

Article

Toxicity Assessment of Catechins on Representative Aquatic Organisms and Terrestrial Plant

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Abstract: Catechins, renowned for their health benefits, have unexamined environmental impacts. This study assessed the toxicity of crude catechin and catechin hydrate on invertebrate larvae, plant, and microalgae. The survival rates of *Daphnia magna* Straus and *Artemia salina* L. were monitored every 24 h over a three-day period. The germination rate and radicle length of *Lactuca sativa* L. was measured every 24 h for four days. Inhibitory effects were evaluated in both freshwater and seawater cultures of *Chlorella vulgaris* Beijerinck, with cell density recorded every 24 h and yield inhibition calculated after 96 h. Results indicated that increasing catechin concentration and exposure duration decreased the survival rate of *D. magna* and *A. salina*. *Daphnia magna* was more sensitive to catechins than *A. salina*, with 24 h lethal concentration 50 (LC-50) values of 1174 µg/mL compared to 1895 µg/mL for crude catechin, and 54 µg/mL compared to 153 µg/mL for catechin hydrate. The germination rate and radicle length of *L. sativa*, along with the cell density of *C. vulgaris*, decreased with increasing catechin concentration, but remained higher even after prolonged exposure. At low catechin concentrations, *C. vulgaris* cell density exceeded control levels. This study demonstrates that catechins in aquatic environments can significantly impact ecosystems. At certain concentrations, catechins are toxic and potentially lethal to aquatic organisms. Conversely, at lower concentrations, catechins may promote microalgal growth, suggesting a fertilizing effect. Understanding these dynamics is crucial for maintaining the stability of aquatic ecosystems.

Keywords: algae; cell density; eco-friendly; germination; plankton; toxicity

Key Contribution: The manuscript highlights the minimal environmental toxicity of catechins, specifically crude catechin and catechin hydrate, while demonstrating their potential to enhance growth at certain concentrations. This study provides valuable insights into the



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environmental applications of catechins, suggesting their dual role as safe substances and potential growth enhancers for plants and microalgae.

1. Introduction

Catechins are a type of flavonoid, which are plant polyphenols that include epicatechin (EC), epigallocatechin (EGC), epicatechin gallate (ECG), and epigallocatechin gallate (EGCG) as diastereoisomers [1]. Among these, catechin hydrate is a natural flavonoid known for its antioxidant and anti-inflammatory properties. It is beneficial not only for prevention but also for the treatment of diseases caused by oxidative damage, such as inhibiting cancer growth [2,3]. As important dietary components, catechins are found in plants like green tea, nuts, chocolate, red wine, and fruits such as apricots, black grapes, cocoa, and cherries [4,5]. These compounds serve as antioxidants, antimicrobials, and anticarcinogens [6,7]. Their efficiency as antioxidants surpasses many other substances, making them a cost-effective choice in food production [8]. Studies on both animals and humans have demonstrated that catechins impact lipid metabolism by reducing triglycerides, total cholesterol [9], and body fat accumulation [10–12]. By binding strongly to reactive oxygen species (ROS), they absorb free radicals [1]. As environmentally friendly plant polyphenols [13], even minimal doses can lead to health improvements [14].

The toxic effects of catechins on aquatic environments need to be evaluated. Freshwater and saltwater ecosystems have distinct characteristics that influence the sensitivity of their resident biota. Studies on the effects of catechins on both freshwater and marine organisms are crucial in understanding the broader ecological risks. In the present study, we utilized several organisms: *Daphnia magna* Straus neonates, *Artemia salina* L. nauplii, *Lactuca sativa* L. seeds, and *Chlorella vulgaris* Beijerinck. *D. magna* is a commonly used freshwater organism in environmental studies [15,16], particularly for assessing drug toxicity [17–20]. It is chosen for toxicity measurement due to its sensitive behavioral and physiological responses to environmental factors and chemicals, making it a biomarker in studies on phenotype, toxicology, and life cycle evolution [21]. *Daphnia magna* is a popular freshwater organism for bioassays in biological and environmental studies, with *A. salina* serving as the seawater equivalent. This species is used in food safety [22], medical safety [23], therapeutic and pharmacological [24–26], and eco-toxicity studies [15,16,27,28].

Lactuca sativa is a macro plant frequently used in bioassays and environmental quality bioindicator studies due to its quick and easy germination [29]. Its sensitivity to environmental changes makes it suitable for water [30] and soil quality studies [22], as well as studies on heavy metal extraction [31] and air pollution [32]. *Lactuca sativa* has also been used in bioherbicide [33] and allelochemical studies [34]. Microalgae, another aquatic organism, is useful for monitoring environmental pollution and conducting aquatic toxicity tests [16,35]. *Chlorella vulgaris* is economically and effectively used in toxicity research due to its sensitivity to toxicants and ease of laboratory cultivation [16].

Previous studies have indicated that catechins are more toxic to Gram-positive bacteria (*Bacillus subtilis*) than to Gram-negative bacteria (*Escherichia coli*) [1]. Additionally, high doses of catechins can cause liver side effects, though this is not the case when consumed as brewed tea, as beverage extracts, or in food form [36]. The appropriate concentration of catechins has been shown to reduce mortality in brine shrimp when exposed to toxic methanol concentrations [37].

Daphnia magna and *A. salina* are crucial components of aquatic ecosystems. *Daphnia magna*, found in freshwater, feeds on algae and phytoplankton, helping to control algal blooms (eutrophication) and serving as a vital food source for fish and invertebrates.

Artemia salina, which inhabits brackish water and seawater, consumes microorganisms and detritus, contributing to ecosystem balance. It also supports the carbon and nitrogen cycles and is an important food source for fish and invertebrates. Both species play key roles in the aquatic food web and help maintain ecological stability.

Lactuca sativa, although not an aquatic macrophyte, shows potential for use in aquatic systems through its phytoremediation abilities. In terrestrial–aquatic integrated systems, it can absorb inorganic nitrogen compounds (e.g., nitrates) and other pollutants from aquatic organism waste, helping stabilize water chemistry and improve system efficiency. *Chlorella vulgaris*, a single-celled microalga, is a primary producer in aquatic environments. Through photosynthesis, it generates oxygen and organic matter that support the food chain. It also absorbs excess nutrients like nitrogen and phosphate, reducing eutrophication, and can capture heavy metals and toxins, making it effective for bioremediation in polluted waters.

By conducting this study, we aim to generate basic knowledge about the significant impacts of catechins on the stability of aquatic ecosystems. Understanding these impacts is essential, as catechins, whether naturally occurring or arising through environmental exposure, can potentially disrupt ecological balance, affect species survival, and alter water quality. This study is expected to contribute to environmental risk assessment and inform future strategies for managing the presence of these compounds in aquatic environments.

2. Results

2.1. HPLC Analysis of Crude Catechin and Catechin Hydrate

For the high-performance liquid chromatography (HPLC) analysis, catechin hydrate standard (50 µg/mL), crude catechin (200 µg/mL), and a combination of both were injected into the HPLC instrument. The resulting chromatogram is shown in Figure 1. Catechin retention times were observed to range from 3.0 to 3.5 min.

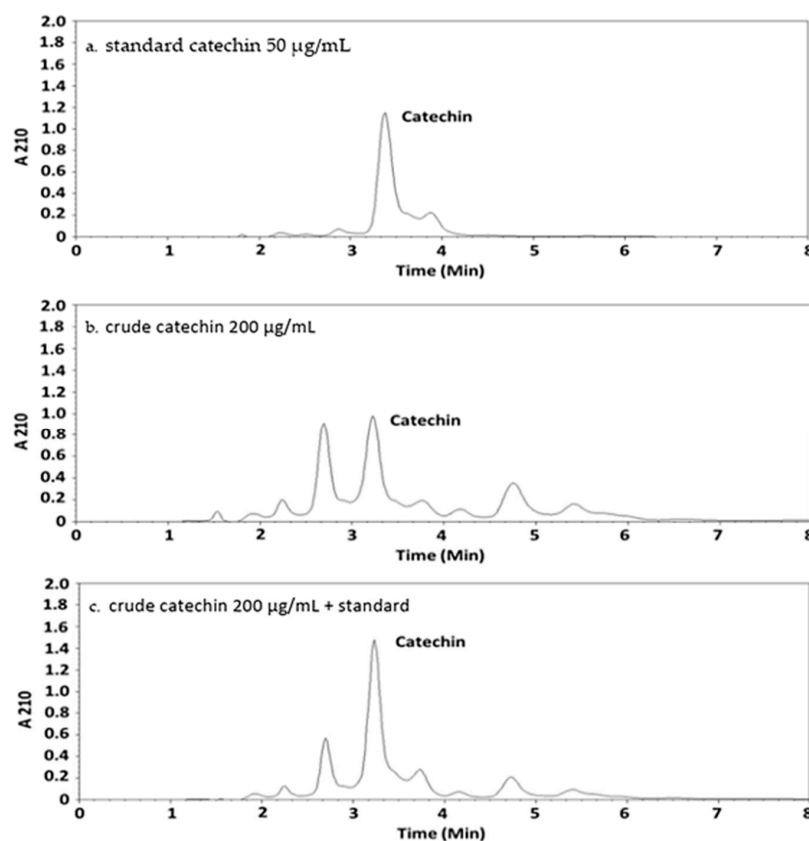


Figure 1. HPLC chromatogram of standard catechin at 50 µg/mL (a), crude catechin at 200 µg/mL (b), and combination of crude catechin (200 µg/mL) + standard catechin (50 µg/mL) (c).

Catechin was successfully identified in the extract samples. In the chromatogram of the pure catechin hydrate standard (Figure 1a), a distinct peak was observed at a retention time characteristic of catechin. The extract sample (Figure 1b) exhibited a peak at the same retention time, indicating the presence of catechin. To further confirm this identification, a co-injection of the extract and catechin standard was performed (Figure 1c). The resulting chromatogram displayed a single intensified peak at the same retention time, with no peak splitting or additional signals. This co-elution demonstrated that the compound in the extract matched the standard completely. This confirms the identity of the compound as catechin, showing qualitative agreement and chromatographic consistency, and providing strong evidence for its presence in the extract.

2.2. Larvicidal Effects of Crude Catechin and Catechin Hydrate on the Survival of *D. magna*

The larvicidal effects on *D. magna* neonates are detailed in Table 1. The control group of neonates exhibited high survival rates of 100%, 94%, and 85% at 24, 48, and 72 h, respectively.

Table 1. Larvicidal effects of crude catechin and catechin hydrate on the survival rate of *D. magna* neonates.

Incubation Time (h)	Survival Rate (%) of <i>Daphnia magna</i> Straus Neonates					LC-50 (µg/mL)
	Control	Crude Catechin (mg/mL)				
		0.5	1.0	2.0	3.0	
24	100.00 ± 0.00	73.00 ± 2.90 *	64.00 ± 6.30 *	45.00 ± 4.10 *	10.00 ± 4.10 *	1174
48	94.00 ± 7.50	43.00 ± 8.70 *	10.00 ± 8.20 *	0.00 ± 0.00 *	0.00 ± 0.00 *	
72	85.00 ± 7.10	28.00 ± 5.00 *	4.00 ± 2.50 *	0.00 ± 0.00 *	0.00 ± 0.00 *	
Incubation Time (h)	Control	Catechin Hydrate (mg/mL)				LC-50 (µg/mL)
		0.01	0.05	0.1	0.5	
	24	100.00 ± 0.00	88.00 ± 2.90 *	68.00 ± 7.60 *	38.00 ± 2.90 *	
48	92.00 ± 2.90	70.00 ± 5.00 *	55.00 ± 5.00 *	28.00 ± 2.90 *	0.00 ± 0.00 *	39
72	77.00 ± 2.90	40.00 ± 5.00 *	20.00 ± 5.00 *	7.00 ± 2.90 *	0.00 ± 0.00 *	7

Values are mean ± S.D. of at least three replications, where each replication contains 20 entities. LC-50: lethal concentration 50, the effective toxicant concentration capable of killing 50% of the organisms (confidence level of 95%). * Indicates significant differences based on Student's *t*-test at $p < 0.05$ compared to control.

Crude catechin showed a larvicidal effect at concentrations of 2.0 and 3.0 mg/mL after 24 h, with the most significant effect observed at 3.0 mg/mL, resulting in only 10% survival. The lethal concentration 50 (LC-50), which is the concentration required to kill 50% of the organisms, was determined to be 1174 µg/mL at 24 h. At a concentration of 0.5 mg/mL, crude catechins showed a mild larvicidal effect, with survival rates of 43% at 48 h and 28% at 72 h. At 48 and 72 h, no neonates survived at concentrations of 2.0 or 3.0 mg/mL.

Catechin hydrate demonstrated the most severe larvicidal effect at a concentration of 0.5 mg/mL after 24 h, with 0% survival. At a concentration of 0.1 mg/mL for 24 h, the survival rate was 38%. The LC-50 at 24 h was found to be 54 µg/mL. After 72 h, all tested concentrations showed a larvicidal effect. Specifically, a concentration of 0.01 mg/mL resulted in a 40% survival rate, while 0.05 mg/mL resulted in a 20% survival rate. The LC-50 at 72 h was determined to be 7 µg/mL.

