Electronic Supplementary Material (ESI) for Environmental Science: Water Research & Technology.

Screen versus cyclone for improved capacity and robustness for sidestream and mainstream deammonification

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Supplemental B

Capacity in sidestream can be estimated by the volumetric ammonium removal rate (g NH_4^+-N/m^3/d), which can be calculated by dividing the AnAOB net growth rate by the AnAOB yield (g COD/g N) (Eq. B1). The AnAOB volumetric removal rate is obtained multiplying the net growth rate $\mu_{net,\,AnAOB}$ (d^{-1}) with the AnAOB concentration in the reactor X_{AnAOB} (g COD/m^3).

$$r_{V,AnAOB} = \frac{\mu_{netAnAOB} * X_{AnAOB}}{Y_{AnAOB}} \tag{B1}$$

The AnAOB concentration can be determined by solving an AnAOB-specific substrate mass balance for ammonium (Eq B2.) (Metcalf & Eddy, 2003):

$$X_{AnAOB} = \left(\frac{\theta_{AnAOB}}{HRT}\right)\left(\frac{Y_{AnAOB} * (S_o - S_{out})}{1 + \theta_{AnAOB} * b_{AnAOB}}\right) \tag{B2}$$

Where θ_{AnAOB} is the SRT for AnAOB as calculated in Eq. 5 (d), HRT the hydraulic retention time of the reactor (d), S_o the influent substrate (g NH_4^+-N/m^3), S_{out} the residual substrate level (g NH_4^+-N/m^3), b_{AnAOB} the decay rate for AnAOB (d^{-1}), and Y_{AnAOB} the AnAOB yield (g COD/g N). Formation of ammonium through hydrolysis was not taken into consideration. Inserting Eq B2. in Eq B1. results in an equation independent of AnAOB concentration or yield (Eq. B3):

$$r_{V,AnAOB} = \mu_{net,AnAOB}\left(\frac{\theta_{AnAOB}}{HRT}\right)\left(\frac{(S_o - S_{out})}{1 + \theta_{AnAOB} * b_{AnAOB}}\right) \tag{B3}$$