

# Cyanotoxin uptake by food crops – what's the risk?

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# Introduction

- Cyanotoxin uptake by food crops has been on the radar for several decades
- Increase use of recycled wastewater has heightened awareness
- Does it pose a health risk to consumers?
- Initial discussions between SA Health and SA Water with subsequent interest from the wider water industry through Water RA resulted in:

**Cyanotoxin Risk in Recycled Water Used for Food Crop Irrigation – Water RA Project  
Number: #3049 (2022 – 2026)**

# Cyanotoxin risk in recycled water used for food crop irrigation - Water RA #3049

1. Literature Review: Conduct comprehensive review of scientific literature to determine current understanding of the issue. [Shayne Faulkner](#)
2. SA Water, Investigation: Review the extent of recycled water use on crops and pasture in Australia, and Worldwide. [Martin Faulkner](#)
3. Flinders Uni, Honours Project: Biodegradation of microcystin within soils. [Paul Canala](#)
4. SA Water/Interstate Authorities: Test for cyanotoxins in South Australia and Interstate food crops. [Peter Hobson](#)
5. Flinders Uni, PhD Project: Investigate the fate of cyanobacterial toxin in the journey from recycled wastewater through to uptake by irrigated crops. [Shayne Faulkner](#)

# Fate of Toxins Following Irrigation

- Source
- Surface Water
  - Recycled Wastewater
  - Groundwater



- Cyanotoxin
- Intracellular
  - Extracellular



Penetration depth

Soil type / Chemistry  
Adsorption/Desorption

Biodegradation



Plant uptake

- Contamination:
- **Internal**
  - External

- Partitioning
- Shoots/leaves/fruits
  - Roots



Consumption  
**Risk assessment**

Paul Canala and Prof. Howard Fallowfield 2023

# Preliminary Risk Assessment

- Three values were used to assess risk to consumers
  1. ABS median daily consumption of fruit and vegetables – 2011/2012
  2. Toxin levels measured in edible food crops from literature
  3. Tolerable daily intakes (TDI) for chronic exposure to cyanotoxins
    - Microcystin - 0.04 ug/kg body weight/day (WHO guideline based on Fawell et al., 1999)
    - Cylindrospermopsin - 0.03 ug/kg body weight/day (WHO guideline based on Humpage and Falconer 2003)
- TDI if food is sole source of toxin for a 70kg adult
  - Microcystin – 2800 ng/day
  - Cylindrospermopsin – 2100 ng/day

# Preliminary Risk Assessment

Maximum concentration of toxin allowed in food crop (ng/g) before reaching tolerable daily intake if sole source of toxin for 70kg person

Food Crop	Microcystin (ng/g)	Cylindrospermopsin (ng/g)
Leaf and Stalk	114	85
Root Vegetables	75	57
Tomato	74	55
Rice	17	13

# Preliminary Risk Assessment

Summary of literature results - edible components only

Experiment Type	No. of Papers	Plant type Tested	Toxin Source	Toxins Tested Microcystin (MIC) Cylindrospermopsin (CYP)	Plant showing exceedance of TDI
Field	4	Root Veg., Leafy Greens, Rice, Fruiting Veg.	<ul style="list-style-type: none"><li>• 1 x ground water</li><li>• 3 x bloom</li></ul>	MIC	All 4 papers - cabbage, dill, lettuce, parsley, spinach, rice
Laboratory Hydroponics	3	Leafy Greens	<ul style="list-style-type: none"><li>• 2 x cyano extract</li><li>• 1 x pure toxin</li></ul>	MIC, CYP	1 paper, MIC, lettuce
Laboratory, soil, water at base	10	Leafy Greens, Fruiting Veg., Root Veg., Rice, Tomato	<ul style="list-style-type: none"><li>• 5 x pure toxin</li><li>• 5 x cyano extract</li><li>• 4 x bloom</li></ul>	MIC	4 papers, MIC, root veg, rice
Laboratory, soil, water over whole plant	7	Leafy Greens, Root Veg.	<ul style="list-style-type: none"><li>• 3 x pure toxin</li><li>• 3 x cyano extract</li></ul>	MIC, CYP	4 paper, MIC, lettuce
Soil Conditioner	1	Leafy Greens	Cyanobacteria biomass	MIC	

# Summary

- Initial review of scientific literature suggests a potential for food crops irrigated with cyanotoxin to pose a health risk to consumers
- More information needed:
  - Are toxin levels in literature representative of those found in irrigation waters
  - Are irrigation methods used in the literature comparable to real practices
  - What happens to toxins from point of irrigation to presence in food crop
  - Extent of recycled water use on food crops in Australia
- **Cyanotoxin risk in recycled water used for food crop irrigation - Water RA #3049** will provide this information
- Outcomes from this project can be used by health regulators and the agricultural industry to guide future policies and guidelines on cyanotoxins in irrigation water and food crops.



# Thankyou

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