2.3. Larvicidal Effects of Crude Catechin and Catechin Hydrate on the Survival of *A. salina*

In this study, pure seawater was used as a negative control and did not kill *A. salina* after 24 h, with minimal mortality observed at 48 h (2%) and 72 h (7%). The larvicidal effects of crude catechin on *A. salina* nauplii are detailed in Table 2. After 24 h, a concentration of 0.5 mg/mL resulted in 100% survival, but higher concentrations induced mortality, with

3.0 mg/mL causing the highest mortality rate of 84%. The LC-50 at 24 h was determined to be 1895 µg/mL. At 48 h, concentrations of 2.0 and 3.0 mg/mL resulted in no surviving *A. salina* nauplii, while a concentration of 1.0 mg/mL had a low survival rate of 20%.

Table 2. Larvicidal effects of crude catechin and catechin hydrate on the survival rate of *A. salina* nauplii.

Incubation Time (h)	Survival Rate (%) of <i>Artemia salina</i> L. Nauplii					LC-50 (µg/mL)
	Control	Crude Catechin (mg/mL)				
		0.5	1.0	2.0	3.0	
24	100.00 ± 0.00	100.00 ± 0.00	99.00 ± 2.50	54.00 ± 8.50 *	16.00 ± 4.80 *	1895
48	98.00 ± 2.90	85.00 ± 4.10 *	20.00 ± 4.10 *	0.00 ± 0.00 *	0.00 ± 0.00 *	
72	93.00 ± 2.90	33.00 ± 8.70 *	13.00 ± 6.50 *	0.00 ± 0.00 *	0.00 ± 0.00 *	
Incubation Time (h)	Control	Catechin hydrate (mg/mL)				LC-50 (µg/mL)
		0.01	0.05	0.1	0.5	
	24	100.00 ± 0.00	90.00 ± 0.00 *	63.00 ± 2.90 *	45.00 ± 5.00 *	
48	97.00 ± 2.90	80.00 ± 2.90 *	52.00 ± 7.60 *	37.00 ± 5.80 *	28.00 ± 2.90 *	70
72	83.00 ± 2.90	42.00 ± 2.90 *	23.00 ± 2.90 *	10.00 ± 10.00 *	0.00 ± 0.00 *	9

Values are mean ± S.D. of at least three replications, where each replication contains 20 entities. LC-50: lethal concentration 50, the effective toxicant concentration capable of killing 50% of the organisms (confidence level of 95%). * Indicates significant differences based on Student's *t*-test at $p < 0.05$ compared to control.

Catechin hydrate showed larvicidal effects at concentrations of 0.1 and 0.5 mg/mL after 24 h, with survival rates of 45% and 40%, respectively. The LC-50 at 24 h was 153 µg/mL. After 72 h, *A. salina* nauplii exposed to concentrations of 0.01 and 0.05 mg/mL showed survival rates of 42% and 23%, respectively. The LC-50 at 72 h was determined to be 9 µg/mL.

2.4. Inhibitory Effect of Crude Catechin and Catechin Hydrate on Germination of *L. sativa*

The toxicity and inhibition levels of crude catechin and catechin hydrate on the germination and radical growth of *L. sativa* are summarized in Table 3. *Lactuca sativa* seeds treated with 1.0 mg/mL crude catechin exhibited a higher germination rate of 87.5% compared to the control at 24 h. However, at a concentration of 50.0 mg/mL, germination did not occur. At 1.0 mg/mL, radicle growth was slower than that of the control, with lengths of 3.11 mm compared to 3.84 mm for the control. At 10.0 mg/mL, germination was 35% at 24 h and 75% at 96 h, both lower than that of the control.

Table 3. Inhibitory effects of crude catechin and catechin hydrate on the germination rate (%) and radical length (mm) of *L. sativa* seeds.

Incubation Time (h)	Germination Rate (%) of <i>Lactuca sativa</i> L. Seeds (Radicle Length of <i>L. sativa</i> Seeds in mm)			
	Control	Crude Catechin (mg/mL)		
		1.0	10.0	50.0
24	82.50 ± 12.60 (3.84 ± 0.46)	87.50 ± 15.00 (3.11 ± 0.50)	35.00 ± 10.00 * (1.95 ± 0.39 *)	0.00 ± 0.00 * (0.00 ± 0.00 *)
48	90.00 ± 8.16 (11.34 ± 2.66)	95.00 ± 10.00 (7.53 ± 1.25)	55.00 ± 5.80 * (3.08 ± 0.41 *)	0.00 ± 0.00 * (0.00 ± 0.00 *)
72	95.00 ± 5.80 (17.72 ± 3.57)	97.50 ± 5.00 (12.67 ± 2.27)	75.00 ± 5.80 * (3.64 ± 0.56 *)	0.00 ± 0.00 * (0.00 ± 0.00 *)
96	95.00 ± 5.80 (23.61 ± 4.64)	97.50 ± 5.00 (18.02 ± 3.42)	75.00 ± 5.80 * (4.71 ± 1.03 *)	0.00 ± 0.00 * (0.00 ± 0.00 *)

Table 3. Cont.

Incubation Time (h)	Control	Catechin Hydrate (mg/mL)				
		0.1	0.5	1.0	5.0	10.0
24	83.30 ± 5.80 (4.10 ± 0.43)	73.30 ± 5.80 (4.47 ± 0.07)	73.30 ± 5.80 (4.79 ± 0.55)	70.00 ± 10.00 (4.42 ± 0.37)	60.00 ± 17.30 (2.95 ± 0.41 *)	16.70 ± 11.60 * (1.89 ± 0.08 *)
48	90.00 ± 10.00 (15.74 ± 1.60)	83.30 ± 5.80 (13.26 ± 0.62 *)	80.00 ± 10.00 (13.40 ± 1.48)	70.00 ± 10.00 (12.95 ± 2.31)	73.30 ± 20.80 (4.33 ± 0.56 *)	33.30 ± 15.30 * (2.40 ± 0.39 *)
72	93.30 ± 5.80 (24.54 ± 2.48)	83.30 ± 5.80 (21.93 ± 1.84)	86.70 ± 5.80 (20.80 ± 3.52)	83.30 ± 15.30 (15.56 ± 1.31 *)	90.00 ± 10.00 (5.85 ± 0.92 *)	33.30 ± 15.30 * (2.63 ± 0.60 *)
96	93.30 ± 5.80 (33.03 ± 1.56)	83.30 ± 5.80 (29.75 ± 1.00 *)	90.00 ± 0.00 (26.53 ± 1.23 *)	83.30 ± 15.30 (20.23 ± 3.14 *)	90.00 ± 10.00 (6.08 ± 0.27 *)	33.30 ± 15.30 * (2.72 ± 0.62 *)

Values are mean ± S.D. of at least three replications, where each replication contains 10 entities. * Indicates significant differences based on Student's *t*-test at $p < 0.05$ compared to control.

Catechin hydrate resulted in longer radicle growth at concentrations of 0.1, 0.5, and 1.0 mg/mL. At 0.1 mg/mL, radical length was 4.47 mm at 24 h, compared to 4.10 mm for the control. At 5.0 mg/mL, radical length was 2.95 mm. After 48 h, a concentration of 0.1 mg/mL catechin hydrate resulted in a radical length of 13.26 mm, compared to 15.74 mm for the control. Germination rates were lower for catechin hydrate, with an 83.3% germination rate at 0.1 mg/mL compared to 93.3% for the control at 96 h.

2.5. Toxicity of Crude Catechin and Catechin Hydrate on Cell Density of Freshwater *C. vulgaris*

The effects of crude catechin and catechin hydrate on the cell density of freshwater *C. vulgaris* are detailed in Table 4. After 24 h, crude catechin at concentrations of 0.5 and 1.0 mg/mL significantly increased cell density, with values of 1.50×10^6 cells/mL and 1.42×10^6 cells/mL, respectively, compared to the control at 1.16×10^6 cells/mL. However, a concentration of 2 mg/mL showed no significant growth enhancement. At 72 h, a concentration of 1.0 mg/mL resulted in a lower cell density than that of the control, while 0.5 mg/mL showed no significant difference. Yield inhibitions for catechin hydrate were $12.29 \pm 1.60\%$ and $33.84 \pm 0.60\%$ at concentrations of 1.0 and 2.0 mg/mL, respectively, with lower concentrations showing approximately a four-fold increase in yield.

Table 4. Toxicity of crude catechin and catechin hydrate on the cell density of freshwater *C. vulgaris*.

Incubation Time (h)	Cell Density of Freshwater <i>Chlorella vulgaris</i> Beijerinck (10^6 cells/mL)			
	Control	Crude Catechin (mg/mL)		
		0.5	1.0	2.0
0	1.08 ± 0.02	1.05 ± 0.06	1.05 ± 0.06	1.06 ± 0.01
24	1.16 ± 0.05	1.50 ± 0.04 *	1.42 ± 0.06 *	1.17 ± 0.06
48	2.02 ± 0.08	2.33 ± 0.07 *	2.27 ± 0.07 *	1.50 ± 0.04 *
72	3.71 ± 0.24	3.84 ± 0.10	3.31 ± 0.22 *	1.58 ± 0.05 *
96	4.26 ± 0.14	4.60 ± 0.17 *	3.40 ± 0.08 *	1.90 ± 0.06 *
Yield inhibition		−(4.61) ± 0.83%	12.29 ± 1.60%	33.84 ± 0.60%

Incubation Time (h)	Control	Catechin Hydrate (mg/mL)			
		0.05	0.1	0.5	1.0
0	1.11 ± 0.05	1.13 ± 0.04	1.10 ± 0.06	1.12 ± 0.06	1.15 ± 0.05
24	1.28 ± 0.04	1.59 ± 0.10 *	1.56 ± 0.29 *	1.56 ± 0.07 *	1.33 ± 0.02 *
48	2.02 ± 0.09	2.22 ± 0.27	2.09 ± 0.28	2.39 ± 0.04 *	1.64 ± 0.06 *
72	3.56 ± 0.22	3.99 ± 0.33 *	3.61 ± 0.35	2.82 ± 0.07 *	1.64 ± 0.05 *
96	4.04 ± 0.18	4.74 ± 0.16 *	4.28 ± 0.18 *	3.10 ± 0.06 *	1.68 ± 0.05 *
Yield inhibition		−(8.10) ± 1.22%	−(2.91) ± 1.03%	13.85 ± 1.53%	34.91 ± 1.26%

Values are mean ± S.D. of at least three replications. * Indicates significant differences based on Student's *t*-test at $p < 0.05$ compared to control.

Catechin hydrate increased cell density at all concentrations after 24 h, with values ranging from 1.33×10^6 to 1.59×10^6 cells/mL. From 48 h to 96 h, a concentration of 1.0 mg/mL did not exceed the cell density of the control. From 72 h to 96 h, a concentration of 0.5 mg/mL did not exceed the control cell density, but lower concentrations resulted in increased cell density.

2.6. Toxicity of Crude Catechin and Catechin Hydrate on Cell Density of Seawater *C. vulgaris*

The effects of crude catechin on the cell density of seawater *C. vulgaris* are presented in Table 5. After 24 h, there were no significant changes in cell density compared to the control. However, significant changes were observed at 48 h, with concentrations of 0.5 and 2.0 mg/mL resulting in cell densities of 1.90×10^6 and 1.37×10^6 cells/mL, respectively. By 96 h, all seawater *C. vulgaris* treatments showed significantly different cell density values. Concentrations of 1.0 and 2.0 mg/mL resulted in lower cell density values (2.63×10^6 and 1.61×10^6 cells/mL, respectively) compared to that of the control (3.96×10^6 cells/mL). At 0.5 mg/mL, cell density increased by 2.61%, while concentrations of 1.0 and 2.0 mg/mL led to inhibitions of 19.90% and 35.26%, respectively.

Table 5. Toxicity of crude catechin and catechin hydrate on the cell density of seawater *C. vulgaris*.

Incubation Time (h)	Cell Density of Seawater <i>Chlorella vulgaris</i> Beijerinck (10 ⁶ cells/mL)				
	Control	Crude Catechin (mg/mL)			
		0.5	1.0	2.0	
0	1.06 ± 0.04	1.02 ± 0.04	1.04 ± 0.04	1.06 ± 0.05	
24	1.18 ± 0.04	1.22 ± 0.04	1.36 ± 0.18	1.23 ± 0.08	
48	1.77 ± 0.08	1.90 ± 0.08 *	1.97 ± 0.13 *	1.37 ± 0.25 *	
72	3.06 ± 0.21	3.52 ± 0.26 *	2.49 ± 0.25 *	1.55 ± 0.20 *	
96	3.96 ± 0.19	4.25 ± 0.19 *	2.63 ± 0.19 *	1.61 ± 0.16 *	
Yield inhibition		−(2.61) ± 1.21%	19.90 ± 2.29%	35.26 ± 1.06%	
Incubation Time (h)	Control	Catechin Hydrate (mg/mL)			
		0.05	0.1	0.5	1.0
	0	1.12 ± 0.07	1.15 ± 0.06	1.09 ± 0.04	1.15 ± 0.09
24	1.25 ± 0.04	1.36 ± 0.11 *	1.56 ± 0.22 *	1.35 ± 0.09 *	1.32 ± 0.08 *
48	2.29 ± 0.08	2.21 ± 0.10	2.20 ± 0.17	1.91 ± 0.12 *	1.46 ± 0.09 *
72	3.35 ± 0.16	3.57 ± 0.14 *	3.41 ± 0.25	2.28 ± 0.13 *	1.72 ± 0.08
96	3.87 ± 0.29	4.15 ± 0.16 *	3.98 ± 0.18	2.77 ± 0.09 *	1.50 ± 0.09 *
Yield inhibition		−(5.92) ± 2.18%	−(1.71) ± 2.21%	16.37 ± 1.53%	35.97 ± 1.70%

Values are mean $\pm$ S.D. of at least three replications. * Indicates significant differences based on Student's *t*-test at $p < 0.05$ compared to control.

