



Effects of cosmetic products on photosynthetic active organisms in freshwater systems

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The negative impact of sun creams on marine ecosystems, especially coral reefs, is currently being discussed. One focus is on the effects on the endo-symbiotic algae in corals. In contrast to marine ecosystems with large amounts of water and a high dilution potential, many freshwater systems, especially lakes, are heavily stressed during the summer months. High concentrations of chemicals were measured, particularly during dry periods.

In freshwaters, higher aquatic plants play an important role in the ecosystem, as they serve as a refuge and breeding ground for many aquatic organisms. For this reason, the influence of sun creams on aquatic plants was investigated. We present data collected according to international guidelines. The focus was on the OECD guideline 239 on aquatic plants in a water-sediment system with the standard species *Myriophyllum spicatum*.

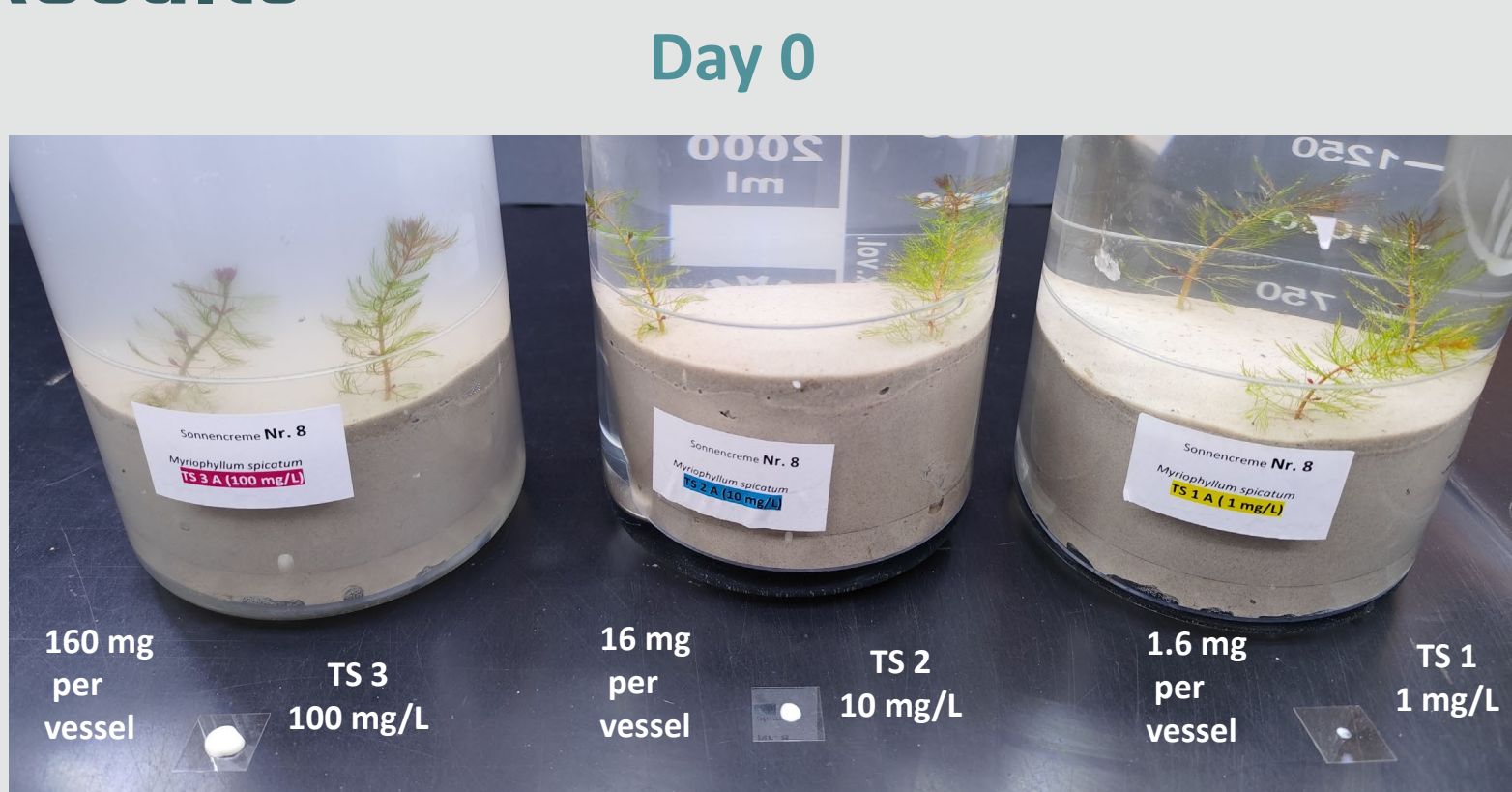
Material & Methods

- Test design:** based on OECD 239
- Test duration:** 14 days
- Test plant:** *Myriophyllum spicatum*
- Test item:** 10 sun creams of 9 different brands
- Concentrations:** 1 mg/L, 10 mg/L, 100 mg/L
- Validity criteria:** OECD 239
 - CV (Yield Fresh Weight) $\leq 35.0\%$
 - Growth Factor (Fresh Weight) ≥ 2.0
 - Growth Factor (Total Shoot Length) ≥ 2.0

EC₅₀ of yield and Growth Rate (GR) of Total Shoot Length (TSL), Fresh (FW) and Dry Weight (DW) in mg/L

Sun cream	TSL		FW		DW	
	Yield	GR	Yield	GR	Yield	GR
1	>100	>100	>100	>100	>100	>100
2	1.82	29.4	3.73	50.4	7.25	56.2
3	>100	>100	>100	>100	>100	>100
4	>100	>100	>100	>100	>100	>100
5	>100	>100	>100	>100	>100	>100
6	5.85	26.5	8.82	46.0	28.8	117
7	>100	>100	>100	>100	>100	>100
8	>100	>100	>100	>100	>100	>100
9	>100	>100	>100	>100	>100	>100
10	>100	>100	>100	>100	>100	>100

