INFLUENCE OF COBALAMIN (VITAMIN B\textsubscript{12}) ON THE MICROBIAL DEGRADATION OF DIMETHYLSULFONIOPROPIONATE AND RELATED COMPOUNDS

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**Background**

- Autotrophic DMSP production and subsequent microbial degradation play an important role in global sulfur cycle
- Sulfur Requirements of marine microbes
- Global climate Processes
  - Demethylation/demethiolation
  - Methionine Synthesis
- Cleavage into DMS
  - Source for cloud condensing nuclei (CCN)
- Vitamin B\textsubscript{12}
  - All eukaryotes auxotrophic
  - Known cofactor for MetH
- Potential limiting factor in Met production

**Objective and Hypotheses**

O: Determine the effect of Vitamin B\textsubscript{12} on the microbial switch and relative use of each DMSP degradation pathway

- \textsubscript{H\textsubscript{1}}: B\textsubscript{12}-spiked treatments will produce a larger fraction of demethylation products
- \textsubscript{H\textsubscript{2}}: Chloroform-spiked treatments will produce a larger fraction of cleavage products

**Expected Stable Isotope Products of Degradation Pathways**

- \textsubscript{H\textsubscript{2}}C – S – CH\textsubscript{3}
- \textsubscript{D\textsubscript{2}}C – S – CD\textsubscript{3}
- biogenic DMSP: m/z 63
- D6-DMSP: m/z 69

- \textsubscript{H\textsubscript{2}}C – S – H
- \textsubscript{D\textsubscript{2}}C – S – H
- biogenic MeSH: m/z 49
- D3-MeSH: m/z 52

- \textsubscript{H\textsubscript{2}}C – H
- \textsubscript{D\textsubscript{2}}C – H
- biogenic methane: m/z 16
- D3-methane: m/z 19

**Methods**

- Conduct 6x Vitamin B\textsubscript{12} addition experiments using natural SC bacterioplankton assemblages
- Pump (and pre-screen using 5 µm filter) ~50 L water from ~5m depth.
- Utilize a Latin Square Experimental Design to compare four treatment types
- Each treatment will be spiked with the stable isotope deuterium labeled D6 DMSP
- Use Proton Transfer Reaction 1000 Time of Flight (PTR-TOF) mass spectrophotometer to measure the D6 DMSP degradation products over the course of 48 hours

**Additional Research Goals**

- Determine effect of Vitamin B\textsubscript{12} on the relative preference of DMSO degradation pathways
- Identify enzymes associated with the DMSP/DMSO degradation pathways in natural microbial assemblages
- Methyl Transferase
- DMSP Lyases
- DMSO Reductases
- DMSO Monoxygenases

**References**


**Broader Impacts**

- Climatic Implications
  - CLAW: Negative feedback loop
  - Anti-CLAW: Positive feedback loop
- Potential increase in CH\textsubscript{4} production (greenhouse effect)
- Ecological Implications
  - Sulfur Requirements of Marine Microbes
  - DMS as a feeding cue
    - Reef fish
    - Marine birds
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**References**