A review of sulfide emissions in sewer networks: overall approach and systemic modelling

APPENDIX

In practice, the pressure loss can be written as a mean velocity gradient \( G \), empirically linked to the flow characteristics. Lahav et al. (2004) linked \( K_{L12S} \) to \( G \) with an \( n \) exponent dependency. According to Bratby (1980), \( G \) is proportional to the dissipation function \( W \) and the fluid dynamic viscosity \( \mu \):

\[
G = \left( \frac{W}{\mu} \right)^{0.5}
\]  

(S1)

In a straight pipe, \( W \) can be calculated from the pressure loss in a straight pipe and the retention time:

\[
G = \left( \frac{\gamma \Delta H x}{\mu x} \right)^{0.5} = \left( \frac{\gamma \Delta H x u}{\mu x} \right)^{0.5}
\]  

(S2)

In order to compute the part-flow hydraulic parameters, \( G \) can be related to the usual parameters describing the geometry from the Darcy–Weisbach Equation (35):

\[
\Delta H x = \frac{\lambda u^2}{8gR}
\]  

(S3)

where \( \lambda \) is determined by the Colebrook–White equation (Lahav et al. 2004).

Eliminating \( \lambda \) from these two equations gives an explicit equation for the mean velocity in the sewer:

\[
\frac{u}{Sv} = \frac{Q}{Sv} = -\sqrt{\frac{2g \Delta H x}{x}} \times \log \left[ \frac{k}{14.8R} + 1.255v \left( R \sqrt{\frac{2g \Delta H x}{x}} \right) \right].
\]  

(S4)

In the simple case of uniform steady flow, the energy gradient \( \frac{\Delta H x}{x} \) is equal to the slope. In gravitational pipes, the turbulence intensity plays a role in the interface thickness and is controlled by the pipe slope and the wall characteristics (Lahav et al. 2004, 2006).

REFERENCES

Lahav, O., Sagiv, A. & Friedler, E. 2006 A different approach for predicting \( H_2S(g) \) emission rates in gravity sewers. Water Research 40 (2), 259–266.