

Supplementary Material

Title: Artificial consortium demonstrates emergent properties of enhanced cellulosic-sugar degradation and biofuel synthesis

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Supplementary Table 1. Summary growth properties for *E. coli* (Ec) and *C. phytofermentans* (Cp) monocultures and binary consortium (EcCp) grown on mGS-2 medium with and without glycerol.

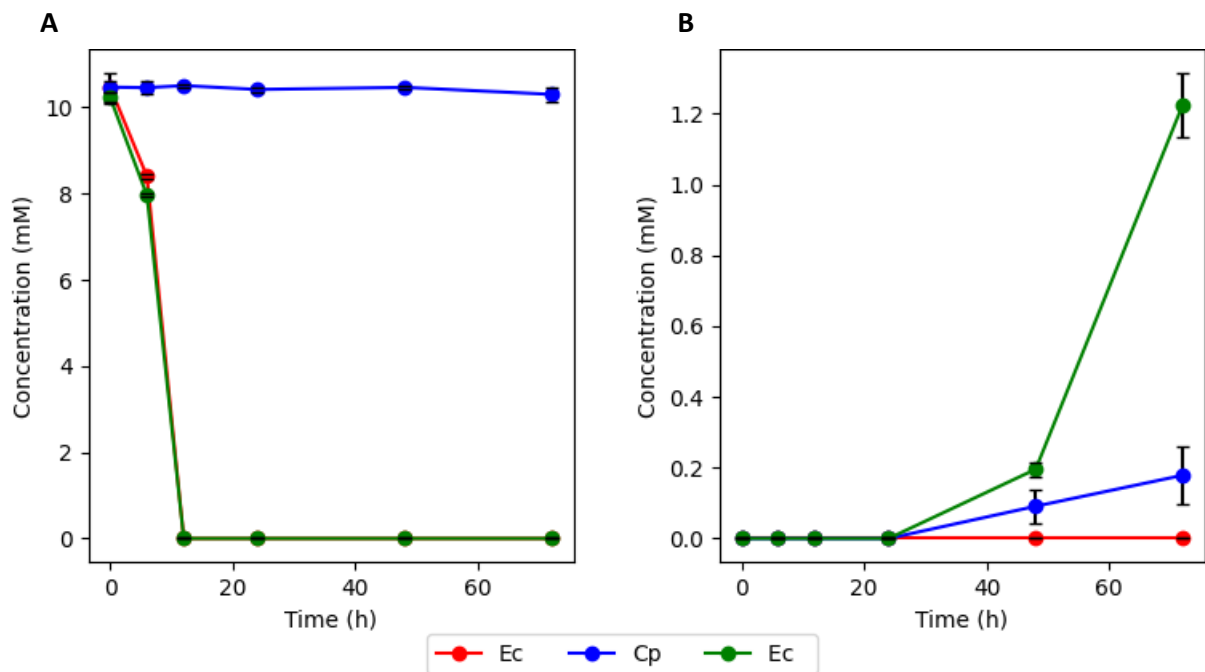
	Ethanol (mM)			Formate (mM)			Acetate (mM)		
	Ec	Cp	EcCp	Ec	Cp	EcCp	Ec	Cp	EcCp
w/ gly	1.24	3.27	26.71	1.00	1.27	7.49	16.79	2.41	25.40
wo/gly	0.46	3.05	20.16	0.00	0.49	4.70	7.36	1.38	19.18

