Using Tedlar bags to measure DMS_{air}

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This guide refers to the use of Tedlar bags to measure DMS in the air outflow of algal cultures which are bubbled at a constant rate and have a defined gas outflow. In steady state this can be used to measure the net DMS production rate by the culture.

Need:

- Experience of using the Purge and Trap well (see protocol).

Sampling and storage

- There is a set of 5L Tedlar bags used for DMS in air measurements. These are rinsed with N_2(g) and stored empty.
- The Tedlar bags are closed when the plug is up and open the plug is pushed down.
- Attach the Tedlar bag to the gas outflow of the culture and make sure the bag is open. Capture 2 - 5 minutes of gas (depending on gas volume needed and the flow rate) then close and detach the bags. Collect 50% more gas then you need .
- Use the flow meter to record the flow rate of the culture gas outflow.
- Initial tests on a *E.hux* cultures indicate that the quantity of DMS within the bags does not vary significantly over 24 hours of storage in the dark ($p<0.05$). The DMS does however seem to increase after two days, possibly due to the breakdown of aerosolised DMSP to DMS.
- A conservative recommendation is that samples are measured within 6 - 12 hours of capture and are stored in the dark at room temperature before measurement.

Setting up the purge and trap (as in Figure 1, position II)

- The purge tube is removed.
- Gas flow should be 60 mL min^{-1} (purge) and 150 mL min^{-1} (drier).
- the three-way valve (C) should be in position II.
- the stop valve at (B) should be open.
- 'hex' valve 1 should be set to 'trap' and valve 2 should be set to 'System 1'.
- Cool the trap to between -145 to 155^{o}C.

Connecting the Tedlar bag and trapping (as in Figure 1, position I)

- Turn three-way valve to position I. (N_2(g) is now stopped and airflow is now possible between the bag, trap and out the waste).
- Tedlar bag is connected at the three-way valve using the detachable flow tube so the bag hangs underneath the bench out of the way (Photo XXX).
- Connect glass 100 mL syringe to the gas outflow.
- Pull 50-200 mL of gas at 60 mL min^{-1} bag past the trap and out the waste. (volume will depend on [DMS] of sample).
- The DMS will be cryogenically enriched on the loop.
- Turn three-way back to position II and detach syringe (flushes remaining DMS in system over trap.

- After >10 seconds flush sample to GC by turning 'hex' valve 1 to flush and submerging trap in just boiled water

Cleanup

- Disconnect the Tedlar bag turn three-way to position III to rinse flow tube (5 seconds).
- REMEMBER to turn three-way back to position II (very important)
- Attach the next bag.

Cleaning the Tedlar bags

- Suck remaining gas out of bags with vacuum pump.
- Rinse with excess N_2(g) using spare flow line (5 seconds).
- Suck empty again and store for next use.

Gas volume pulled over trap calculation

- The volume of gas pulled through the P&T must be corrected to represent a volume of gas captured from the sample.
- Corrects for gas sample lost in flow tube and differences in temperature between culture and measurement.

- **V_C = Corrected volume of culture gas trapped (mL) = (V - 0.705) * 1/ [(1/(T_1+273.15)) * (T_2+273.15)]**

  V = Volume of gas pulled through P&T (mL)
  T_1 = temperature of culture (^oC)
  T_2 = temperature during measurement (^oC)

Calibration

- Makes use of the vial headspace purge technique (see protocol)
- A linear calibration line of the sqrt areas v pmol DMS in the gas phase is used to calculate the quantity of DMS in each peak (Q) in pmol.

Calculating the DMS release by the culture

- **Gas release from the culture (pmol min^{-1}) =Q / V_C *F**

  F = flow rate of culture (mL min^{-1})

Problems

- Always and regularly run blanks. This technique can cause build up of contamination in the Nafion dryer. If the contaminating peak obscures the DMS peak the system will need to be cleaned.

Tedlar Cheat sheet

1. Start in Pos II
2. Attach bag
3. Switch Pos I, pull gas through
4. Switch Pos II, detach syringe (>10 secs)
5. Flush sample
6. Disconnect bag
7. Switch Pos III (5s)
8. Switch Pos II