluorescence detectors: FL1 (505–550 nm), FL2 (585 nm for phycobilines), FL3 (670 nm for chlorophyll).



Phaeodactylum tricornutum

Commercial sunscreen:SPF50+(UVA/UVB)

Exposure to a range of concentrations: 0,5, 10, 25, 50, 100, 200 mg/L



Salinity / temperature
20°C 36 PSU
t0:10^4 cells mL^{-1}

96H

Endpoints:

- **Growth rate: Area under curve**
- **Chlorophyll fluorescence**
- **Reactive Oxygen Species: ROS**

ROS: quantified using 2′-7′-dichlorofluorescein diacetate (DCFH- DA) following the method Stachowski-Haberkorn et al., 2013.

RESULTS

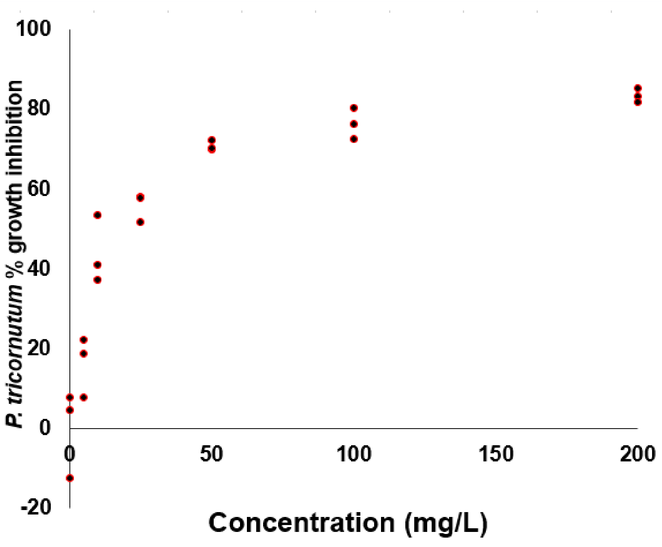


Fig 1: Effect of Sunscreen Exposure on Growth Inhibition of *P. tricornutum*

1.Growth Inhibition: The exposure of *P. tricornutum* to sunscreen led to a decline in growth compared to the control group with an EC50 value of 26.8 ± 4.6 mg/L

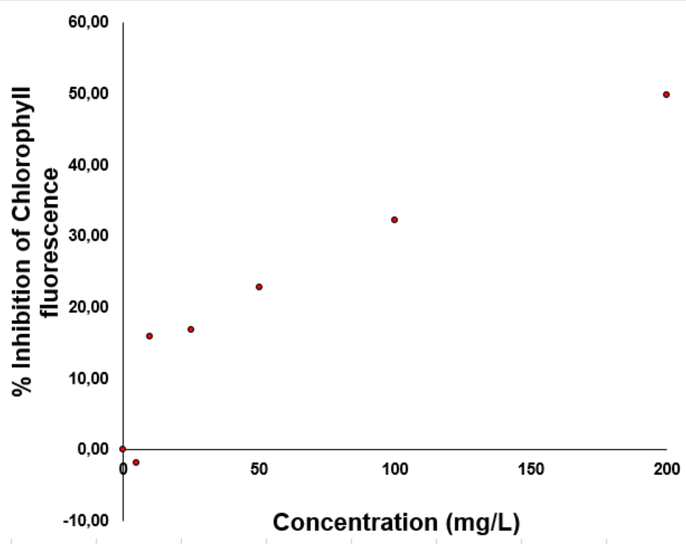


Fig 2: Sunscreen-Induced Changes in Chlorophyll Fluorescence of *P. tricornutum*

2. Inhibition of Chl-fluorescence: Increase of sunscreen concentrations imply an decrease in FL3 signal per cell (related to Chl content). The highest concentration used provoked an inhibition of around 60% of FL3 signal.

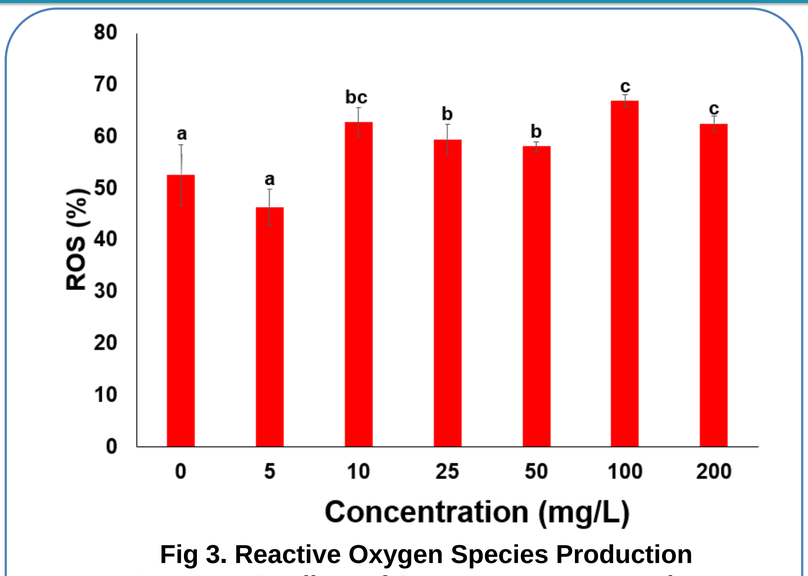


Fig 3. Reactive Oxygen Species Production Across a Gradient of Sunscreen concentrations

3. Reactive Oxygen Species Production
Elevated levels of ROS production observed across a range of sunscreen concentrations indicate oxidative stress, which can disrupt cellular processes and contribute to cellular damage

CONCLUSION

The findings of this study highlight the significant impact of sunscreen on *P. tricornutum*, particularly in terms of growth inhibition, photosynthetic efficiency, and reactive oxygen species (ROS) production. Growth inhibition is the most sensitive endpoint among the measured parameters. Further research is needed to elucidate the mechanisms of toxicity and assess the long-term effects on marine biodiversity.

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