When exposed to catechin hydrate, seawater *C. vulgaris* showed significant changes in cell density compared to the control after 24 h at all concentrations. The lowest concentration resulted in a cell density of 1.36×10^6 mg/mL, while at 0.1 mg/mL, cell density was 1.56×10^6 mg/mL. Higher concentrations (0.5 and 1.0 mg/mL) decreased cell density to 1.35×10^6 and 1.32×10^6 cells/mL, respectively. After 48 h, concentrations of 0.05 and 0.1 mg/mL showed no significant differences in cell density (2.21×10^6 and 2.20×10^6 cells/mL) compared to the control (2.29×10^6 mg/mL). After 96 h, all concentrations except 0.1 mg/mL were significantly different from that of the control. Yield inhibitions for concentrations of 0.5 and 1.0 mg/mL were $16.37 \pm 1.53\%$ and $35.97 \pm 1.70\%$, respectively, while lower concentrations (0.05 and 0.1 mg/mL) increased cell density by 5.92% and 1.71%, respectively.

3. Discussion

In this study, *D. magna* was placed on 24-well plates with 2 mL of solution, minimizing the use of compounds and bioactive reagents. Crude catechins showed mild larvicidal effects at 2.0 mg/mL and high larvicidal effects at 3.0 mg/mL after 24 h, with survival rates of $45.0 \pm 4.1\%$ and $10.0 \pm 4.1\%$, respectively (LC-50 at 24 h: 1174 $\mu\text{g/mL}$). At 48 h, 0.5 mg/mL showed mild effects, while 1.0 mg/mL showed high effects, and 2.0 and 3.0 mg/mL resulted in 100% mortality. Catechin hydrate at 0.5 mg/mL resulted in 0% survival at 24 h (LC-50 at 24 h: 54 $\mu\text{g/mL}$). At 0.1 mg/mL, it had mild larvicidal effects, with a survival rate of $38.0 \pm 2.9\%$. The increase in mortality is likely due to the higher concentrations and longer exposure times [38]. Catechin hydrate was more toxic to *D. magna* than crude catechin, consistent with Hu et al. [36], who found fewer side effects from catechins in brewed tea or food than in pure form.

For *A. salina* nauplii, crude catechins at 0.5, 1.0, and 2.0 mg/mL did not show larvicidal effects up to 24 h, while 3.0 mg/mL did show effects (LC-50 at 24 h: 1895 $\mu\text{g/mL}$). At 48 h, 2.0 and 3.0 mg/mL resulted in 100% mortality, with 1.0 mg/mL showing mild effects ($20.0 \pm 4.1\%$ survival rate). Catechin hydrate was more toxic to *A. salina* than crude catechin, with mild effects at 0.1 and 0.5 mg/mL after 24 h (survival rates of $45.0 \pm 5.0\%$ and $40.0 \pm 5.0\%$, respectively). The LC-50 at 24 h was observed to be 153 $\mu\text{g/mL}$. At 48 h, 0.01 and 0.05 mg/mL showed no larvicidal effects, with a survival rate of 80% and 52%, respectively. The LC-50 at 48 h was 70 $\mu\text{g/mL}$. After 72 h, 0.01 mg/mL showed mild larvicidal effects, and 0.05 mg/mL showed high effects, with survival rates of 42% and 23%, respectively. The LC-50 at 72 h was noted to be 9 $\mu\text{g/mL}$.

Increasing both the catechin concentration and the exposure time showed reduced survival rates of *D. magna* and *A. salina*. Catechin hydrate was more toxic, likely due to its pure form and greater concentration of active compounds, resulting in stronger biological effects. Its higher solubility and bioavailability further enhance absorption by organisms, which intensifies its toxic impact. In contrast, crude catechin, being a crude extract, contains a mixture of various compounds, some of which may function as buffers or neutralizers of toxic effects [22,39]. The absence of these mitigating components in catechin hydrate could contribute to its more pronounced toxicity in zooplankton.

The larvicidal effect of crude catechin on *A. salina* was higher than that reported in Rodrigues et al. [39], who reported no toxic effects of *Camellia sinensis* L. Kuntze (green tea) on *A. salina* up to 1.0 mg/mL for 48 h, but lower than that reported in Silva et al. [22], who reported mild larvicidal effects of matcha green tea extract (*C. sinensis*), with an LC-50 at 24 h of 0.4 mg/mL. In addition, they observed an increase in mortality with increasing concentration (up to 1000 $\mu\text{g/mL}$) of matcha green tea extract. The larvicidal effects of crude catechin and catechin hydrate on *A. salina* appeared to be weaker than that on *D. magna*. This is probably because *Daphnia* sp. is more sensitive to environmental toxicity than *Artemia* sp., as shown by Ivorra et al. [40] and de la Vega et al. [15]. Harwanto et al. [16] also reported higher mortality in *D. magna* than in *A. salina* when exposed to the same concentrations of crude phlorotannin or pure phlorotannin.

Crude catechin also impacted *L. sativa* germination and radicle growth. Germination was relatively higher at 1.0 mg/mL ($87.5 \pm 15.0\%$) but decreased with higher concentrations, with significant inhibition observed at 50.0 mg/mL, resulting in 0% germination. Radicle growth was optimal at 1.0 mg/mL (18.02 ± 3.42 mm) and minimal at 10.0 mg/mL (4.71 ± 1.03 mm). Catechin hydrate led to faster radicle growth at 0.1 mg/mL (29.75 ± 1.00 mm at 96 h). The germination rate decreased with increasing concentrations, with the highest rate at 0.5 mg/mL ($90.0 \pm 0.00\%$) and the lowest at 10.0 mg/mL ($33.3 \pm 15.3\%$) at 96 h. This pattern suggests that higher catechin levels exert an inhibitory effect on early plant development. However, despite prolonged exposure, both germination

rate and radical length remained elevated, indicating a potential resilience or adaptive physiological response in *L. sativa*, enabling partial recovery or continued growth even under suboptimal conditions. A previous study by Harwanto et al. [16] using phlorotannin and phloroglucinol showed lower survival rates for *L. sativa* compared to the present study, suggesting a lower toxicity of crude catechin and catechin hydrate. In this study, radical growth was slower for crude catechin but faster for catechin hydrate compared to phlorotannin and phloroglucinol.

Crude catechin inhibited the cell density of freshwater *C. vulgaris* at all tested concentrations after 24 h. At 48 h, the lowest concentration of catechin hydrate did not show significant changes. At 72 h, 0.5 mg/mL crude catechin and 0.05 and 0.1 mg/mL catechin hydrate increased cell density by 4.61%, 8.10% and 2.91%, respectively. This study found that *C. vulgaris* cell density decreased with increasing catechin concentration, indicating an inhibitory effect of catechin exposure. However, cell density continued to rise with longer exposure, suggesting a potential tolerance of *C. vulgaris* to catechin exposure. At the lowest catechin concentration, cell density was higher than in the control, indicating a potential stimulatory effect of catechin. Rashidinejad et al. [14] reported comparable results, showing that minimal doses of catechins can improve health, while higher doses can be toxic. Seawater *C. vulgaris* exposed to crude catechin and catechin hydrate showed similar patterns. Concentrations of 0.5 mg/mL crude catechin and 0.05 and 0.1 mg/mL catechin hydrate increased cell density by 2.61%, 5.92%, and 1.71%, respectively. A previous study by Harwanto et al. [16] also reported higher toxicity for phlorotannin and phloroglucinol compared to crude catechins and catechin hydrate. The results of the present study suggest that crude catechins and catechin hydrates can act as fertilizers at lower concentrations.

Catechins can induce oxidative stress by promoting the generation of reactive oxygen species (ROS), leading to cellular damage in various biological systems. This oxidative stress affects critical cellular components such as DNA, proteins, and lipids. In aquatic organisms like *D. magna* and *A. salina*, this oxidative stress may contribute to the observed toxicity, as both species serve as valuable models for assessing the overall cytotoxicity of compounds [15–19,21–24,27,40]. These crustaceans are commonly used to evaluate the potential toxic effects of chemicals, providing insights into the compound's impact on multiple biological systems within an organism. The primary target organs and tissues for catechins in *D. magna* and *A. salina* include the digestive system, nervous system, reproductive organs, and epidermal tissues. The effects of catechins on these organs suggest that they may disrupt a wide range of physiological processes, leading to broader systemic toxicity. The observed increase in mortality of *D. magna* and *A. salina* with increasing catechin concentration and exposure time in this study is strongly suspected to be associated with elevated levels of ROS, which are known to induce cellular damage across various biological systems [21–24,27,40]. This finding is consistent with previous studies demonstrating that ROS levels tend to rise in response to higher concentrations and prolonged exposure to a variety of chemical agents. Similar patterns of ROS-induced toxicity have been reported with exposure to nano-titanium dioxide [15], extract of matcha green tea [22], dental restoration materials [23], and extract of *Hyptis suaveolens* [24].

Catechin compounds exhibited a range of phytotoxic effects on *L. sativa* and *C. vulgaris* primarily through their interaction with ROS and their influence on cellular processes. These compounds can act as both protective agents and phytotoxins, depending on their concentration. As phytotoxins, catechins induce ROS production, leading to oxidative stress and cell death in plants and algae. In *L. sativa*, the root system is a primary target of phytotoxins, where catechins or other phytotoxic compounds induce ROS production, leading to root cell death and inhibition of root growth [31–34,41]. In *C. vulgaris*, phytotoxins primarily target body cells or newly developing cells, especially those involved in cell

division or growth processes [16,35,42]. Phytotoxins like those derived from catechins can induce ROS production, causing oxidative stress, damaging cell membranes, and ultimately disrupting cellular functions. They also affect chloroplasts, the main organelles responsible for photosynthesis, which can lead to cell death.

Research on the effects of catechins on aquatic organisms holds enormous potential to provide insights into how these natural compounds can impact aquatic ecosystems and environmental quality. Catechins are known for their various biological benefits, such as antioxidants, antimicrobial, and anti-inflammatory properties [1–8]. However, their effects on aquatic microorganisms, such as bacteria, algae, and protozoa, can vary significantly depending on the concentration, type of microorganism, and environmental quality. Some studies suggest that catechins have the potential to inhibit the growth of certain microorganisms, functioning as natural antimicrobial agents [22,39]. However, at certain concentrations, catechins may disrupt the microbial balance within the aquatic ecosystem, either by reducing microbial diversity or affecting specific populations crucial for biogeochemical cycles. This research demonstrates that crude catechins and catechin hydrate can influence the presence of zooplankton and algae, which are foundational to the aquatic food chain. Their impact on algae, whether through stimulating or inhibiting growth, affects oxygen production in the water and the stability of the aquatic ecosystem. A reduction in zooplankton populations could disrupt the ecological balance and decrease food availability for other organisms in the aquatic food web. The study also indicates that if catechins are applied in high concentrations or over extended periods [38,39], their effects on aquatic microorganisms may become more pronounced. If microorganisms beneficial to water quality, such as organic matter decomposers, are affected, it could interfere with processes like organic matter decomposition and nitrification, both of which are crucial for maintaining nutrient balance in aquatic environments.

It is important to note that further research is needed to better understand the bioaccumulation of catechins in the tissues of microorganisms, as well as the long-term impacts on aquatic microorganisms and the entire ecosystem. If catechins are used in large quantities, potential risks may include changes in the microbial community structure within aquatic environments, ultimately affecting the health and sustainability of the overall aquatic ecosystem. Additionally, the interactions between catechins and other pollutants or chemicals in the water need further exploration, as these compounds may have synergistic or antagonistic effects that could either exacerbate or improve environmental conditions.

4. Conclusions

This study demonstrates that the survival rate of zooplankton in both freshwater and seawater decreases with higher concentrations of and longer exposure times to catechin. In plants such as *L. sativa*, germination and radicle growth can still increase with extended catechin exposure, similar to the response in microalgae like *C. vulgaris*, which can increase its cell density even as catechin exposure time extends. *Chlorella vulgaris* can even grow faster than the control at low catechin concentrations, indicating a stimulatory effect of catechins. The use of *A. salina*, *D. magna*, *L. sativa*, and *C. vulgaris* in toxicity tests confirmed the larvicidal and inhibitory effects of various concentrations of crude catechins and catechin hydrate. Crude catechin and catechin hydrate were more larvicidal for *D. magna* than *A. salina*, while the inhibitory effect was greater in seawater *C. vulgaris* compared to freshwater *C. vulgaris*. The results of this study suggest that catechins, at appropriate concentrations, can function as fertilizers, enhancing the growth of terrestrial plants and microalgae.

5. Materials and Methods

5.1. Sample Preparation

Daphnia magna Straus were obtained from a local live feed breeder for fish. Adult *D. magna* were reared in a 2 L Erlenmeyer flask in the laboratory, with the rearing medium maintained at 25 ± 1.0 °C and aeration provided for oxygen supply. During rearing, *C. vulgaris* was provided daily as feed. *D. magna* neonates aged 24 h were harvested for use as test animals, following previous studies [16,43].

