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UASB Tank Calculation

Yelow block is the design datameter : be filled in
Brown: calculate process data
Red : last result for your process

1.UASB Tank-Parameter

Raw data						
Inlet flow Q（m3/d）	240.00	℃	25.00			
Influent quality	COD_0	BOD_0	SS_0	碱度	TN_0	TP_0
（mg/l）	7290.00	3500.00	294.00	300~700	165.00	5~17
Volume load rate U	4.00	kgCOD/（m3.d）	Generally, it can reach 5.0~6.0, and the flocculent sludge generally takes a value of 2.0~3.0kg			
COD removal rate %	0.70		The removal rate of organic wastewater can reach 80%~96%			
SS removal rate %	0.60		The general removal rate is about 70%.			
Apparent biogas yield	0.50	m3/（remove kgCOD）	The general biogas yield is 0.3~0.5			
Sludge apparent yield	0.05	kgVSS/（remove kgCOD）	The general yield is calculated from 0.05 to 0.1			
VSS/SS	0.60		It is generally between 0.6 and 0.85			
1. Effluent quality after treatment						
Effluent quality	COD_1	BOD_1	SS_1		TN_1	TP_1
（mg/l）	2187.00		117.60			
2. UASB reactor effective volume and length, width, height size determination						
2.1. Effective volume VR	437.40	m3				
2.2. Number of reactors	1.00		Consider maintenance does not stop production, generally choose 2 seats.			
2.3. Single volume VR'	437.40	m3				
2.4, effective height H	10.00	m3	The total reactor height is H2	10.50	m	
2.5. Reactor area S	43.74	m2				
2.6. Reactor size						
Set the reactor width B	8.00	m	The length of the reactor L	5.47	m	5.00
Reactor diameter D	7.46	7.00	m			m
3, the dimensions of the reactor						
long	5.00	wide	8.00	long	10.50	
diameter	7.00	high	10.50			
The area after re-accounting	40.00	Or circle	38.47	m2		
volume	400.00	Or circle	384.65	m3		
4. Hydraulic residence time of the reactor						
HRT	40.00	Or circle	38.47	h		
5, three-phase separator design						
Surface load in the settling zone	0.13	Or circle	0.13	m3/（m2.h）	The value of the granular sludge bed is between 1.0 and 2.0 The value of flocculent sludge bed is between 0.4 and 0.8	
The depth of the settling area h	1.00	m	Generally, the value is greater than 1.0m			
Residence time	4.00	Or circle	3.85	h		
6. Reflux joint design						
The horizontal Angle of the collecting t	55.00		Generally desirable 45-60°			
The protection height h1 is used	0.50	m				
Set the triangle hood height h3	0.80	m				
Top depth of the upper triangle is h2	0.50	m				
Then we have b1	0.56	m	Width of the base of the lower triangular hood			
The unit three-phase separator is set	2.50	m				
Then we have Lower sludge return seam width b2	1.38	m	The horizontal distance between two adjacent lower triangular hoods			
The total area of the lower sludge retu	22.07	Or circle	27.04	m2		
Granular sludge this value，less2.0		Flocculent sludge has this value，less1.0				
Then we have The ascending velocity v1 of the lower triangular return joint	0.45	Or circle	0.37	m/h		
The width of the return seam of the upper triangular air collector is set at b3	0.64	m		Rectangular pool，8.00	Circular pool，7.69	
Total area a2	20.47	Or circle	25.08	Not less than 20% of the reactor area, i.e. not less than		
Then we have Rising velocity v2 in the upper return seam	0.24	Or circle	0.40	m/h	Granular sludge, guaranteedv1<v2<2.0m/h	
					Flocculent sludge ensuresv1<v2<1.0m/h	
7. Determination of the position of the three-phase separator						
The vertical distance from the bottom end of the upper triangular hood to the bevel of the lower triangular hood		CE	0.52	m		
The vertical distance from the bottom end of the upper triangular hood to the lower triangular hood		BC	0.91	m		
Take the length of the bevel that overlaps the upper triangle hood and the lower triangle hood		AB	0.40	m	Generally, it should be up to 10-20cm or determined by calculation	
Then we have Height of the bottom end of the upper triangle hood and the bottom end of the lower triangle hood		h	1.31	m		
Confirm date，						
The distance from the bottom end of the upper triangular hood to the top of the pool	1.80	m				
The distance from the bottom end of the lower triangle hood to the top of the pool	3.11	m				
8. Gas-liquid separation design						
Water velocity va along the slope of the lower hood	0.60	Or circle	0.49	m/h		
The diameter of the bubble dg is set to	0.01	cm				
					β— collision coefficient, preferably 0.95	
The dynamic viscosity coefficient of wastewater μ=vp1	0.01	Take 0.02 value	0.02		g——acceleration of gravity，cm/s²	
					ρ1——liquid density，g/cm² Take 1.03g/cm² Value	
	（β*g/18μ）*（ρ1-ρg）*d²				ρg——methane density，g/cm² Take 1.2*10⁻³ Value	
The rising velocity of the bubble at	0.27	cm/s			d——Bubble diameter，cm	
	9.59	m/h			μ——Dynamic viscosity coefficient of wastewater，g/cm²	
					v——kinematic viscosity coefficient of liquid，cm²/s Take 0.0101 Value	
9. Accounting design results						
BC/AB=	2.28					
vb/va=	16.08	Or circle	19.70			
Meet the requirements of vb/va > BC/AB, and can remove bubbles with a diameter equal to or greater than 0.01cm.						
10. Production of biogas						
Volume of production per day V=	612.36	m³/d				
Volume of biogas tank used in boiler =	122.47	m3	Designed according to 20% of daily gas volume			
Surface area of water sealed tank	0.07	m2	The rising flow rate of biogas is 0.1m/ss			
Size of water seal tank						
diameter	0.30	m				
Altitude	1.20	m	The liquid level should be 0.5-0.8m			
			The height of the gas is 0.3-0.5m			
11. Sludge production						
V mud=	102.06	kgSS/d				