

Harmful Algal Blooms

Hamzah D. Ansari

Oakland University

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Outline

Harmful Algal
Blooms

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Ansari

Introduction

Survey

References

1 Introduction

2 Survey

Harmful Algal Blooms

Harmful Algal Blooms

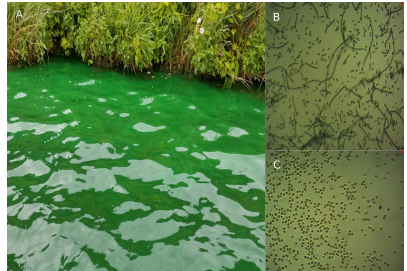
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Survey

References

- Increase in primary productivity and
- Explosive growth of microscopical algae and cyanobacteria
- Toxin-producing genera
- Decrease biodiversity
- Anoxic environment



HAB

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Survey

References

- Naturally occurring
- Exacerbate from anthropogenic causes¹
- Worldwide issue
- Coastal environments
- Freshwater lakes

¹Rastogi, Sinha, and Incharoensakdi, "The cyanotoxin-microcystins: current overview".

Lake Erie 2014

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Possible causes

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Toxicity

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- Irritant
 - Lipolysacharides²
- Toxins
 - Microcystin and nodularin ¹
 - Cylindrospermopsin³
 - Anatoxin⁴
 - Saxitoxin ¹

²Moore, Richard and Ohtani, Ikuko, "Cyanobacterial Toxins".

³Dittmann, Fewer, and Neilan, "Cyanobacterial toxins".

⁴Codd et al., "Cyanobacterial toxins, exposure routes and human health".

Microcystin

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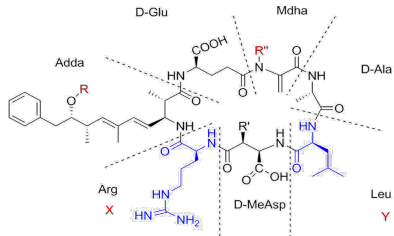
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- Cyclic peptide
- 1000 Da
- Hepatoxin and carcinogenic
- Inhibits protein phosphatase
- Diverse structures



Cylindrospermopsin

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- Polycyclic uracil derivative
- Covalently binds to DNA/RNA
- Inhibits protein synthesis
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Anatoxin

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Saxitoxin

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Exposure Route

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- Direct contact
- Aerosols
- Ingestion
 - Seafood/Fish
 - Drinking water
 - Algal supplements

Law and Regulation

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- Safe Drinking Water Act
- Maximum Contaminant Level
 - Regulated and enforced
- Contaminant Candidate List
 - “More like guidelines”

Objectives

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Surveyed Lakes

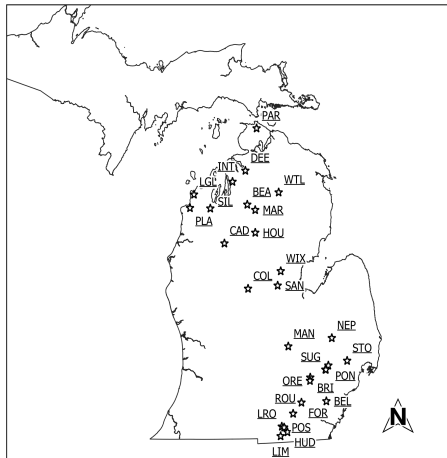
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Water Sampling

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- Sampled each lake once a month
- Collected water
- Quickly transported back
- Analyzed ASAP

SPATT

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- Solid phase adsorption
toxin tracking
 - Sachet filled with resin
 - Left for one month
- test

Analysis

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Nutrients

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- Orthophosphate-P
- Nitrate+nitrite-N
- Ammonia-N
- Total Kjeldahl nitrogen
- Total Phosphorus

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LC-MS/MS

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- Freeze/Thaw
- Filter

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- Solid phase adsorption toxin tracking
- Similar to the stationary phase

ELISA

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Geospatial Analysis

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Results

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Could we predict HABs?

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Acknowledgment

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References

- My lab partners Brian Spies and Andrew Herrpich
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- Dr.David Szlag and Dr. Thomas Raffel
- Michigan Department Environmental Quality
- Oakland University and the Chemistry Department

References I

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Codd, Geoffrey A. et al. "Cyanobacterial toxins, exposure routes and human health". In: *European Journal of Phycology* 34.4 (Oct. 1999), pp. 405–415. ISSN: 0967-0262.

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"Cyanobacterial toxins: Biosynthetic routes and evolutionary roots". In: *FEMS microbiology reviews* 37 (Sept. 2012). DOI: 10.1111/1574-6976.12000.

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Rastogi, R. P., R. P. Sinha, and A. Incharoensakdi. "The cyanotoxin-microcystins: current overview". English. In: *Reviews in Environmental Science and Bio-Technology* 13 (June 2014), pp. 215–249. ISSN: 1569-1705. DOI: 10.1007/s11157-014-9334-6.