EtOH/For (mol/mol)	Ec	Cp	EcCp
w/ gly	1.25	2.58	3.57
wo/gly	N/A	6.17	4.29

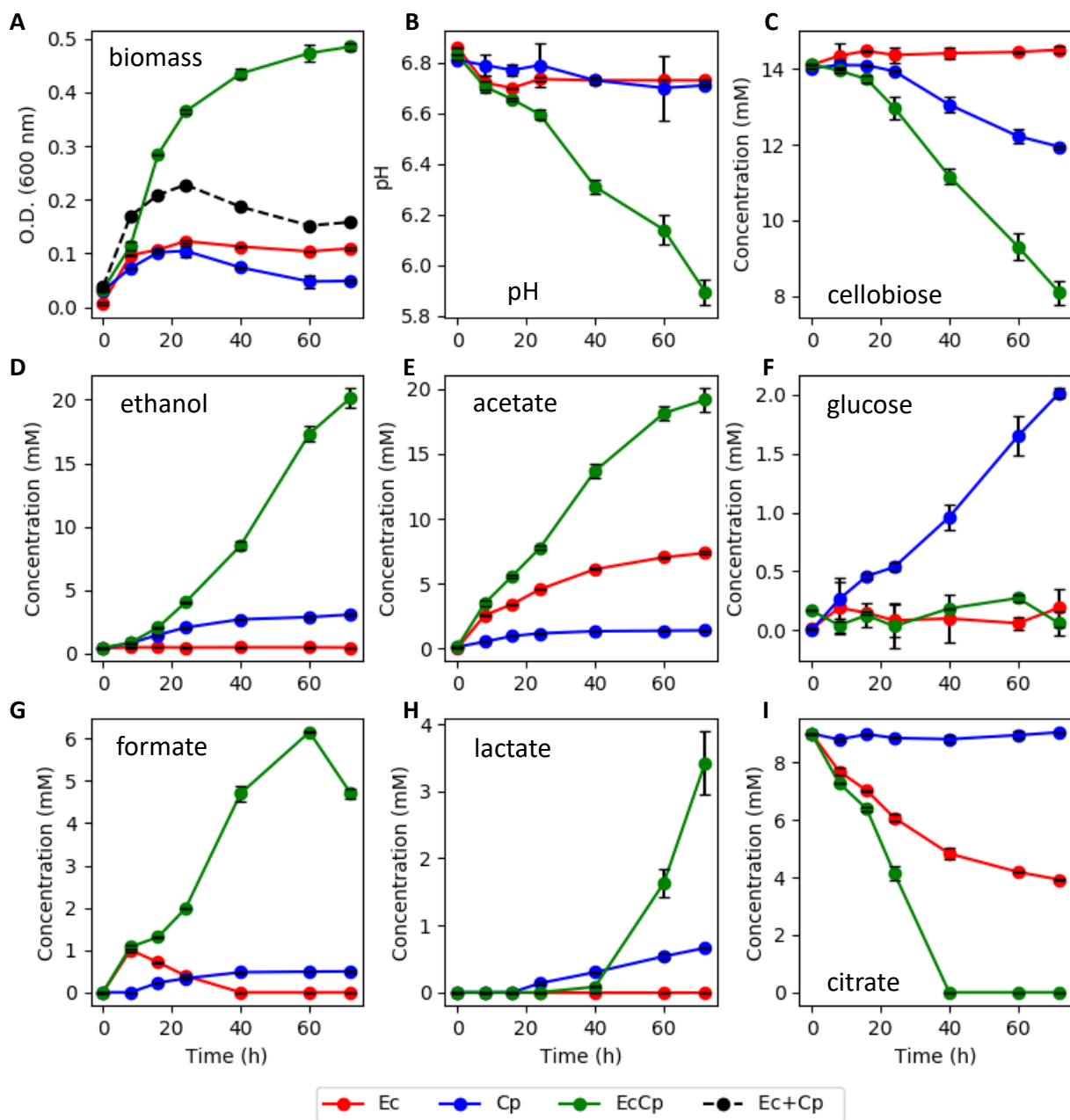
EtOH/Ace (mol/mol)	Ec	Cp	EcCp
w/ gly	0.07	1.36	1.05
wo/gly	0.06	2.21	1.05

Supplementary Table 2. Chemically-defined CSP medium.

