Methane Production from COD Removed in an Anaerobic Reactor

COD balance of an anaerobic reactor: COD to effluent, to biomass and to methane, the methane yield at the operating temperature and the biogas flow.

Input parameters

Unit system: SI

Parameter	Value	Unit
Wastewater flow	1,200.0	m³/d
Biodegradable COD in the feed	3,000.0	mg/L
bCOD removal	85.000	%
Net biomass yield (g VSS/g COD used)	0.050000	
Gas temperature	30.000	°C
Gas pressure	1.0000	atm
Methane in the biogas	75.000	%

Calculated results

Parameter	Value	Unit
COD in	3,600.0	kg/d
COD to biomass	217.26	kg/d
COD converted to methane	2,842.7	kg/d
Methane per COD converted	388.68	L/kg
Methane	1,104.9	m³/d
Total biogas	1,473.2	m³/d
Methane energy (LHV)	412.38	kW

Notes for this case

• One mole of methane takes 64 g of COD to oxidise, so 0.35 L CH_4 forms per g COD at 0 °C and 1 atm, 0.40 L at 35 °C. Biomass is 1.42 g COD per g VSS. Methane energy uses a lower heating value of 50.0 MJ/kg.

Formula and method

$$COD_{CH_4} = COD_{in} - COD_{eff} - 1.42\,Y_n\,ECOD_{in}, \quad Q_{CH_4} = COD_{CH_4}\frac{RT/p}{64\ \mathrm{g/mol}}$$

Variables

Q	Wastewater flow	m³/s
$bCOD$	Biodegradable COD in the feed	kg/m³
E	bCOD removal	-
Y_n	Net biomass yield (g VSS/g COD used)	-
T	Gas temperature	K
p	Gas pressure	Pa
x_{CH_4}	Methane in the biogas	-
COD_{in}	COD in	kg/s
COD_{VSS}	COD to biomass	kg/s
COD_{CH_4}	COD converted to methane	kg/s

y_{CH_4}	Methane per COD converted	m³/kg
Q_{CH_4}	Methane	m³/s
Q_{gas}	Total biogas	m³/s
E_{CH_4}	Methane energy (LHV)	W

Method and standards

COD mass balance for anaerobic treatment.

Assumptions and limits

- Steady state; sulphate reduction and dissolved methane in the effluent neglected.

Report details

Report reference	FCC-GF1K-5YD1 (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/environmental/wastewater/anaerobic-methane-from-cod

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.