Dried brine shrimp eggs (*Artemia salina* L.; SWORM, Seoul, Republic of Korea) were placed in a 250 mL flask containing filtered seawater (32 ppt), with the density of dry brine shrimp eggs set at 1.0 g egg/L. The flasks were incubated at 20 °C with a constant light intensity of 40 $\mu\text{mol}/\text{m}^2/\text{s}$ and slight aeration. *Artemia salina* was harvested using a Pasteur pipette 24 h post-hatching for bioassays [16,27].

Lettuce seeds (*Lactuca sativa* L.; Korean cultivar, Hongbitjeokchimasangchu) were purchased from Danong Co., Ltd., Namyangju, Republic of Korea. Seeds were selected based on their intact profile, undamaged condition, and uniform size for growth and survival monitoring.

Chlorella vulgaris Beijerinck culture (FBCC-A49) was obtained from the Bioresources Culture Collection, Sangju, Republic of Korea, and divided into two portions for cultivation in freshwater and seawater (32 ppt) medium. A 250 mL Erlenmeyer flask containing 150 mL of Bold's Basal Medium (BBM) was used as the culture medium [35,42]. Dense cultures were diluted with new sterile BBM every four days to maintain exponential growth. Cultivation took place in a shaking incubator (VS-8480; KOLAB, Korea Science Ltd., Uiwang, Republic of Korea) at 150 rpm, 23.0 ± 1.0 °C, with a light: dark cycle of 14:10 and a light intensity of 4000 lx, under aseptic conditions to avoid contamination.

5.2. Catechin Hydrate and Catechin Extracts

Catechin hydrate with 98% purity (HPLC grade) was purchased from Sigma Aldrich, St. Louis, MO, USA. Crude catechins used in this study were extracted from food-grade semi-purified green tea extract powder (Anhui Redstar Pharmaceutical Corp., Ltd., Xuan, Anhui, China) following the method reported by Vuong et al. [44]. Briefly, green tea powder was extracted into a solvent, concentrated, separated, isolated, and dried to produce crude catechins in powder form for further analysis. Catechin hydrate and crude catechin extracts at different concentrations were used to treat *A. salina* nauplii, *D. magna* neonates, *L. sativa* seeds, and *C. vulgaris*. The determination of concentration was based on the preliminary experiments. Crude catechin showed a lower toxic level compared to catechin hydrate. The effects on each organism varied, as did the duration of exposure required. Based on these factors, the concentration applied to arthropods and the observation period differed from those applied to *L. sativa* and *C. vulgaris*.

5.3. HPLC Analysis

The catechin content in the green tea extract from Anhui Redstar Pharmaceutical Corporation was analyzed using a 2424 Evaporative Light Scattering (ELC) Detector integrated with an Alliance HPLC System (Waters Corp., Milford, MA, USA) and a Platinum EPS C18 reversed-phase column (53 $\times$ 7 mm, 1.5 μm) from Analytical (Flanders, NJ, USA). Standard catechin was sourced from Sigma Aldrich, St. Louis, MO, USA. The mobile phase comprised water and acetonitrile at an 87:13 ratio, with 0.05% (*v/v*) trifluoroacetic acid. Samples were filtered through a 0.20 μm syringe filter (Agilent Technologies, Inc., Santa Clara, CA, USA) prior to injection, and the mobile phase was filtered with a 0.45 μm membrane filter (Agilent Technologies) before use. Catechin detection was performed at

210 nm. The sample injection volume was set at 20 μ L with a flow rate of 1.0 mL/min, and results were quantified by comparing them with those of the standard solution.

5.4. *A. salina* and *D. magna* Lethality Test

The *A. salina* and *D. magna* were placed in 24-well plates modified to supply oxygen, based on a previous study by Harwanto et al. [16], as an external oxygen supply is necessary at high densities. The mortality test method for *D. magna* and *A. salina* in this study was based on previous similar studies [16,27,43], with slight modifications. The lethality test was performed to determine the toxic effects of exposure to crude catechins and catechin hydrate on *D. magna* and *A. salina*.

Twenty *D. magna* neonates were placed in each well containing 400 μ L of distilled freshwater media, while 20 *A. salina* nauplii were placed in each well containing 400 μ L of sterilized seawater media. Concentrations of crude catechins and catechin hydrate were 0.5, 1.0, 2.0, and 3.0 mg/mL for crude catechins and 0.01, 0.05, 0.1, and 0.5 mg/mL for catechin hydrate. Controls without crude catechin or catechin hydrate were also included. The media volume in each well was adjusted to 2 mL with freshwater or seawater [27]. Plates were maintained at 24 ± 1 °C. Survival rate observations were conducted at 24, 48, and 72 h. All experiments were repeated three times.

The survival rate was based on criteria specified by Kim and Choi [27] and Harwanto et al. [16]. *Daphnia magna* neonates and *A. salina* nauplii were considered dead if they showed no movement during observation. Concentration was classified as non-larvicide if the survival rate was >50%, mild larvicidal if >25% but <50%, highly larvicidal if <25%, and extremely larvicidal if no organisms survived.

5.5. *L. sativa* Germination Assays

The germination analysis followed the methods of Choi and Choi [41] and Harwanto et al. [16]. Filter papers with a diameter of 55 mm (Toyo Roshi Kaisha, Ltd., Tokyo, Japan) were placed in 6 cm-diameter sterile Petri dishes and treated with crude catechin or catechin hydrate at concentrations of 1.0, 10.0, and 50.0 mg/mL. The filter papers were then air-dried to ensure that the toxic properties were derived solely from the catechins absorbed on the filter paper.

Ten intact, uniform *L. sativa* seeds with no broken parts were evenly placed on each filter paper and saturated with 1% Tween 20 (L33109; Duksan Pure Chemicals, Ansan, Republic of Korea). Controls were treated with only 1% Tween 20 [45,46]. Since Tween 20 is non-toxic, it was utilized as a surfactant in this study [16]. The plates were placed in an incubator at 25 ± 1 °C in the dark, and germination rates and radicle length were recorded every 24 h for four days. Seeds were considered germinated when the radicle length was 1 mm long [16], measured by a digital caliper. The survival rate of the seeds was determined based on the percentage of germinated seeds.

5.6. Yield Inhibition Test of *C. vulgaris*

The yield inhibition test was based on previous studies by Qian et al. [35] and Xiong et al. [47], with slight modifications. *Chlorella vulgaris* was placed in 15 mL vials containing BBM medium with various concentrations of crude catechin (0.5, 1.0, and 2.0 mg/mL) or catechin hydrate (0.05, 0.1, 0.5, and 1.0 mg/mL). Control vials contained BBM solution without crude catechin or catechin hydrate. Each experiment was repeated three times. Vials were incubated for 72 h under aseptic conditions to avoid contamination. The optical density (OD) was evaluated at 24, 48, and 72 h at 680 nm (OD₆₈₀) using a SPECTROstar® Nano spectrophotometer (BMG LABTECH, Offenburg, Germany).

Cell density (cells/mL) was measured using a hemocytometer (HSU-0650010; Paul Marienfeld GmbH & Co. KG., Lauda-Königshofen, Germany), under a microscope.

Chlorella vulgaris with a high cell density was diluted to examine the association between optical density and cell density. The linear relationship between OD₆₈₀ and cell density was determined by Equation (1).

$$\text{Cell density} = [(\text{OD}_{680} + 0.0282)/0.0004] \times 10,000 \quad (R^2 = 0.9936) \quad (1)$$

The relationship between OD₆₈₀ and dry cell weight (DCW) was also determined following Equation (2) [16,35].

$$\text{DCW} = 0.1244 + 680 + 0.017 \quad (R^2 = 0.9908) \quad (2)$$

The yield inhibition rate (I_y ; %) was calculated following Equation (3), as reported by Xiong et al. [47].

$$\% I_y = ((N_c - N_t)/N_c) \times 100 \quad (3)$$

where N_c is the DCW in the control group and N_t is the DCW in the treatment group.

5.7. Statistical Analysis

Data are presented as mean $\pm$ standard deviation (S.D.) of three independent experiments ($n = 3$). Experimental results were checked for normality and homogeneity before performing the Student's t -test analysis. The t -test was used to compare each treatment group with the control group, with statistical significance set at $p < 0.05$. The LC-50, which is the effective toxicant concentration capable of killing 50% of the organisms, was determined using probit analysis. This involved deriving the LC-50 value through regression of the exposed solution concentration against the percentage of organism mortality [48].

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Abbreviations

The following abbreviations are used in this manuscript:

LC-50	Lethal concentration 50, the effective toxicant concentration capable of killing 50% of the organisms
DCW	Dry cell weight
OD	Optical density
BBM	Bold's Basal Medium
HPLC	High-performance liquid chromatography
EC	Epicatechin
EGC	Epigallocatechin
ECG	Epicatechin gallate

EGCG Epigallocatechin gallate

References

- Fathima, A.; Rao, J.R. Selective toxicity of catechin—A natural flavonoid towards bacteria. *Appl. Microbiol. Biotechnol.* **2016**, *100*, 6395–6402. [\[CrossRef\]](#) [\[PubMed\]](#)
- Al-Hazzani, A.A.; Alshatwi, A.A. Catechin hydrate inhibits proliferation and mediates apoptosis of SiHa human cervical cancer cells. *Food Chem. Toxicol.* **2011**, *49*, 3281–3286. [\[CrossRef\]](#) [\[PubMed\]](#)
- Kaur, R.; Rajput, R.; Nag, P.; Kumar, S.; Singh, M. Synthesis, characterization and evaluation of antioxidant properties of catechin hydrate nanoparticles. *J. Drug Deliv. Sci. Technol.* **2017**, *39*, 398–407. [\[CrossRef\]](#)
- Muzolf-Panek, M.; Gliszczynska-Świągło, A.; Szymusiak, H.; Tyrakowska, B. The influence of stereochemistry on the antioxidant properties of catechin epimers. *Eur. Food Res. Technol.* **2012**, *235*, 1001–1009. [\[CrossRef\]](#)
- Kim, J.M.; Heo, H.J. The roles of catechins in regulation of systemic inflammation. *Food Sci. Biotechnol.* **2022**, *31*, 957–970. [\[CrossRef\]](#)
- Scalia, S.; Marchetti, N.; Bianchi, A. Comparative evaluation of different co-antioxidants on the photochemical- and functional-stability of epigallocatechin-3-gallate in topical creams exposed to simulated sunlight. *Molecules* **2013**, *18*, 574–587. [\[CrossRef\]](#)
- Sentkowska, A. Content of selenoaminoacids and catechins in Chinese green teas. *Eur. Food Res. Technol.* **2021**, *247*, 613–622. [\[CrossRef\]](#)
- Senanayake, S.P.J.N. Green tea extract: Chemistry, antioxidant properties and food applications—A review. *J. Funct. Foods* **2013**, *5*, 1529–1541. [\[CrossRef\]](#)
- Chan, P.T.; Fong, P.; Cheung, Y.L.; Huang, Y.; Kwok, W.; Ho, K.; Chen, Z.-Y. Biochemical and molecular action of nutrients jasmine green tea epicatechins are hypolipidemic in hamsters (*Mesocricetus auratus*) fed a high fat diet. *J. Nutr.* **1999**, *129*, 1094–1101. [\[CrossRef\]](#)
- Nagao, T.; Meguro, S.; Soga, S.; Otsuka, A.; Tomonobu, K.; Fumoto, S.; Chikama, A.; Mori, K.; Yuzawa, M.; Watanabe, H.; et al. Tea catechins suppress accumulation of body fat in humans. *J. Oleo Sci.* **2001**, *5*, 717–728. [\[CrossRef\]](#)
- Nagao, T.; Komine, Y.; Soga, S.; Meguro, S.; Hase, T.; Tanaka, Y.; Tokimitsu, I. Ingestion of a tea rich in catechins leads to a reduction in body fat and malondialdehyde-modified LDL in men. *Am. J. Clin. Nutr.* **2005**, *81*, 122–129. [\[CrossRef\]](#) [\[PubMed\]](#)
- Nagao, T.; Hase, T.; Tokimitsu, I. A green tea extract high in catechins reduces body fat and cardiovascular risks in humans. *Obesity* **2007**, *15*, 1473–1483. [\[CrossRef\]](#) [\[PubMed\]](#)
- Fang, Z.; Zhao, J.; Li, Y.; Wang, Y.; Qiu, T.; Wu, Y.; Dong, W.; Mailhot, G. Improving Fenton-like system with catechin, an environmental-friendly polyphenol: Effects and mechanism. *Chem. Eng. J.* **2021**, *426*, 127946. [\[CrossRef\]](#)
- Rashidinejad, A.; Boostani, S.; Babazadeh, A.; Rehman, A.; Rezaei, A.; Akbari-Alavijeh, S.; Shaddel, R.; Jafari, S.M. Opportunities and challenges for the nanodelivery of green tea catechins in functional foods. *Food Res. Int.* **2001**, *142*, 110186. [\[CrossRef\]](#)
- De la Vega, A.C.S.; Cruz-Alcalde, A.; Mazón, C.S.; Martí, C.B.; Diaz-Cruz, M.S. Nano-TiO₂ phototoxicity in fresh and seawater: *Daphnia magna* and *Artemia* sp. as proxies. *Water* **2021**, *13*, 55. [\[CrossRef\]](#)
- Harwanto, D.; Negara, B.F.S.P.; Tirtawijaya, G.; Meinita, M.D.N.; Choi, J.S. Evaluation of toxicity of crude phlorotannins and phloroglucinol using different model organisms. *Toxins* **2022**, *14*, 312. [\[CrossRef\]](#)
- Fuertes, I.; Piña, B.; Barata, C. Changes in lipid profiles in *Daphnia magna* individuals exposed to low environmental levels of neuroactive pharmaceuticals. *Sci. Total Environ.* **2020**, *733*, 139029. [\[CrossRef\]](#)
- Szabelak, A.; Bownik, A. Behavioral and physiological responses of *Daphnia magna* to salicylic acid. *Chemosphere* **2021**, *270*, 128660. [\[CrossRef\]](#)
- Adamczuk, M. Environmentally realistic concentrations of ibuprofen influence life histories but not population dynamics of *Daphnia magna*. *Sci. Total Environ.* **2022**, *848*, 157783. [\[CrossRef\]](#)
- Cristóvão, M.B.; Bernardo, J.; Bento-Silva, A.; Ressureição, M.; Bronze, M.R.; Crespo, J.G.; Pereira, V.J. Treatment of anticancer drugs in a real wastewater effluent using nanofiltration: A pilot scale study. *Sep. Purif. Technol.* **2022**, *288*, 1206565. [\[CrossRef\]](#)
- Tkaczyk, A.; Bownik, A.; Dudka, J.; Kowal, K.; Ślaska, B. *Daphnia magna* model in the toxicity assessment of pharmaceuticals: A review. *Sci. Total Environ.* **2021**, *763*, 143038. [\[CrossRef\]](#) [\[PubMed\]](#)
- Silva, T.M.; Fracasso, D.S.; Visentin, A.P.V.; Cassini, C.; Scariot, F.J.; Danetti, S.; Echeverrigaray, S.; Moura, S.; Touguinha, L.B.; Branco, C.S.; et al. Dual effect of the herbal matcha green tea (*Camellia sinensis* L. Kuntze) supplement in EA.hy926 endothelial cells and *Artemia salina*. *J. Ethnopharmacol.* **2022**, *298*, 115564. [\[CrossRef\]](#) [\[PubMed\]](#)
- Milhem, M.M.; Al-Hiyasat, A.S.; Darmani, H. Toxicity testing of restorative dental materials using brine shrimp larvae (*Artemia salina*). *J. Appl. Oral Sci.* **2008**, *16*, 297–301. [\[CrossRef\]](#) [\[PubMed\]](#)
- Bezerra, J.W.A.; Costa, A.R.; da Silva, M.A.P.; Rocha, M.I.; Boligon, A.A.; da Rocha, J.B.T.; Barros, L.M.; Kamdem, J.P. Chemical composition and toxicological evaluation of *Hyptis suaveolens* (L.) Poiteau (LAMIACEAE) in *Drosophila melanogaster* and *Artemia salina*. *S. Afr. J. Bot.* **2017**, *113*, 437–442. [\[CrossRef\]](#)

