Acetogenic & sulfidogenic methanol utilization

Desulfotomaculum orientis utilizes methanol via the acetyl-CoA pathway and produces acetate in the absence of sulfate as oxidant. It produces hydrogensulfide as long as sulfate is present, and it changes its mode of life from being a sulfate reducer to becoming an acetogen if sulfate concentrations are low. *Desulfotomaculum orientis* can be isolated most successfully from habitats which get depleted of sulfate either temporarily or spatially, e.g. from deeper layers of freshwater lake sediments which receive sulfate through diffusion from the water column.

We will apply thermodynamic concepts to evaluate dissimilation and assimilation reactions under sulfate-reducing and acetogenic conditions as defined below for batch culture growth experiments under the following boundary conditions.

	at beginning [mol/l]	at end of incubation [mol/l]
Sulfidogenic way of life:		
Methanol	5.1*10 ⁻³	10 ⁻⁷
Hydrogencarbonate	30*10	35*10
Sulfate	5*10 ⁻³	10^{-3}
Hydrogensulfide	0.6*10	2.5*10 ⁻³
Biomass <c4h7o3></c4h7o3>	5*10	2*10 ⁻³
pH	7.3	7.7
Growth temperature Ionic strength	$25^{\circ}C \sim 0$	$25^{\circ}C \sim 0$
Acetogenic way of life:		
Methanol	5.2*10 ⁻³	10 ⁻⁵
Hydrogencarbonate	30*10-5	25*10 2
Acetate	10	6*10-5
Biomass <c4h7o3></c4h7o3>	10 ⁻⁴	10 ⁻³
pH	7.3	6.9
Growth temperature Ionic strength	$25^{\circ}C \sim 0$	$25^{\circ}C$ ~ 0

Assimilatory and dissimilatory growth equations are as follows:

Biomass formation reaction **17** CH₃OH + 7 HCO₃⁻ + 7 H⁺ -----> 6 <C₄H₇O₃> + 20 H₂O Sulfidogenic dissimilation reaction CH₃OH + 0.75 SO₄²⁻ ----> HCO₃⁻ + 0.75 HS⁻ + 0.25 H⁺ + H₂O Acetogenic dissimilation reaction CH₃OH + 0.5 HCO₃⁻ ----> 0.75 CH₃COO⁻ + 0.25 H⁺ + H₂O The following values apply for Gf⁰ at 25^oC (in kJoule/mol): CH₃OH_(aq) -175.4, CH₃COO⁻_(aq) -369.4, HCO₃⁻_(aq) -586.9, H⁺_(aq) 0, H₂O₍₁₎ -237.2, SO₄²⁻_(aq) -744.6, HS⁻_(aq) +12.1, C₄H₇O₃ (s) -385.294