

	WASTEWATER TREATMENT PLANT PROJECT	
Document No.	METHANE PRODUCTION IN ANAEROBIC DIGESTER	Rev. No. :
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1. Description

Anaerobic digestion converts biodegradable COD to biogas. Methane production is estimated from the COD removed, subtracting COD used for biomass synthesis.

2. Calculation Objective

Estimate daily methane (m^3/d) and total gas (m^3/d) from bsCOD removal in an anaerobic digester.

3. Data Input

Biosolids flow	Q	=	300	m^3/d
Biodegradable soluble COD	$bsCOD$	=	5,000	g/m^3
COD removal fraction	η_{rem}	=	0.95	—
Biomass yield (VSS/COD)	Y	=	0.04	$\text{g VSS}/\text{g COD}$
Digester temperature	T	=	35	$^{\circ}\text{C}$
Methane fraction (vol)	f_{CH_4}	=	0.65	—

4. Calculation

Use a steady-state mass balance to determine the amount of the influent COD converted to methane:

$$0 = COD_{in} - COD_{eff} - COD_{vss} - COD_{CH_4}$$

4.1 Determine the individual COD values

Influent COD load	COD_{in}	=	1,500,000 g/d
Effluent COD load	COD_{eff}	=	75,000 g/d
Removed COD	$COD_{removed}$	=	1,425,000 g/d

4.2 COD to biomass (equivalent)

Noting that the COD of waste activated sludge is 1.42 (P x) :

COD of waste activated sludge	COD_{vss}	=	80,940 g/d
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4.3 COD to methane

Solve the mass balance for COD_{CH_4} :

$$COD_{CH_4} = COD_{in} - COD_{eff} - COD_{vss}$$

COD to methane	COD_{CH_4}	=	1,344,060 g/d
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4.4 Correct for temperature

Correct the theoretical methane gas production for the actual anaerobic digester temperature.

Temperature correction factor	θ^T	=	1.1	—
Methane production	VCH_4	=	530.7	m ³ /d

4.5 Total gas production

Assuming methane is 65% of the gas volume:

Total gas production	V_{gas}	=	816.5	m ³ /d
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5. Result Summary

 Methane Production 530.70 m³/d	 Total Gas Production 816.46 m³/d
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6. Reference

Davis, M. L. (2010). Water and wastewater engineering: Design principles and practice (Professional ed.). WEF Press.