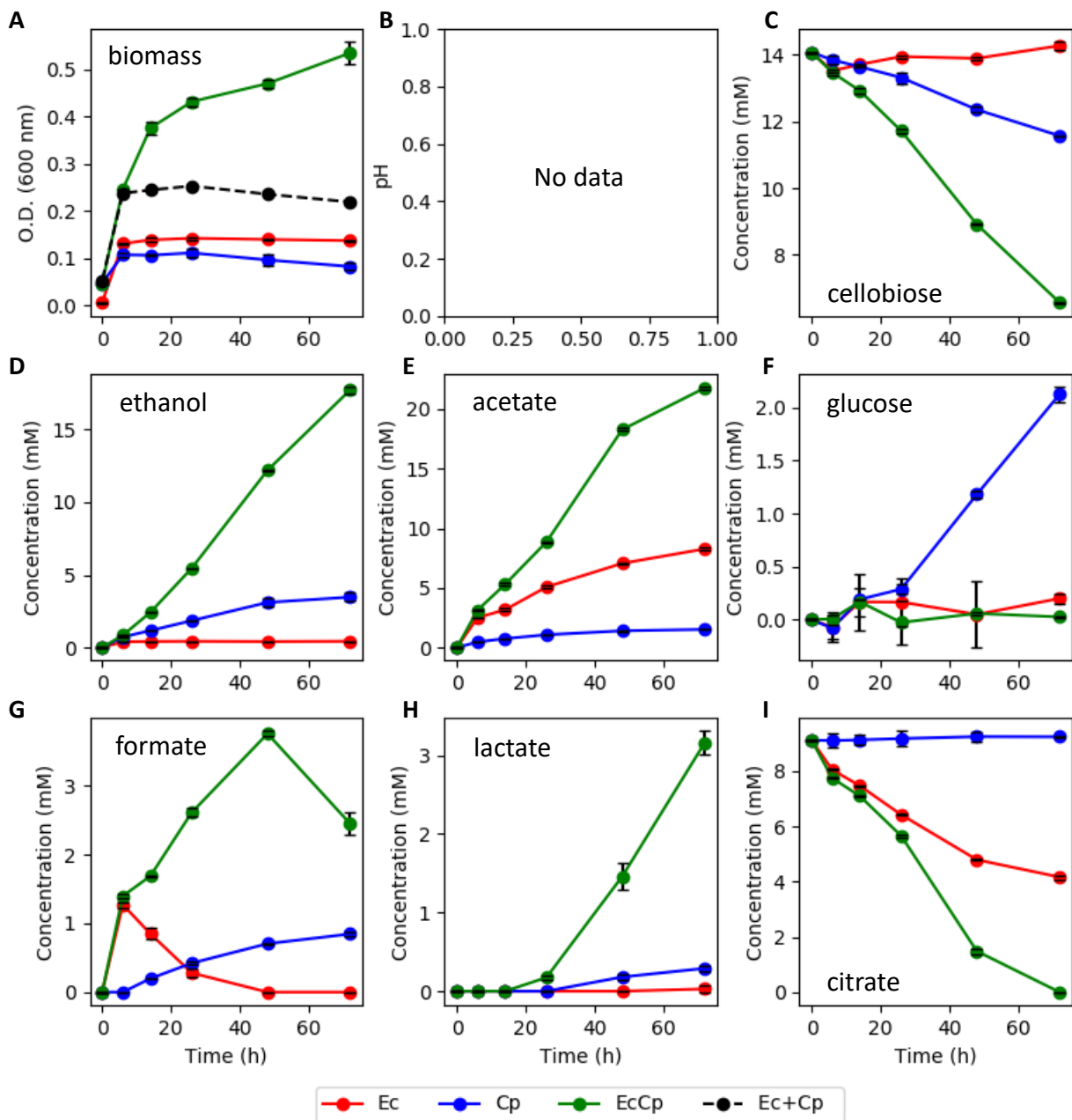
4 g/L glucose
0.7 g/L sodium citrate
0.1 g/L EDTA tetrasodium salt
1.7 g/L yeast nitrogen base
1X minimum essential media (MEM) non-essential amino acid (100X solution)
1X minimum essential media (MEM) amino acid (50X solution)
4.7 g/L KH_2PO_4
8.2 g/L Na_2HPO_4
0.02 g/L adenine
0.02 g/L uracil
0.02 g/L cytosine
0.02 g/L guanine
0.15 g/L glutamine
 2.0×10^{-6} g/L vitamin B_{12}
 2.8×10^{-3} g/L $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$
 1.2×10^{-5} g/L $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$