25. Minello, L.; Mattiello, G.S.; Cassini, C.; Touguinha, L.A.; Paim, L.F.; Moura, S.; Salvador, M.; Branco, C.S. Chemical characterization, in vivo safety profile and effects of the extract from unconventional food plant *Acca sellowiana* (O. Berg) Burret on endothelial cells under glucose overload. *J. Pharm. Biomed. Anal.* **2024**, *248*, 116304. [\[CrossRef\]](#)
26. Oliveira, M.A.; dos Santos, C.A.L.; da Silva Teles, B.R.; Oliveira, C.V.B.; da Silva, V.B.; Pereira, A.L.G.; Rodrigues, V.L.C.; Fonseca, V.J.A.; dos Santos Santana, M.; Lima, C.M.G.; et al. Chemical composition, antifungal activity and toxicological evaluation of *Lippia sidoides* Cham. *J. Agric. Food Res.* **2024**, *18*, 101333. [\[CrossRef\]](#)
27. Kim, Y.D.; Choi, J.-S. Larvicidal effects of Korean seaweed extracts on brine shrimp *Artemia salina*. *J. Anim. Plant Sci.* **2017**, *27*, 1039–1046.
28. Balamurugan, V.; Ragavendran, C.; Arulbalachandran, D.; Alrefaei, A.F.; Rajendran, R. Green synthesis of silver nanoparticles using *Pandanus tectorius* aerial root extract: Characterization, antibacterial, cytotoxic, and photocatalytic properties, and ecotoxicological assessment. *Inorg. Chem. Commun.* **2024**, *168*, 112882. [\[CrossRef\]](#)
29. Tigre, R.C.; Silva, N.H.; Santos, M.G.; Honda, N.K.; Falcão, E.P.S.; Pereira, E.C. Allelopathic and bioherbicidal potential of *Cladonia verticillaris* on the germination and growth of *Lactuca sativa*. *Ecotoxicol. Environ. Saf.* **2012**, *84*, 125–132. [\[CrossRef\]](#)
30. Bertan, A.S.; Teles, A.G.D.X.; de Oliveira, B.C.T.; Ferreira, L.M.R.; Thiel, N.A.; Fieira, C.; Chiarello, M.; Manosso, F.C.; Pokrywiecki, J.C.; Tonial, I.B.; et al. Influence of the seasons on the water quality of the Marmeleiro River (Paraná, Brazil) using different bioindicators. *Discov. Appl. Sci.* **2020**, *2*, 1825. [\[CrossRef\]](#)
31. Guzmán-Morales, A.R.; Cruz-La Paz, O.; Valdés-Carmenate, R.; Valdés-Hernández, P.A. Evaluation of heavy metal contamination and accumulation in lettuce (*Lactuca sativa* L.) plants. *Cult. Trop.* **2021**, *42*, e03.
32. Izquierdo-Díaz, M.; Hansen, V.; Barrio-Parra, F.; De Miguel, E.; You, Y.; Magid, J. Assessment of lettuces grown in urban areas for human consumption and as bioindicators of atmospheric pollution. *Ecotoxicol. Environ. Saf.* **2023**, *256*, 114883. [\[CrossRef\]](#) [\[PubMed\]](#)
33. De Moura, D.R.; Araujo, E.C.G.; Borges, C.H.A.; Araujo, L.H.B.; de Lima, T.V.; Silva, T.C.; da Nobrega, C.C. Allelopathic effects of aqueous extracts from *Bambusa vulgaris* Schrad. Ex J. C. Wendl. on seed germination and vigor from *Lactuca sativa*. *Afr. J. Agric. Res.* **2018**, *13*, 1954–1958.
34. Souza, M.M.V.; Souza, A.D.V.; Rodrigues, A.A.; Batista, P.F.; Castro, S.T.; Silva, I.M.H.L.; Jakelaitis, A.; Costa, A.C.; Sales, J.F. The allelopathic effects of aqueous *Talinum triangulare* (Jacq.) wild extracts on the development of *Lactuca sativa* L. seedlings. *Braz. J. Biol.* **2024**, *84*, e279983. [\[CrossRef\]](#)
35. Qian, L.; Qi, S.; Cao, F.; Zhang, J.; Zhao, F.; Li, C.; Wang, C. Toxic effects of boscalid on the growth, photosynthesis, antioxidant system and metabolism of *Chlorella vulgaris*. *Environ. Pollut.* **2018**, *242*, 171–181. [\[CrossRef\]](#)
36. Hu, J.; Webster, D.; Cao, J.; Shao, A. The safety of green tea and green tea extract consumption in adults—Results of a systematic review. *Regul. Toxicol. Pharmacol.* **2018**, *95*, 412–433. [\[CrossRef\]](#)
37. Chobot, V.; Huber, C.; Trettenhahn, G.; Hadacek, F. (±)-Catechin: Chemical weapon, antioxidant, or stress regulator? *J. Chem. Ecol.* **2009**, *35*, 980–996. [\[CrossRef\]](#)
38. Ahmad, N.; Ahmad, R.; Alrasheed, R.A.; Almatar, H.M.A.; Al-Ramadan, A.S.; Amir, M.; Sarafroz, M. Quantification and evaluations of catechin hydrate polymeric nanoparticles used in brain targeting for the treatment of epilepsy. *Pharmaceutics* **2020**, *12*, 203. [\[CrossRef\]](#)
39. Rodrigues, M.J.; Neves, V.; Martins, A.; Rauter, A.P.; Neng, N.R.; Nogueira, J.M.F.; Varela, J.; Barreira, L.; Custódio, L. In vitro antioxidant and anti-inflammatory properties of *Limonium algarvense* flowers' infusions and decoctions: A comparison with green tea (*Camellia sinensis*). *Food Chem.* **2016**, *200*, 322–329. [\[CrossRef\]](#)
40. Ivorra, L.; Cardoso, P.G.; Chan, S.K.; Tagulao, K.; Cruzeiro, C. Environmental characterization of 4,4'-dichlorobenzophenone in surface waters from Macao and Hong Kong coastal areas (Pearl River Delta) and its toxicity on two biological models: *Artemia salina* and *Daphnia magna*. *Ecotoxicol. Environ. Saf.* **2019**, *171*, 1–11. [\[CrossRef\]](#)
41. Choi, J.-S.; Choi, I.S. Inhibitory effect of marine green algal extracts on the germination of *Lactuca sativa* seeds. *J. Environ. Biol.* **2016**, *37*, 207–213. [\[PubMed\]](#)
42. Xiong, J.Q.; Kurade, M.B.; Jeon, B.H. Biodegradation of levofloxacin by an acclimated freshwater microalga, *Chlorella vulgaris*. *Chem. Eng. J.* **2017**, *313*, 1251–1257. [\[CrossRef\]](#)
43. Na, J.; Kim, Y.; Song, J.; Shim, T.; Cho, K.; Jung, J. Evaluation of the combined effect of elevated temperature and cadmium toxicity on *Daphnia magna* using a simplified DEBtox model. *Environ. Pollut.* **2021**, *291*, 118250. [\[CrossRef\]](#) [\[PubMed\]](#)
44. Vuong, Q.V.; Golding, J.B.; Nguyen, M.; Roach, P.D. Extraction and isolation of catechins from tea. *J. Sep. Sci.* **2010**, *33*, 3415–3428. [\[CrossRef\]](#)
45. Vinayak, R.C.; Sudha, S.A.; Chatterji, A. Bio-screening of a few green seaweeds from India for their cytotoxic and antioxidant potential. *J. Sci. Food Agric.* **2011**, *91*, 2471–2476. [\[CrossRef\]](#)
46. Kang, S.M.; Khan, A.L.; Hussain, J.; Ali, L.; Kamran, M.; Waqas, M.; Lee, I.J. Rhizonin A from *Burkholderia* sp. KCTC11096 and its growth promoting role in lettuce seed germination. *Molecules* **2012**, *17*, 7980–7988. [\[CrossRef\]](#)

47. Xiong, J.Q.; Kurade, M.B.; Abou-Shanab, R.A.I.; Ji, M.K.; Choi, J.; Kim, J.O.; Jeon, B.H. Biodegradation of carbamazepine using freshwater microalgae *Chlamydomonas mexicana* and *Scenedesmus obliquus* and the determination of its metabolic fate. *Bioresour. Technol.* **2016**, *205*, 183–190. [[CrossRef](#)]
48. Beula, M.; Ravikumar, S.; Ali, M.S. Mosquito larvicidal efficacy of seaweed extracts against dengue vector of *Aedes aegypti*. *Asian Pac. J. Trop. Biomed.* **2011**, *1*, S143–S146. [[CrossRef](#)]

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Emerging Mycotoxins in Aquaculture: Current Insights on Toxicity, Biocontrol Strategies, and Occurrence in Aquafeed and Fish (/2072-6651/17/7/356)

by **Patrizio Lorusso, Giusy Rusco, Alessio Manfredi, Nicolaia Iaffaldano, Angela Di Pinto and Elisabetta Bonerba**

Toxins **2025**, *17*(7), 356; <https://doi.org/10.3390/toxins17070356> (<https://doi.org/10.3390/toxins17070356>) - 17 Jul 2025

Abstract Mycotoxins are secondary metabolites produced by various fungal species that can contaminate food and feed, posing significant risks to human and animal health. In aquaculture, the replacement of fishmeal with alternative protein sources has increased the risk of mycotoxin contamination, becoming a major [...]

(This article belongs to the Special Issue [Risk Assessment of Mycotoxins: Challenges and Emerging Threats \(/journal/toxins/special_issues/S18IFJ789U\)](#))

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Translational Impact of Genetics and Epigenetics of CGRP System on Chronic Migraine Treatment with Onabotulinumtoxin A and Other Biotech Drugs (/2072-6651/17/7/355)

by **Damiana Scuteri and Paolo Martelletti**

Toxins **2025**, *17*(7), 355; <https://doi.org/10.3390/toxins17070355> (<https://doi.org/10.3390/toxins17070355>) - 17 Jul 2025

Abstract Migraine is a neurovascular paroxysmal disorder characterized by neurogenic inflammation and has a remarkable impact on the quality of life. The Food and Drug Administration (FDA) approved onabotulinumtoxin A in 2010 for the prophylactic treatment of chronic migraine. Today, in its 4th decade, [...]

