Metal in glitter impairs aquatic plant growth, study shows

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Glitter is widely used by Carnival revelers and all year round in makeup, apparel and accessories, among many other applications. Credit: Daniel Antônio/Agência FAPESP

Glitter is used in a wide array of colors and shapes in apparel, footwear,

cosmetics, makeup, handbags, festive decorations, arts and crafts, and jewelry, among many other applications. During the Carnival holidays, hundreds of thousands of Brazilians cover parts of their bodies with it while dancing in the streets.

Its brilliance is dazzling, but it is considered an emerging pollutant by many scientists: like other microplastics (small plastic pieces less than 5 mm long), it is not filtered by wastewater treatment plants and ends up in rivers and the sea, interfering with aquatic life in various ways.

A study conducted at the Federal University of São Carlos (UFSCar) detected an additional problem: besides plastic, glitter contains metals, typically aluminum, and according to the findings of the study, reported in the *New Zealand Journal of Botany*, these can hinder the underwater passage of light sufficiently to impair aquatic plant photosynthesis and growth.

The authors of the article focus on the Large-flowered waterweed Egeria densa, a macrophyte (aquatic plant) native to Argentina, Brazil, and Uruguay. Macrophytes are visible to the naked eye, serving as food and shelter for many species, providing shade and producing oxygen. They are a key component of biofilters in phytoremediation projects that use plants to detoxify soil, water, or air.

Some, including E. densa, are widely used for oxygenation and landscaping in aquariums and artificial lakes.

The researchers analyzed the action of glitter in laboratory experiments involving 400 fragments of E. densa incubated in flasks containing water from the Monjolinho reservoir on the campus at UFSCar and common glitter of the type available from retail stores, with an average particle surface area of 0.14 mm^2.

They tested four combinations: E. densa in the presence of glitter at 0.04 grams per liter, with and without light, and E. densa in the absence of glitter, with and without light, as control. They analyzed photosynthesis rates using the "light and dark flask" method developed in 1927 and widely used in this type of study. In the light flask, the plant undergoes photosynthesis, producing oxygen as a byproduct.

The dark flask is used to measure respiration, where the plant consumes oxygen. The net rate of photosynthesis is determined by comparing the rates of gas exchange in the light and dark flasks.

The experiment showed that photosynthesis rates were 1.54 times higher in the absence of glitter. The reason was that the microplastic particles reduced the amount of light in the water. Respiration was also affected, but not as significantly.

"These findings support the hypothesis we began with, which was that glitter interferes with photosynthesis, possibly owing to the reflection of light by the microplastic particles' metallic surface," said Luana Lume Yoshida, first author of the article. The study was part of her scientific initiation project at the Bioassay and Mathematical Modeling Laboratory (LBMM) in UFSCar's Department of Hydrobiology. Yoshida is currently researching there for a master's degree in ecology and natural resources.

Sustainable Carnival

"In this experiment, we specifically observed the physical interference of glitter in a species of macrophyte, but there are better-known references in the scientific literature to water contamination and consumption of these particles by other aquatic organisms. We put all the pieces of the puzzle together and were able to describe the functioning of the entire ecosystem, as well as point out what can happen throughout the food

chain."

"That's the key difference of an ecological approach," said Marcela Bianchessi da Cunha-Santino, the last author of the article and one of LBMM's principal investigators.

"With a robust 'database,' we'll be able to think about public policy to foster more conscious consumption of this type of material, but for now, it's important to warn society that changes in photosynthesis rates, however remote they may seem from our lives, are linked to other changes that affect us more directly, such as the decrease in primary production by food chains in aquatic environments (i.e., organisms at the bottom of the food chain)."

"If there are more sustainable alternatives to glitter, why not switch to these right away?" said Irineu Bianchini Jr., the other co-author of the article and also a PI at LBMM.

More information: Luana Lume Yoshida et al, Interference of glitter with the photosynthetic rates of a submerged macrophyte, Egeria densa, *New Zealand Journal of Botany* (2023). DOI: 10.1080/0028825X.2023.2276284

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