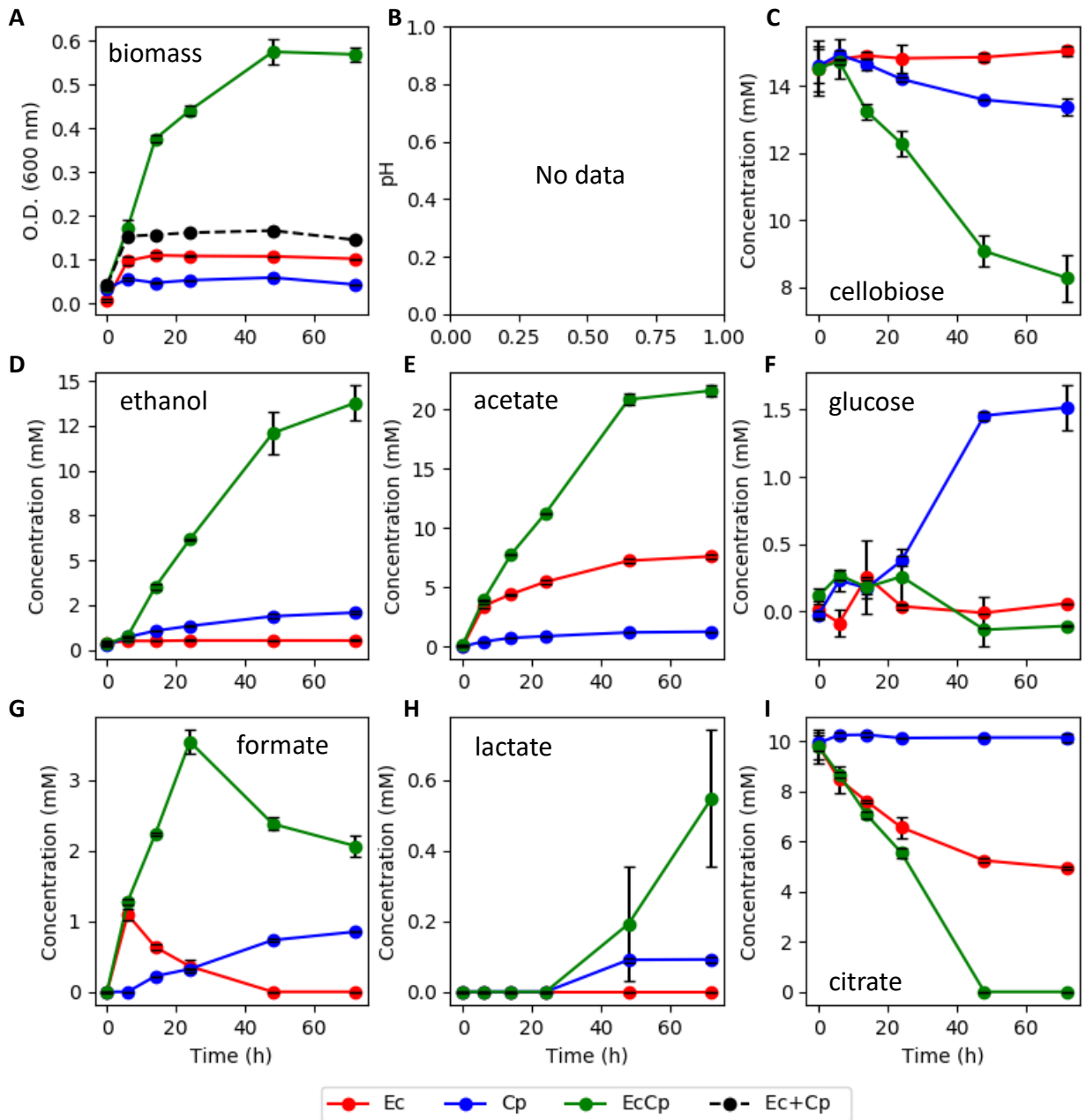
Supplementary Figure 1. Planktonic growth properties for *E. coli* (Ec) and *C. phytofermentans* (Cp) monocultures and a binary consortium (EcCp) grown anoxically on mGS-2 medium containing glycerol. **(A)** Citrate concentration. **(B)** Lactate concentration. Error bars represent standard deviation from three biological replicates. See Figure 1 in the main text for additional data.



