Mechanism of Action: Bacillus Bacteria in Controlling Cyanobacterial (Algal) Blooms. Marine Easy Clean (TWC)

1. Mechanisms by Which Bacillus Suppresses Cyanobacteria

Production of Algicidal Compounds

Bacilysin, produced by Bacillus amyloliquefaciens strain FZB42, disrupts algal cell walls and organelles, causing cell lysis. It also downregulates genes responsible for cell division (ftsZ), photosynthesis (psbA1), peptidoglycan synthesis (glmS), and toxin production (mcyB). Other Bacillus strains like B. velezensis also secrete metabolites effective against cyanobacteria. Study link: https://journals.asm.org/doi/10.1128/aem.02605-14

Enzymatic and Metabolic Disruption

Bacillus secretions include lytic enzymes and allelochemicals that degrade algal structures and inhibit critical cellular functions, contributing to bloom collapse.

Physical Interactions – Biofilm Facilitation & Adsorption

Bacillus forms extracellular polymeric substance (EPS) biofilms that trap cyanobacteria and concentrate algicidal activity, accelerating the breakdown process.

2. Scientific Evidence Base & Field Support

- **Cyanobactericidal bacteria such as Bacillus disrupt cyanobacterial growth via physical contact, allelochemicals, and transcriptional suppression.**

  https://link.springer.com/article/10.1007/s11274-020-02965-5

- **Modified clay with B. amyloliquefaciens enhanced bloom control through flocculation and sustained algicide production.**

  https://www.frontiersin.org/articles/10.3389/fmicb.2025.1550905/full

- **In shrimp pond systems, the addition of Bacillus strain CZBC1 and molasses effectively suppressed blooms over 56 days. https://www.x-mol.com/paper/1308207216384512000**

- **Direct lysis of Oscillatoria by Bacillus CZBC1 confirmed in detailed studies.**
  https://ambexpress.springeropen.com/articles/10.1186/s13568-019-0872-8

3. Summary of Mechanisms

Mechanism	Action	Outcome
Algicidal metabolites (e.g., bacilysin)	Disrupt cell structures & inhibit toxin/growth genes	Cyanobacterial lysis, bloom suppression
EPS-mediated aggregation	Traps cyanobacteria in biofilms	Concentrates algicide effect
Enzymatic dissolution	Weakens critical algal cell functions	Facilitates breakdown and removal
Flocculation (with clay)	Physically settles algae	Reduces surface-living bloom populations

4. Conclusion & Practical Implications

Bacillus bacteria suppress toxic algal blooms through a multi-faceted approach involving biochemical attack, biofilm aggregation, metabolic disruption, and physical removal. Scientific literature supports both laboratory and field efficacy. This mechanism explains why The Water Cleanser, by increasing Bacillus numbers, is effective in reducing cyanobacteria and restoring water quality.

Website