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Isolation of a Novel *Streptomyces* sp. TH05 with Potent Cyanocidal Effects on *Microcystis aeruginosa* (/2072-6651/17/7/354)

by **Xuhan Wang, Siqi Zhu, Shenchao Tao, Shaoyong Zhang, Ruijun Wang and Liqin Zhang**

Toxins **2025**, *17*(7), 354; <https://doi.org/10.3390/toxins17070354> (<https://doi.org/10.3390/toxins17070354>) - 17 Jul 2025

Abstract In this paper, cultivable actinobacteria were isolated, cultured, and identified from the heavily algal-bloomed waters of Taihu Lake using 16S rRNA gene sequencing. Among the isolates, a single strain exhibiting vigorous cyanocidal activity against *Microcystis aeruginosa* FACHB-905 was selected for further investigation. The [...]

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Explaining *Echis*: Proteotranscriptomic Profiling of *Echis carinatus carinatus* Venom (/2072-6651/17/7/353)

by **Salil Javed, Prasad Gopalkrishna Gond, Arpan Samanta, Ajinkya Unawane, Muralidhar Nayak Mudavath, Anurag Jaglan and Kartik Sunagar**

Toxins **2025**, *17*(7), 353; <https://doi.org/10.3390/toxins17070353> (<https://doi.org/10.3390/toxins17070353>) - 16 Jul 2025

Abstract Snakebite remains the most neglected tropical disease globally, with India experiencing the highest rates of mortality and morbidity. While most envenomation cases in India are attributed to the 'big four' snakes, research has predominantly focused on Russell's viper (*Daboia russelii*). [...]

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The Venom Proteome of the Ecologically Divergent Australian Elapid, Southern Death Adder *Acanthophis antarcticus* (/2072-6651/17/7/352)

by **Theo Tasoulis, C. Ruth Wang, Shaun Ellis, Tara L. Pukala, Joanna Sumner, Kate Murphy, Nathan Dunstan and Geoffrey K. Isbister**

Toxins **2025**, *17*(7), 352; <https://doi.org/10.3390/toxins17070352> (<https://doi.org/10.3390/toxins17070352>) - 14 Jul 2025

Abstract The composition of Australian snake venoms is the least well-known of any continent. We characterised the venom proteome of the southern death adder *Acanthophis antarcticus*—one of the world's most morphologically and ecologically divergent elapids. Using a combined bottom-up proteomic and venom gland [...]

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Assessing the Use of BotulinumtoxinA for Hyperactive Urinary Tract Dysfunction a Decade After Approval ([./2072-6651/17/7/351](#))

by Heinrich Schulte-Baukloh

Toxins **2025**, *17*(7), 351; <https://doi.org/10.3390/toxins17070351> (<https://doi.org/10.3390/toxins17070351>) - 13 Jul 2025

Abstract Botulinum toxin was approved by the Food and Drug Administration in 2011 for neurogenic bladder and in 2013 for idiopathic overactive bladder (OAB) [...] [Full article](#) ([./2072-6651/17/7/351](#))

(This article belongs to the Special Issue [Botulinum Toxin for Urinary Tract Disease: After a Decade from Approval](#) ([./journal/toxins/special_issues/07648BYB32](#)))

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Intramuscular Botulinum Toxin for Complex Regional Pain Syndrome: A Narrative Review of Published Cases ([./2072-6651/17/7/350](#))

by Marc Klee, Nilkolaj Ia Cour Karottki and Bo Biering-Sørensen

Toxins **2025**, *17*(7), 350; <https://doi.org/10.3390/toxins17070350> (<https://doi.org/10.3390/toxins17070350>) - 11 Jul 2025

Abstract Background: Since the 1980s, numerous case reports have explored the use of intramuscular botulinum toxin (BoNT) for Complex Regional Pain Syndrome (CRPS), with significant variation in rationale, dosing, guidance techniques, and outcome measures. This narrative review aims to summarize published evidence on the [...] [Read more](#).

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Efficacy and Safety of Letibotulinum Toxin A for the Treatment of Melasma in Two Different Dilutions: A Randomized Double-Blind Split-Face Study ([./2072-6651/17/7/349](#))

by Juthapa Pongklaokam, Woraphong Manuskiatti, Rungsima Wanitphakdeedecha, Pitchaya Maneeprasopchoke, Panwadee Thongjaroensirikul, Yanin Nokdhes, Rona Maria R. Abad-Constantino, Woramate Bhorntarakcharoen, Sariya Sittivanaruk and Thanya Techapichetvanich

Toxins **2025**, *17*(7), 349; <https://doi.org/10.3390/toxins17070349> (<https://doi.org/10.3390/toxins17070349>) - 11 Jul 2025

Abstract Background: Melasma is an acquired hyperpigmentation disorder with multifactorial etiologies and limited response to conventional therapies. Recent evidence suggests that Botulinum Toxin A (BoNT-A) may modulate ultraviolet (UV)-induced pigmentation and offer therapeutic benefits. Objective: We sought to evaluate the efficacy and safety of [...] [Read more](#).

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Recent Advancements in Lateral Flow Assays for Food Mycotoxin Detection: A Review of Nanoparticle-Based Methods and Innovations ([./2072-6651/17/7/348](#))

by Gayathree Thenuwara, Perveen Akhtar, Bilal Javed, Baljit Singh, Hugh J. Byrne and Furong Tian

Toxins **2025**, *17*(7), 348; <https://doi.org/10.3390/toxins17070348> (<https://doi.org/10.3390/toxins17070348>) - 11 Jul 2025

Abstract Mycotoxins are responsible for a multitude of diseases in both humans and animals, resulting in significant medical and economic burdens worldwide. Conventional detection methods, such as enzyme-linked immunosorbent assay (ELISA), high-performance liquid chromatography (HPLC), and liquid chromatography-tandem mass spectrometry (LC-MS/MS), are highly effective, [...] [Read more](#).

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Differentiating Zeranol Implant Abuse and *Fusarium* spp. Toxin-Contaminated Corn Intake by Detection and Quantification of Resorcylic Acid Lactones in Bovine Urine [\(/2072-6651/17/7/347\)](https://pub.mdpi-res.com/toxins/toxins-17-00347/article_deploy/html/images/toxins-17-00347-ag-550.jpg?1752232124)

by Rafael Silva Gomes, Vanessa Gonçalves dos Santos, Carlos Juliano da Silva, Amanda Martinez Nagato Simões, Eliene Alves dos Santos, Mary Ane Gonçalves Lana, Kelly Moura Keller, Marco Blokland, Ane Arrizabalaga-Larrañaga, Rafael Romero Nicolino, Marcelo Resende de Souza, Tadeu Chaves de Figueiredo, Saskia Sterk and Silvana de Vasconcelos Cançado

Toxins **2025**, *17*(7), 347; <https://doi.org/10.3390/toxins17070347> (<https://doi.org/10.3390/toxins17070347>) - 11 Jul 2025

Abstract Resorcylic acid lactones (RALs) are fungal metabolites with known biological activity. Zeranol, a synthetic RAL, has been used as an estrogenic growth promoter in cattle; however, its use is prohibited in several countries. Zearalenone, a mycotoxin produced by *Fusarium* spp., is commonly found [...][Read more](#).

(This article belongs to the Section [Mycotoxins](#) ([/journal/toxins/sections/mycotoxins](#)))

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Biodegradation of Microcystins by Aquatic Bacteria *Klebsiella* spp. Isolated from Lake Kasumigaura [\(/2072-6651/17/7/346\)](https://pub.mdpi-res.com/toxins/toxins-17-00346/article_deploy/html/images/toxins-17-00346-g001-550.jpg?1752479132)

by Thida Lin, Kazuya Shimizu, Tianxiao Liu, Qintong Li and Motoo Utsumi

Toxins **2025**, *17*(7), 346; <https://doi.org/10.3390/toxins17070346> (<https://doi.org/10.3390/toxins17070346>) - 10 Jul 2025

Abstract Microcystins (MCs) are the most toxic and abundant cyanotoxins found in natural waters during harmful cyanobacterial blooms. These toxins pose a significant threat to plant, animal, and human health due to their toxicity. Degradation of MCs by MC-degrading bacteria is a promising method [...][Read more](#).

(This article belongs to the Section [Marine and Freshwater Toxins](#) ([/journal/toxins/sections/marine_and_freshwater](#)))

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Increased Cardiovascular Mortality in Hemodialysis: The Role of Chronic Inflammation, Complement Activation, and Non-Biocompatibility [\(/2072-6651/17/7/345\)](https://pub.mdpi-res.com/toxins/toxins-17-00345/article_deploy/html/images/toxins-17-00345-g001-550.jpg?1752137706)

by Ákos Géza Pethő, Tibor Fülöp, Petronella Orosz, Gábor Szénási, Mihály Tapolyai and László Dézsi

Toxins **2025**, *17*(7), 345; <https://doi.org/10.3390/toxins17070345> (<https://doi.org/10.3390/toxins17070345>) - 10 Jul 2025

Abstract Background: Chronic kidney disease (CKD) is an established global health problem, with the increased prevalence of vascular inflammation, accelerated atherogenesis, and thrombotic risk all contributing to overall cardiovascular risk. The major CKD-specific risk factor is presumed to be the accumulation of uremic toxins [...][Read more](#).

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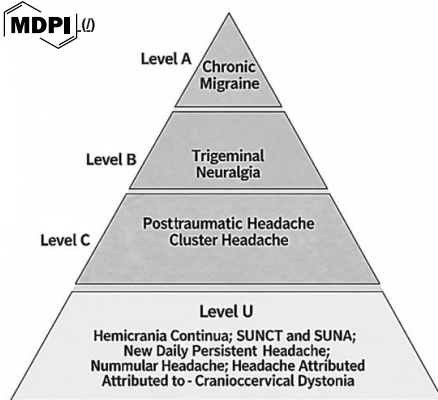
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[Uses of Botulinum Toxin in Headache and Facial Pain Disorders: An Update \(/2072-6651/17/7/314\)](#)

by **[Pedro Augusto Sampaio Rocha-Filho \(/search?authors=Pedro%20Augusto%20Sampaio%20Rocha-Filho&orcid=0000-0001-5725-2637\)](#)** et al.

Toxins **2025**, *17*(7), 314; <https://doi.org/10.3390/toxins17070314> (<https://doi.org/10.3390/toxins17070314>)

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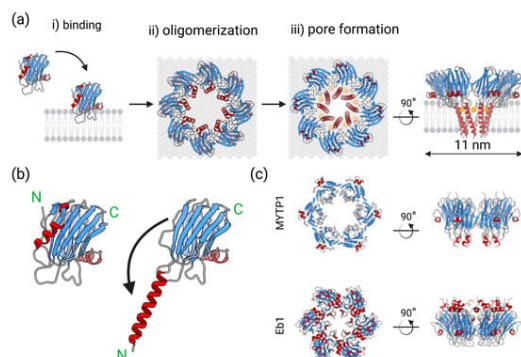
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by **Matija Ruparčič** (/search?authors=Matija%20Rupar%C4%8Di%C4%8D&orcid=0009-0009-8412-6295) et al.

Toxins **2025**, *17*(6), 291; <https://doi.org/10.3390/toxins17060291> (<https://doi.org/10.3390/toxins17060291>)

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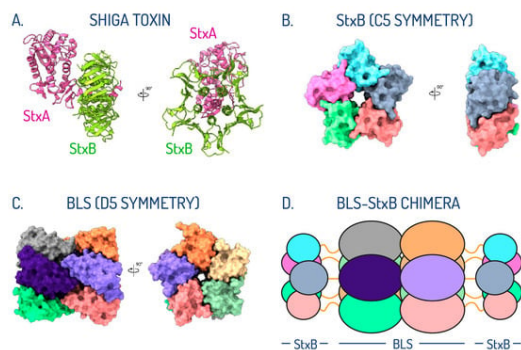
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Toxins **2025**, *17*(6), 282; <https://doi.org/10.3390/toxins17060282> (<https://doi.org/10.3390/toxins17060282>)

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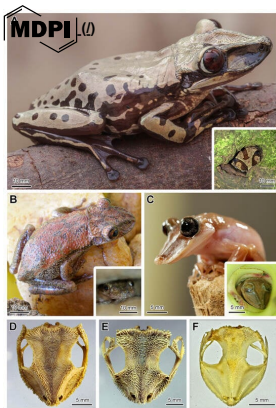
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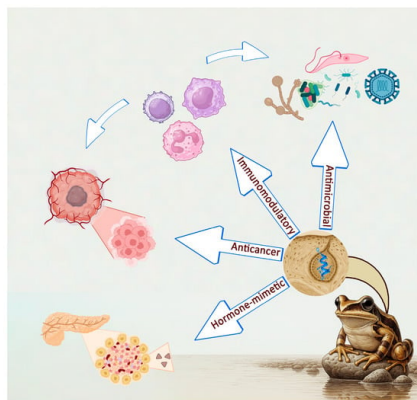
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The Therapeutic Potential of Antimicrobial Peptides Isolated from the Skin Secretions of Anurans of the Genus *Boana* in the Face of the Global Antimicrobial Resistance Crisis (/2072-6651/17/7/312)

by **Priscila Mendes Ferreira** (/search?authors=Priscila%20Mendes%20Ferreira&orcid=) et al.

Toxins **2025**, *17*(7), 312; <https://doi.org/10.3390/toxins17070312> (<https://doi.org/10.3390/toxins17070312>)

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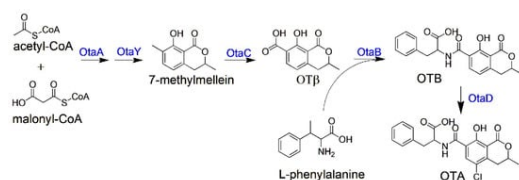
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by **Lin Chen** (/search?authors=Lin%20Chen&orcid=) et al.

