|  |  |  |
| --- | --- | --- |
| Anammox | | |
| Component | Anabolism | Catabolism |
| NH3 | -1.6 | -1 |
| NO2- | 0 | -1 |
| NO3- | 0 | 0 |
| O2 | 0 | 0 |
| HCO3- | -1 | 0 |
| gN2 | 0.7 | 1 |
| H2O | 2.5 | 1 |
| H+ | -1 | 0 |
| Biomass | 1 | 0 |

|  |  |  |
| --- | --- | --- |
| Aerobic heterotroph | | |
| Component | Anabolism | Catabolism |
| Glucose | -0.175 | -1 |
| NH3 | -0.2 | 0 |
| NO2- | 0 | 0 |
| NO3- | 0 | 0 |
| O2 | 0 | -6 |
| HCO3- | 0.05 | 6 |
| gN2 | 0 | 0 |
| H2O | 0.4 | 0 |
| H+ | 0.05 | 6 |
| Biomass | 1 | 0 |

|  |  |  |
| --- | --- | --- |
| Anaerobic heterotroph denitrifying on NO3- | | |
| Component | Anabolism | Catabolism |
| Glucose | -0.175 | -0.1667 |
| NH3 | -0.2 | 0 |
| NO2- | 0 | 0 |
| NO3- | 0 | -0.8 |
| O2 | 0 | 0 |
| HCO3- | 0.05 | 1 |
| gN2 | 0 | 0.4 |
| H2O | 0.4 | 0.4 |
| H+ | 0.05 | 1 |
| Biomass | 1 | 0 |

|  |  |  |
| --- | --- | --- |
| Anaerobic heterotroph denitrifying on NO2- | | |
| Component | Anabolism | Catabolism |
| Glucose | -0.175 | -0.1667 |
| NH3 | -0.2 | 0 |
| NO2- | 0 | 0 |
| NO3- | 0 | -0.8 |
| O2 | 0 | 0 |
| HCO3- | 0.05 | 1 |
| gN2 | 0 | 0.4 |
| H2O | 0.4 | 0.4 |
| H+ | 0.05 | 1 |
| Biomass | 1 | 0 |

|  |  |  |
| --- | --- | --- |
| AOB | | |
| Component | Anabolism | Catabolism |
| Glucose | 0 | 0 |
| NH3 | -0.9 | -1 |
| NO2- | 0.7 | 1 |
| NO3- | 0 | 0 |
| O2 | 0 | -1.5 |
| HCO3- | -1 | 0 |
| gN2 | 0 | 0 |
| H2O | 1.1 | 1 |
| H+ | -1 | 1 |
| Biomass | 1 | 0 |

|  |  |  |
| --- | --- | --- |
| NOB | | |
| Component | Anabolism | Catabolism |
| Glucose | 0 | 0 |
| NH3 | 0 | 0 |
| NO2- | -2.9 | -1 |
| NO3- | 2.7 | 1 |
| O2 | 0 | -0.5 |
| HCO3- | -1 | 0 |
| gN2 | 0 | 0 |
| H2O | 0.2 | 0 |
| H+ | 1 | 0 |
| Biomass | 1 | 0 |

Growth rates expressions

|  |  |
| --- | --- |
|  |  |
| AOB |  |
| NOB |  |
| Annamox |  |
| HET-aerobic |  |
| HET-NO3 |  |
| HET-NO2 |  |

*Source for anammox, AOB & NOB Volke et al. Effect of granule size on autotrophic nitrogen removal in a granular sludge reactor*

*Source for HET parameters: Ni et al.. Modeling a Granule-Based ANAMMOX Process, 2009, Biotechnology & Bioengineering Assumed the decay rate 5% of µmax.*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Kinetic parameters | µmax (h-1) | Ks-O2 – mol/L | Ks-glucose  mol/L | Ks-NH3 | Ks-NO2 | Ks-NO3 | k-decay (h-1) |
| Species |  |  |  |  |  |  |  |
| Annamox | 0.0022 | (inhib)  3.125e-7 | - | 4.36e-8 | 7.1e-12 | - | 1.1e-4 |
| AOB | 0.057 | 9.4e-6 | - | 1.6e-6 |  | - | 0.0029 |
| NOB | 0.033 | 3.44e-5 | - |  | 7.1e-10 | - | 0.0017 |
| HET-aerobic | 0.5 | 3.75e-6 | 1e-4 | - | - | - | 0.025 |
| HET – NO3 | 0.3 | - | 1e-4 | - | - | 3.5714E-05 | 0.015 |
| HET – NO2 | 0.3 | - | 1e-4 | - | 3.5714E-05 | - | 0.015 |

Initial conditions

Temperature = 30 C

Initial pH = 7

Small ammonia concentration && small O2 concentration && small glucose concentration

|  |  |  |
| --- | --- | --- |
| Component | Concentration mol/L | Concentration kg/m3 |
| Glucose | 5.56e-5 | 0.01 |
| NH3 | 1.8e-3 | 0.03 |
| NO2- | 0 | 0 |
| NO3- | 0 | 0 |
| O2 | 6.25e-5 | 2e-3 |
| HCO3- | 1e-3 | 0.044 |

High ammonia concentration (might not work) && saturation O2 concentration

|  |  |  |
| --- | --- | --- |
| Component | Concentration mol/L | Concentration kg/m3 |
| Glucose | 5.56e-4 | 0.1 |
| NH3 | 5.9e-3 | 0.1 |
| NO2- | 0 | 0 |
| NO3- | 0 | 0 |
| O2 | 2.81e-4 | 9e-3 |
| HCO3- | 1e-3 | 0.044 |

Medium ammonia concentration (might not work) && saturation O2 concentration

|  |  |  |
| --- | --- | --- |
| Component | Concentration mol/L | Concentration kg/m3 |
| Glucose | 5.56e-4 | 0.1 |
| NH3 | 2.95e-3 | 0.05 |
| NO2- | 0 | 0 |
| NO3- | 0 | 0 |
| O2 | 2.81e-4 | 9e-3 |
| HCO3- | 1e-3 | 0.044 |

Small ammonia concentration && saturation O2 concentration

|  |  |  |
| --- | --- | --- |
| Component | Concentration mol/L | Concentration kg/m3 |
| Glucose | 5.56e-4 | 0.1 |
| NH3 | 1.8e-3 | 0.03 |
| NO2- | 0 | 0 |
| NO3- | 0 | 0 |
| O2 | 2.81e-4 | 9e-3 |
| HCO3- | 1e-3 | 0.044 |

Small ammonia concentration && small O2 concentration

|  |  |  |
| --- | --- | --- |
| Component | Concentration mol/L | Concentration kg/m3 |
| Glucose | 5.56e-4 | 0.1 |
| NH3 | 1.8e-3 | 0.03 |
| NO2- | 0 | 0 |
| NO3- | 0 | 0 |
| O2 | 6.25e-5 | 2e-3 |
| HCO3- | 1e-3 | 0.044 |