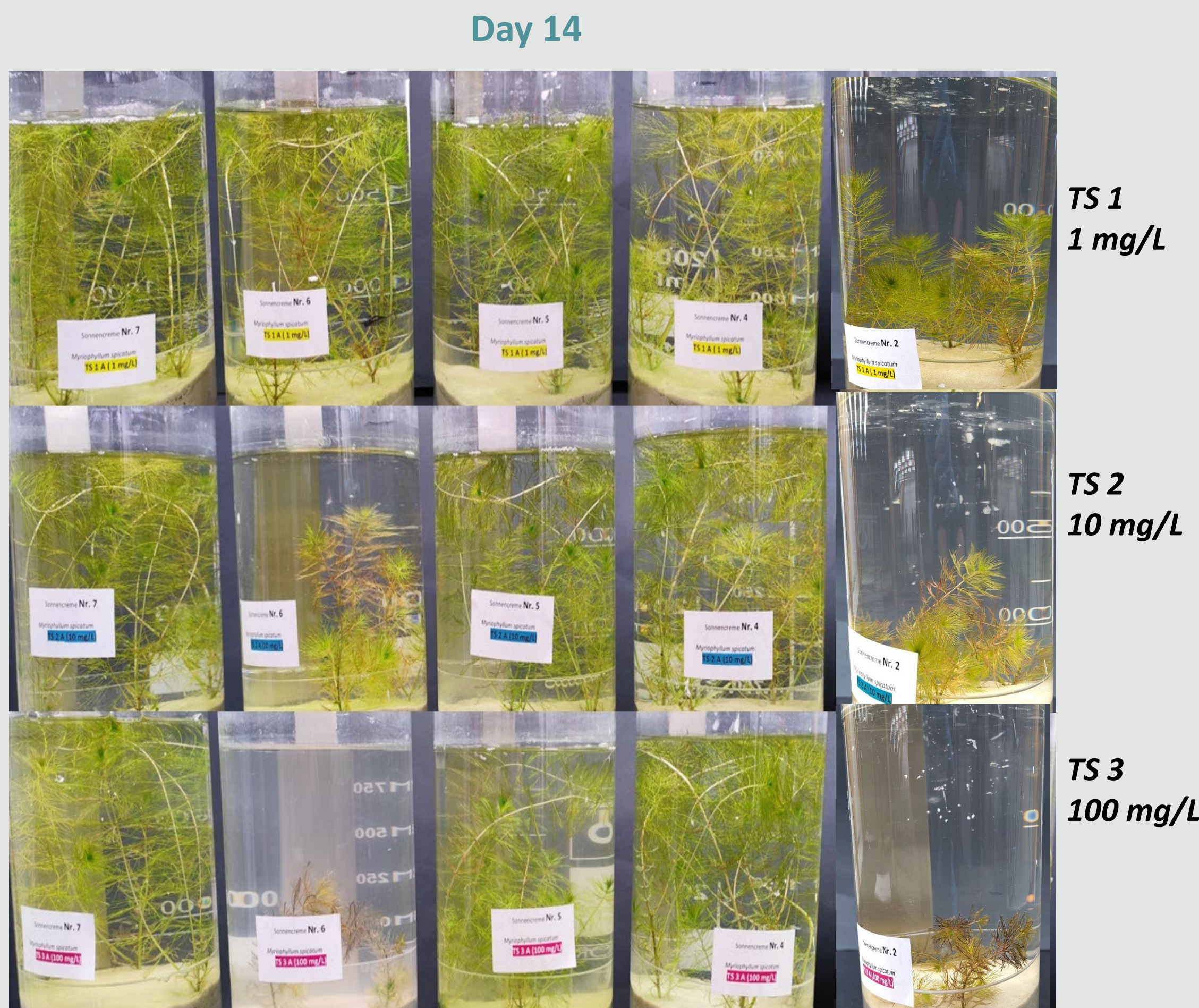
Results



Myriophyllum spicatum with sun cream at day 0, with amount of test item per concentration and test vessel. The amount of sun cream (160 mg per vessel) at the highest concentration (100 mg/L) caused a white **turbidity** in all tested sun creams after strong stirring.



The turbidity in TS 3 almost cleared up till day 7. Sun creams number 3, 6 stayed slightly milky till day 7 and even up to the end of the test at day 14.



Myriophyllum spicatum at day 14 from the lowest (1 mg/L) to the highest concentration of 100 mg/L of some tested sun creams. Visual effects like chlorosis and necrosis occurred with sun creams 2 and 6 at concentration level 2 (10 mg/L) and 3 (100 mg/L) and at the lowest concentration level (1 mg/L) with sun cream 2 at the end of the test.

Ten sun creams in a water-sediment system were tested with the standard species *Myriophyllum spicatum*. Two out of ten sun creams caused visual effects (necrosis and chlorosis) and effects on growth (total shoot length and fresh and dry weight). Comparing the ingredients of the sunscreen formulations zinc oxide (nano) was an UV-Filter that occurs only in the tested sun creams 2 and 6. However, sun creams are complex formulations with often more than 20 ingredients. Therefore, toxicity can not be related to one active ingredient. Unfortunately, in this study the sun creams labelled with an organic certificate showed the highest effect on aquatic plants.

Discussion

It is currently being discussed that sun creams can affect the marine ecosystem, especially corals and their endosymbiotic algae (e.g. Presentation ID: 2.07.P-Th058; Effects of sun creams on corals). But it is unclear whether toxic concentrations of skin care products can be reached under natural conditions in saltwater habitats. However, the freshwater ecosystem has a much lower water exchange and a much higher chemical load, as almost all wastewater is purified via freshwater. Some rivers are exchanged several times with purified wastewater. However, stagnant waters in particular are exposed to high levels of pollution from swimmers, especially in summer, particularly from cosmetic products such as sun cream. Many sun cream manufacturers label their products with “safe for corals” or other organic certificates. It is obvious that it is necessary to assess the environmental risk. The indication that the formulation does not contain toxic compounds does not allow the conclusion that there is no environmental risk. Only data based on clear guidance with a clear methodological structure according to international guidelines focusing on the relevant validity criteria are suitable for a risk assessment. It has been shown that there is a risk to higher aquatic plants from cosmetic products. However, this is not taken into account in most risk assessments. When labelling any type of product as resource-saving, product testing should be carried out on higher aquatic plants to assess risk, avoid hazards and minimise costs for the restoration of aquatic ecosystems.