

Techno-economic analysis and life cycle assessment of sustainable farnesene production by genetically engineered cyanobacteria utilizing carbon dioxide: A step towards commercial viability

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Supplementary Table 1: MFSP analysis

Parameters required		Million USD
FR	farnesene Revenue	13.49201587
ER	Revenue without farnesene	20.819
OC	Operating Cost	30.758
DR	Discount rate	0.0674
TPI	Total Project investment	28.162
DC	Depreciation cost (million USD/year)	0.845
Interest	Interest rate	0.2
TR	Tax Rate	0.35
Re	Residual (salvage value)	11.265
ELS	Economic life of project (Year)	20.000
Capex	Capital cost	28.162

Supplementary Table 2: Financial calculations

Depreciation cost (million USD/year)	0.844849809
Return on investment (ROI)	2.604783934
Income tax (IT) (0.35*FR)	-3.774548719
Farnesene revenue (FR) (million/year) (0.65*FR)	8.770
Farnesene revenue (FR) (million USD/year)	13.49201587
farnesene revenue (FR) (USD/year)	13492015.87

Supplementary Table 3: Farnesene Productivity

	Farnesene productivity (kg/day/100m³)	Farnesene productivity (g/m³/day)	Farnesene production (kg/year)	FR (USD/year)	MFSP (USD/kg)
	0.1287	1.287	45443.97	13492015.87	296.8934244
	0.2	2	70620	13492015.87	191.0509186
Actual productivity	0.2574	2.574	90887.94	13492015.87	148.4467122
	0.5148	5.148	181775.88	13492015.87	74.22335611
10x	2.574	25.74	345713.94	13492015.87	39.02653122
20x	5.148	51.48	691427.88	13492015.87	19.51326561
30x	7.722	77.22	1037141.82	13492015.87	13.00884374
40x	10.296	102.96	1382855.76	13492015.87	9.756632806
50x	12.87	128.7	1728569.7	13492015.87	7.805306245
60x	15.444	154.44	2074283.64	13492015.87	6.504421871
70x	18.018	180.18	2419997.58	13492015.87	5.575218746
80x	20.592	205.92	2765711.52	13492015.87	4.878316403
90x	23.166	231.66	3111425.46	13492015.87	4.336281247
100x	25.74	463.32	3457139.4	13492015.87	3.902653122
110x	28.314	2316.6	3802853.34	13492015.87	3.547866475
120x	30.888	4633.2	4148567.28	13492015.87	3.252210935
130x	33.462	6949.8	4494281.22	13492015.87	3.002040863
140x	36.036	9266.4	4839995.16	13492015.87	2.787609373
150x	38.61	11583	5185709.1	13492015.87	2.601768748
200x	51.48	13899.6	6914278.8	13492015.87	1.951326561
1000x	257.4	16216.2	34571394	13492015.87	0.390265312

Supplementary Table 4: MFSP variation over a range of farnesene productivity (g/m³/day)

Parameter	Lower bound	Base value	Upper bound	MFSP LB	MFSP UB	MFSP base value	MFSP (high diff)	MFSP (low diff.)	% change LB	% change UB
Nitrogen cost (\$/kg)	0.1	0.15	0.5	147.864	152.526	148.447	4.079	-0.583	0.39273276	-2.747782037
Cost of PBRs	6	6.87	7.5	147.239	149.321	148.447	0.874	-1.208	0.813758446	-0.588762319
Project length (year)	15	20	30	154.169	143.44	148.447	5.722	-5.007	-3.85457436	3.372920975
cost of land \$/acre	0	3000	5000	0	143.473	148.447	-4.974	0	100	3.350690819
Cost of inducer	5	7	15	144.748	163.241	148.447	14.794	-3.699	2.49179842	-9.965846396
Cost of isopropyl myristate	0.01	0.0167	0.5	148.172	168.252	148.447	19.805	-0.275	0.185251302	-13.34146194
Cost of electricity	0.08	0.088	0.11	120.72	224.36	148.447	75.913	-27.727	18.67804671	-51.13811663
Farnesene productivity (g/m ³ /day)	2	2.574	25.74	191.051	39.02	148.447	42.604	-109.427	-28.69980532	73.71452438

Supplementary Table 5: Net Present value (NPV)

Year	CapEx	OpEx	Revenue	Cash Flow	Discounted cash flow
2024	28.161	15.37920945	17.15542983	-26.38477961	-24.72800339
2025		30.7584189	34.31085967	3.552440771	3.120311897
2026		30.7584189	34.31085967	3.552440771	2.924378535
2027		30.7584189	34.31085967	3.552440771	2.740748392
2028		30.7584189	34.31085967	3.552440771	2.568648915
2029		30.7584189	34.31085967	3.552440771	2.407356059
2030		30.7584189	34.31085967	3.552440771	2.407356059
2031		30.7584189	34.31085967	3.552440771	2.256191246
2032		30.7584189	34.31085967	3.552440771	2.114518506
2033		30.7584189	34.31085967	3.552440771	1.981741805
2034		30.7584189	34.31085967	3.552440771	1.857302535
2035		30.7584189	34.31085967	3.552440771	1.740677165
2036		30.7584189	34.31085967	3.552440771	1.631375038
2037		30.7584189	34.31085967	3.552440771	1.528936305
2038		30.7584189	34.31085967	3.552440771	1.432929995
2039		30.7584189	34.31085967	3.552440771	1.342952198
2040		30.7584189	34.31085967	3.552440771	1.258624366
2041		30.7584189	34.31085967	3.552440771	1.17959172
2042		30.7584189	34.31085967	3.552440771	1.105521762
2043		30.7584189	34.31085967	3.552440771	1.03610287
2044		30.7584189	34.31085967	3.552440771	0.97104299
				NPV	12.87830497
				IRR	12%

Net cash flow = revenue-OpEx

NPV= Sum of discounted cash flow