Toxins **2025**, *17*(6), 311; <https://doi.org/10.3390/toxins17060311> (<https://doi.org/10.3390/toxins17060311>)

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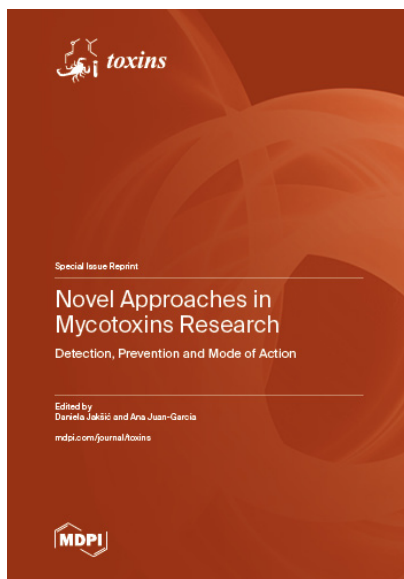
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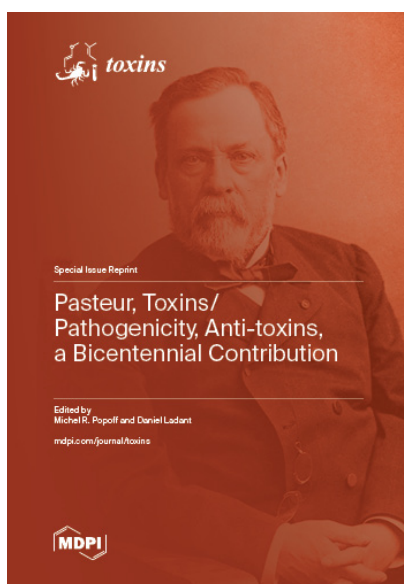
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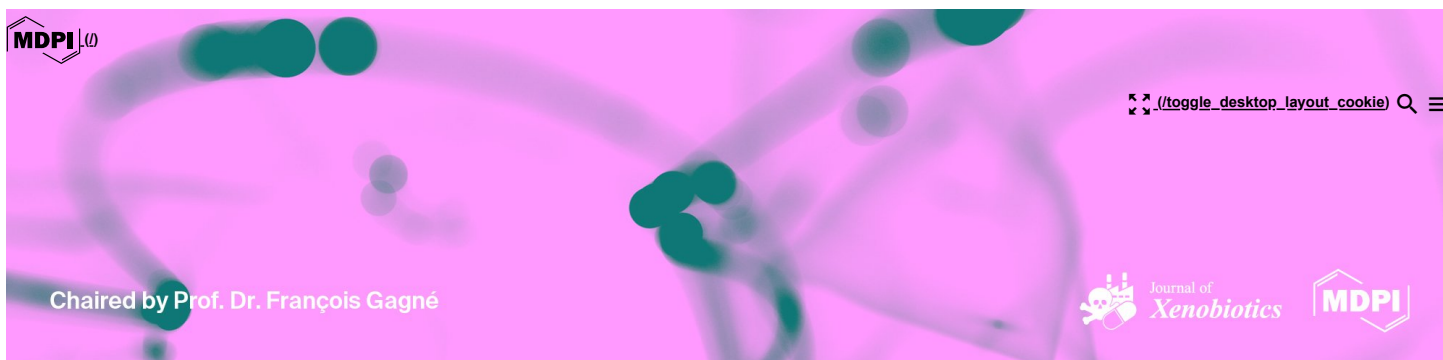
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Toxins **2025**, *17*(2), 94; <https://doi.org/10.3390/toxins17020094> (<https://doi.org/10.3390/toxins17020094>)

Report from the 29th Meeting on Toxinology, "Toxins: From the Wild to the Lab", Organized by the French Society of Toxinology on 30 November–1 December 2023
(/2072-6651/16/3/147)

Toxins **2024**, *16*(3), 147; <https://doi.org/10.3390/toxins16030147> (<https://doi.org/10.3390/toxins16030147>)

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[Website \(https://med.virginia.edu/faculty/faculty-listing/jwf8x/\)](https://med.virginia.edu/faculty/faculty-listing/jwf8x/)

Editor-in-Chief

Department of Microbiology, University of Virginia, Charlottesville, VA, USA

Interests: snake venom metalloproteinases; SVMPs; ADAMs; disintegrins; pathophysiology/histology; hemorrhagic toxins; coagulopathy; disintegrin-like/cysteine-rich domains

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Dr. Andrea Bolognesi *

[Website \(https://orcid.org/0000-0001-7497-4586\)](https://orcid.org/0000-0001-7497-4586)

Section Editor-in-Chief

Department of Medical and Surgical Sciences-DIMEC, General Pathology Section, Alma Mater Studiorum University of Bologna, 40126 Bologna, Italy

Interests: Xanthine oxidoreductase; oxidative stress; uric acid; nitric oxide; cytotoxicity; plant toxin; rRNA glycosylase; immunotoxin; targeted therapy; anti-tumour therapy

* Section: Plant Toxins

Special Issues, Collections and Topics in MDPI journals



Dr. Bryan Grieg Fry *

[Website \(https://about.uq.edu.au/experts/540\)](https://about.uq.edu.au/experts/540)

Section Editor-in-Chief

Adaptive Biotoxicology Lab, School of the Environment, University of Queensland, St Lucia, QLD 4072, Australia

Interests: venom molecular evolution; phylogenetics and structure–function relationships; toxins

* Section: Animal Venoms

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Antonio Moretti *

Website1 (<http://www.ispacnr.it/organico/>) **Website2** (<http://www.cnr.it/people/antonio.moretti>)

Section Editor-in-Chief

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Institute of Science of Food Production (ISPA), National Research Council (CNR), Via Amendola 122/O,
70126 Bari, BA, Italy

Interests: plant pathology; mycology; fungal genetics; mycotoxicology; mycotoxins; food microbiology; food safety

* Section: Mycotoxins

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Michel R. Popoff *

Website (<https://www.researchgate.net/profile/Michel-Popoff>)

Section Editor-in-Chief

Unité des Toxines Bactériennes, Institut Pasteur, Université Paris Cité, CNRS UMR 2001 INSERM U1306,
F-75015 Paris, France

Interests: bacterial, botulinum, clostridial, and pore-forming toxins; cellular uptake; interactions with actin cytoskeleton; passage through epithelial barrier; regulation of synthesis; Rho-GTPases

* Section: Bacterial Toxins

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Raymond Vanholder *

Website1 (<https://biblio.ugent.be/person/801000337335>) **Website2** (<https://orcid.org/0000-0003-2633-1636>)

Section Editor-in-Chief

Nephrology Section, 0K12, Department of Internal Medicine, Ghent University Hospital, 9000 Ghent,
Belgium

Interests: uremia; chronic kidney disease; hemodialysis; adequacy of dialysis; acute kidney injury

* Section: Uremic Toxins

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Vitor Vasconcelos *

Website (<https://orcid.org/0000-0003-3585-2417>)

Section Editor-in-Chief

1. Faculdade de Ciências da Universidade do Porto, 4169-007 Porto, Portugal

2. CIIMAR, Interdisciplinary Centre of Marine and Environmental Research of the University of Porto,
4450-208 Porto, Portugal

Interests: cyanobacteria; toxins; cyanotoxins; marine biotechnology; secondary metabolites; cyanobacterial bloom; mycotoxicology; environmental contamination

* Section: Marine and Freshwater Toxins

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**Dr. Rish Dutertre ***

Website (<https://orcid.org/0000-0002-2945-1484>)

Associate Editor

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Institut des Biomolécules Max Mousseron, UMR 5247, Université Montpellier, CNRS, Place Eugène Bataillon, 34095 Montpellier CEDEX 5, France

Interests: venoms; conotoxins; peptides; proteomics; transcriptomics; drug discovery

* Section: Animal Venoms

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**Dr. Griet Glorieux ***

Website (<https://biblio.ugent.be/person/801000957024>)

Associate Editor

Department of Internal Medicine and Pediatrics, Ghent University Hospital, Ghent University, 9000 Gent, Belgium

Interests: uremic toxins; protein-bound uremic toxins; chronic kidney disease; leukocyte/monocyte function; leukocyte–endothelial interaction; inflammation in CKD; dialysis fluid purity/endotoxins; gut–kidney axis

* Section: Uremic Toxins

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Website (<https://profil-profiles.science.gc.ca/en/profile/mark-w-sumarah>)

Associate Editor

Agriculture and Agri-Food Canada, Edmonton, AB, Canada

Interests: fungal secondary metabolites; detection and monitoring of mycotoxins; mass spectrometry; NMR; emerging mycotoxins

* Section: Mycotoxins

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**Dr. Peiwu Li**

Website (<https://www.cae.cn/cae/html/main/colys/44745441.html>)

Advisory Board Member

Oil Crops Research Institute, Chinese Academy of Agricultural Sciences, Wuhan 430062, China

Interests: mycotoxins; aflatoxin

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**Dr. Michael Adang**

Website (<https://www.bmb.uga.edu/directory/people/michael-adang>)

Editorial Board Member

Departments of Biochemistry and Molecular Biology and Entomology, University of Georgia, Athens, GA 30602, USA

Interests: *Bacillus thuringiensis*; Cry proteins; *Lysinibacillus sphaericus*; Bin toxin; insect midgut; uptake of protein toxins

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Dr. Jean-Denis Bailly

<http://www.envt.fr/content/jean-denis-bailly>

Editorial Board Member

Laboratoire de Chimie Agro-Industrielle, Ecole Nationale Vétérinaire de Toulouse, Toulouse, France

Interests: impact of climate changes on fungal biodiversity; fungi and indoors; modulation of mycotoxin synthesis by natural compounds

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Dr. Joseph Barbieri

<https://www.mcw.edu/departments/microbiology-immunology/faculty/joseph-barbieri-phd>

Editorial Board Member

Microbiology and Immunology, Medical College of Wisconsin, 8701 Watertown Plank Rd., Microbiology and Immunology, BSB-255, Milwaukee, WI 53226, USA

Interests: protein toxins; type-III effectors; structure-based mechanisms of toxin action; botulinum toxins; tetanus toxin; cellular microbiology

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Dr. Terenzio Bertuzzi

<https://docenti.unicatt.it/ppd2/en/docenti/05411/terenzio-bertuzzi/profilo>

Editorial Board Member

Department of Animal Science, Food and Nutrition, Faculty of Agricultural, Food and Environmental Sciences, UCSC, Via Emilia Parmense, 84, 29122 Piacenza, Italy

Interests: food safety; mycotoxin

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Dr. Philippe Billiald

<https://www.researchgate.net/profile/Philippe-Billiald>

Editorial Board Member

Inserm U1148 LVTS, School of Pharmacy, University Paris-Saclay, 91400 Orsay, France

Interests: scorpion; spider; antivenom; recombinant antibody; neurotoxin; immunoassay



Dr. Frédéric Boyer

<https://www.c3m-nice.fr/en/Teams/team-06/>

Editorial Board Member

Centre Méditerranéen de Médecine Moléculaire (C3M), INSERM U1065, Université Côte d'Azur, 06204 Nice, France

Interests: bacterial toxins; RhoGTPases; innate immunity; inflammasomes

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Dr. Alejandra Bravo

[Profile Page \(https://www.ibt.unam.mx/perfil/1289/dra-maria-alejandra-bravo-de-la-parra\)](https://www.ibt.unam.mx/perfil/1289/dra-maria-alejandra-bravo-de-la-parra)

Editorial Board Member

Instituto de Biotecnología, Universidad Nacional Autónoma de México, Cuernavaca 62250, Mexico

Interests: *Bacillus thuringiensis*; Cry toxins; Vip3A toxins; pore formation; toxin receptors; resistance mechanisms; Cyt toxin

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Dr. Sabino Aurelio Bufo

[Profile Page \(http://oldwww.unibas.it/utenti/bufo/index.htm\)](http://oldwww.unibas.it/utenti/bufo/index.htm)

Editorial Board Member

Department of Science, University of Basilicata, Potenza, Italy

Interests: pharmaceuticals from plants and microorganisms; chemistry of natural substances in vegetables and soil; secondary plant metabolites; protection and recovery of ecosystems

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Dr. Allan Cembella

[Profile Page \(https://www.gulfbase.org/people/dr-allan-d-cembella\)](https://www.gulfbase.org/people/dr-allan-d-cembella)

Editorial Board Member

Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (AWI), Am Handelshafen 12, 27570 Bremerhaven, Germany

Interests: chemical and molecular ecology of protists; genetics of toxin biosynthesis; toxinology and ecotoxicology of harmful microalgae; harmful algal blooms and marine food webs; marine phycotoxin dynamics and diversity; marine microbial biotechnology

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Dr. Jing Chen

[Profile Page \(http://www.plateaulake.ynu.edu.cn/info/1019/1122.htm\)](http://www.plateaulake.ynu.edu.cn/info/1019/1122.htm)

Editorial Board Member

Institute for Ecological Research and Pollution Control of Plateau Lakes, School of Ecology and Environmental Science, Yunnan University, Kunming 650500, China

