APPENDIX VI

DETERMINATION OF KINETIC PARAMETERS USING CHEN AND HASHIMOTO MODEL FOR SSOFMSW

i. Determination of ultimate methane yield ($B_0$) and kinetic constants

From graph $B$ versus $\frac{1}{\theta}$, $B_0 = 0.75$

From graph $\theta$ versus $\frac{B}{B_0 - B}$

\[
\frac{1}{\mu_m} = 10 \quad \text{Therefore } \mu_m = 0.1 \text{ d}^{-1}
\]

\[
\frac{k}{\mu_m} = 10 \quad \text{Therefore } k = 1.0
\]

\[
B = B_0 \left(1 - \frac{k}{\mu_m \theta - 1 + k}\right)
\]

\[
= 0.75 \left(\frac{1}{0.1 \times 25 - 1 + 1}\right)
\]

\[
= 0.45
\]

ii. Determination of volumetric methane production rate ($\Gamma_v$)

\[
\Gamma_v = \frac{B_{STO}}{\theta} = B_0 L \left(1 - \frac{k}{\mu_m \theta - 1 + k}\right)
\]

\[
= 0.75 \times 1.0 \left(\frac{1}{0.1 \times 25 - 1 + 1}\right)
\]

\[
= 0.45
\]
iii. Determination of maximum volumetric methane production rate

\[
\Gamma_v = \frac{BS_{TO}}{\theta} \Rightarrow S_{TO} = \frac{\Gamma_v \theta}{B} = \frac{0.45 \times 25}{0.45} = 25 \text{ kg m}^{-3}
\]

\( S_{TO} = \) Total influent substrate concentration (including the non biogradable portion of volatile solids.

Maximum volumetric methane production rate (\(\Gamma_{v_{max}}\))

\[
\Gamma_{vm} = \frac{B_0 S_{TO} \mu_m}{(1+\sqrt{k})^2} = \frac{0.75 \times 25 \times 0.1}{(1+\sqrt{1})^2} = 0.47
\]

Which occurs at \(\theta = \frac{(1+\sqrt{k})}{\mu_m} = \frac{(1+1)}{0.1} = 20 \text{ days}\)

\[
B = B_0 \left(1 - \frac{k}{0.1 \times 20 - 1 + 1}\right) = 0.375
\]

\[
S_{TO} = \frac{0.47 \times 20}{0.375} = 25.1
\]

\[
L = \frac{S_{TO}}{\theta} = \frac{25}{20} = 1.25
\]