Interests: microcystin; cyanotoxin; *Microcystis*; cyanobacteria; toxic mechanisms; reproductive toxicity; developmental toxicity; hepatotoxicity; carcinogenicity; endocrine-disrupting effects; toxicogenomics

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Prof. Dr. Ho Choi

Website (<https://cals.snu.ac.kr/en/about/organization/search/faculty?mode=view&profidx=105>)

Editorial Board Member

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1. Department of Agricultural Biotechnology, Center for Food Safety and Toxicology, Seoul National University, Seoul 08826, Republic of Korea

2. Center for Food and Bioconvergence, Seoul National University, Seoul 08826, Republic of Korea

Interests: molecular microbiology and toxicology

Prof. Dr. Wilmar Dias Da Silva

Website (<https://www.cetics.com.br/en/pesquisadores/wilmar-silva/>)

Editorial Board Member

Immunochemistry Laboratory, Butantan Institute, São Paulo 05503-900, Brazil

Interests: antibodies CDRs; synthetic CDRs; 3D CDRs x ags epitopes interactions; antivenom

Dr. Khashayar Dashtipour

Website (<https://home.llu.edu/academics/faculty/dashtipour-khashayar/research>)

Editorial Board Member

Department of Neurology/Movement Disorders, School of Medicine, Faculty of Medical Offices, 11370 Anderson, Suite B-100, Loma Linda, CA 92354, USA

Interests: blepharospasm; dystonia; parkinson's disease; torticollis; botulinum toxins

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Prof. Dr. Sarah De Saeger

Website (<https://www.ugent.be/fw/bioanalysis/en/research/cemph>)

Editorial Board Member

1. Department of Bioanalysis, Centre of Excellence in Mycotoxicology and Public Health, Faculty of Pharmaceutical Sciences, Ghent University, 9000 Ghent, Belgium

2. Faculty of Science, University of Johannesburg, Johannesburg, South Africa

Interests: mycotoxins

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Dr. Min Dong

Website (<https://www.childrenshospital.org/directory/min-dong>)

Editorial Board Member

Department of Urology, Boston Children's Hospital, Boston, MA 02115, USA

Interests: botulinum neurotoxin; tetanus neurotoxin; clostridial neurotoxin; difficile toxin; TcdA; TcdB; Shiga toxins; pore-forming toxins; insecticidal toxins


Prof. Dr. Lars Ellgaard

Website (<https://www1.bio.ku.dk/english/research/bms/pbg/le/>)

Editorial Board Member

Department of Biology, Linderstrøm-Lang Centre for Protein Science, University of Copenhagen, 2200 Copenhagen, Denmark

Interests: Conotoxins; structure-function relationships; recombinant expression systems for animal toxins; disulfide-bond formation

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**Prof. Dr. Antonio Evidente**

Website (<https://naturalproducts2018.wordpress.com/wp-content/uploads/2018/01/evidente-biography.pdf>)

Editorial Board Member

Institute of Biomolecular Chemistry, National Research Council, Via Campi Flegrei 34, 80078 Pozzuoli, Italy

Interests: natural bioactive substances; spectroscopy; isolation; structure determination; structure–activity relationships; mode of action

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Prof. Dr. Laura Gámiz-Gracia

Website (<https://quimicaanalitica.ugr.es/informacion/directorio-personal/laura-gamiz-gracia>)

Editorial Board Member

Department of Analytical Chemistry, Faculty of Sciences, University of Granada, 18071 Granada, Spain

Interests: development of analytical methods based on liquid-phase separation techniques for determination of contaminants; with special focus on mycotoxins

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**Prof. Dr. Daniel Gillet**

Website (https://joliot.cea.fr/drf/joliot/en/Pages/research_entities/medicines_healthcare_technologies/simos/LBC.aspx)

Editorial Board Member

Section of Molecular Engineering for Health (SIMoS), JOLIOT, CEA, Université Paris-Saclay, F-91191 Gif Sur Yvette, France

Interests: bacterial toxins; diphtheria toxin; ricin toxin; Shiga toxins; botulinum toxins; intracellular trafficking; biodefense; toxin inhibitors; antitoxin drug development

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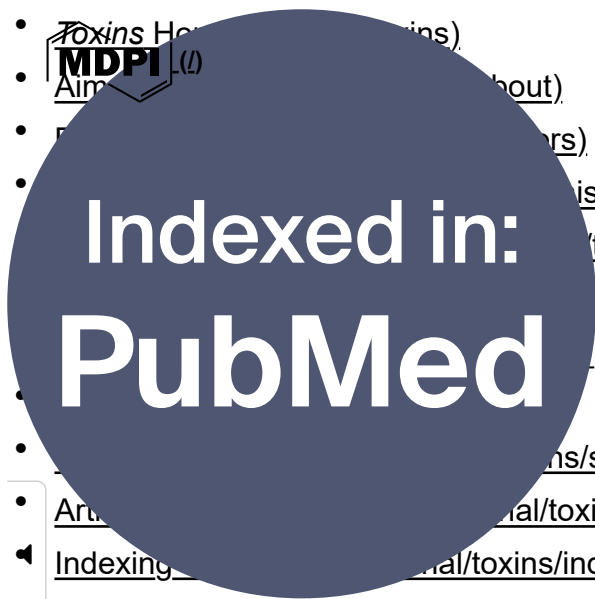
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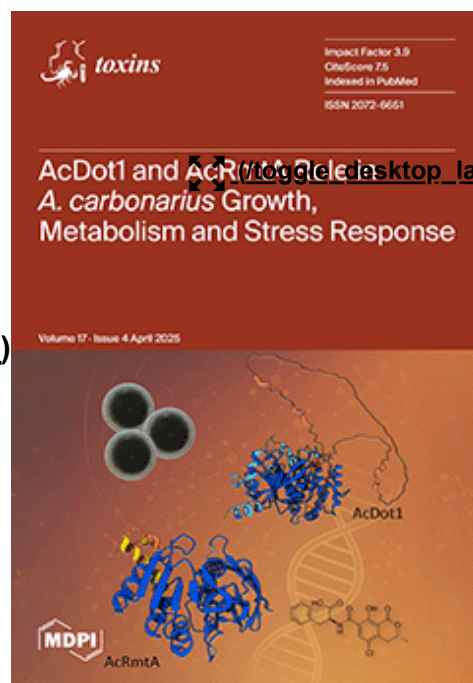
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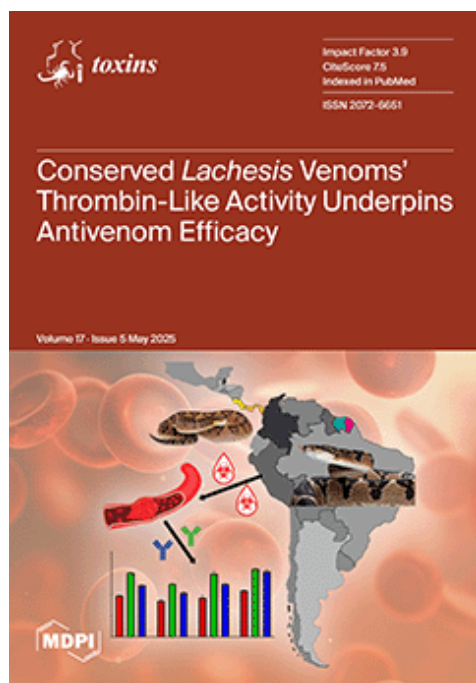
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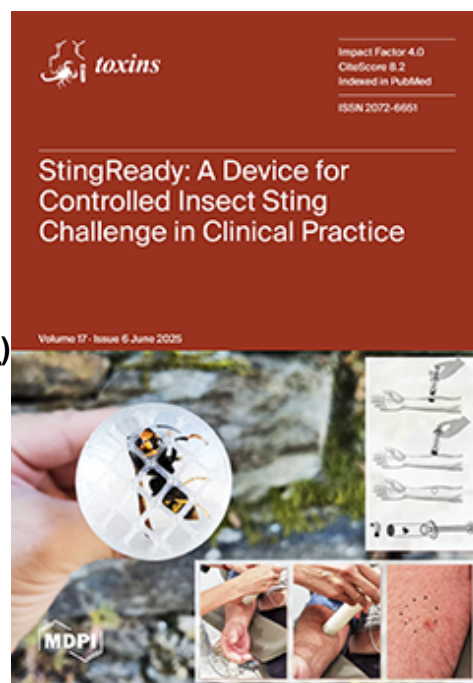
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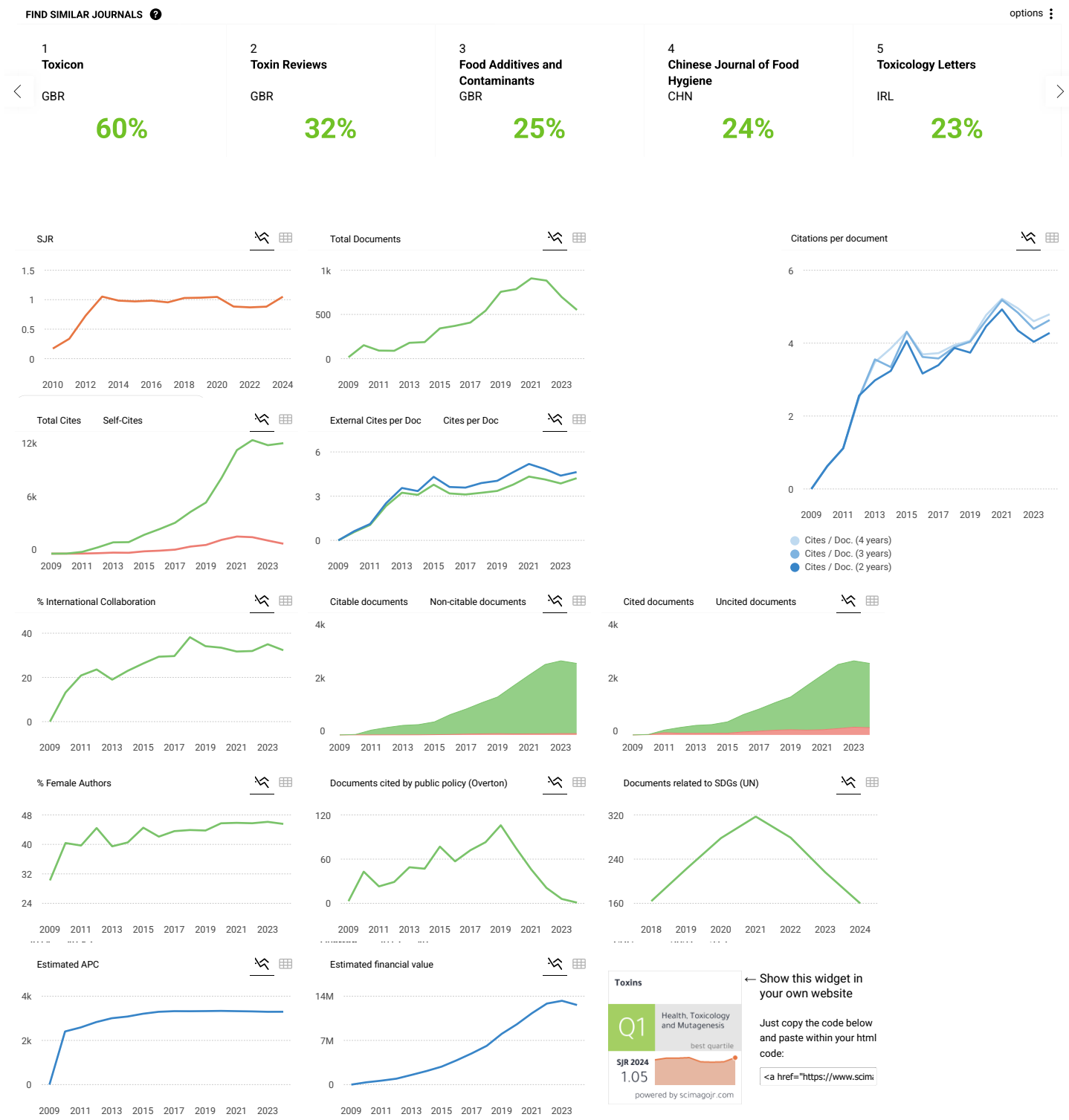
Toxins

COUNTRY	SUBJECT AREA AND CATEGORY	PUBLISHER	SJR 2024
Switzerland	Environmental Science Health, Toxicology and Mutagenesis	Multidisciplinary Digital Publishing Institute (MDPI)	1.051 q1
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Toxins (ISSN 2072-6651) is an international, peer-reviewed open access journal which provides an advanced forum for studies related to toxins and toxinology. It publishes reviews, regular research papers and short communications. Our aim is to encourage scientists to publish their experimental and theoretical results in as much detail as possible. There is no restriction on the length of the papers. The full experimental details must be provided so that the results can be reproduced. There are, in addition, unique features of this journal: manuscripts regarding research proposals and research ideas will be particularly welcomed -electronic files or software regarding the full details of the calculation and experimental procedure, if unable to be published in a normal way, can be deposited as supplementary material -we also accept manuscripts communicating to a broader audience with regard to research projects financed with public funds This journal covers toxinology and all kinds of toxins (biotoxins) from animals, microbes and plants. Some types of toxins covered are: -aflatoxins- exotoxins- endotoxins- neurotoxins- necrotoxins- hemotoxins- mycotoxins- phototoxins- any other toxin from animal, plant or microbial origin.

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