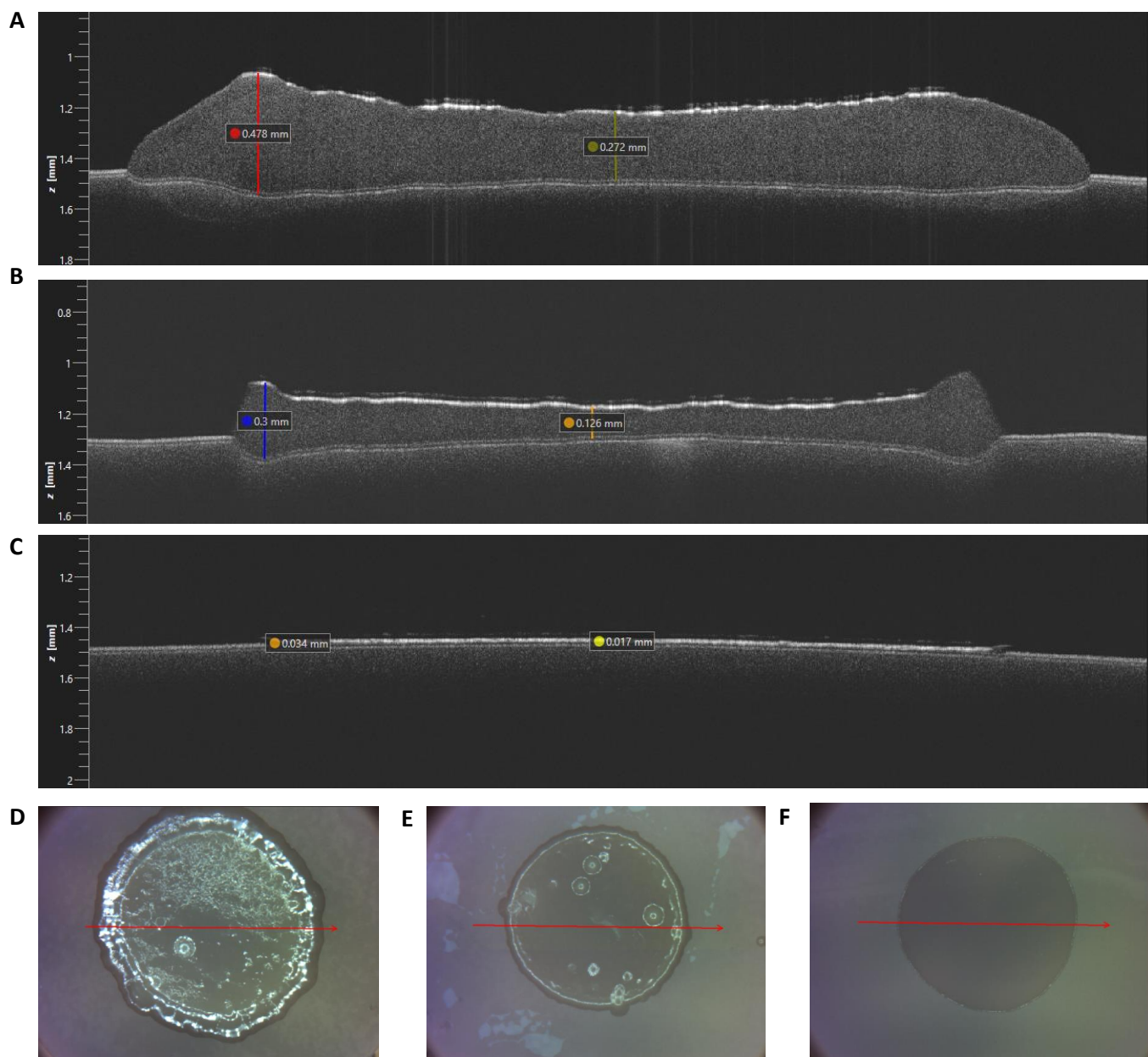
Supplementary Figure 2. Planktonic growth properties for *E. coli* (Ec) and *C. phytofermentans* (Cp) monocultures and a binary consortium (EcCp) grown on mGS-2 medium without glycerol. (A) Optical density (O.D.₆₀₀), (B) pH, (C) cellobiose concentration, (D) ethanol concentration, (E) acetate concentration, (F) glucose concentration, (G) formate concentration, (H) lactate concentration, and (I) citrate concentration. Ec+Cp indicates the sum of *E. coli* and *C. phytofermentans* monoculture properties. Error bars represent the standard deviation from three biological replicates.



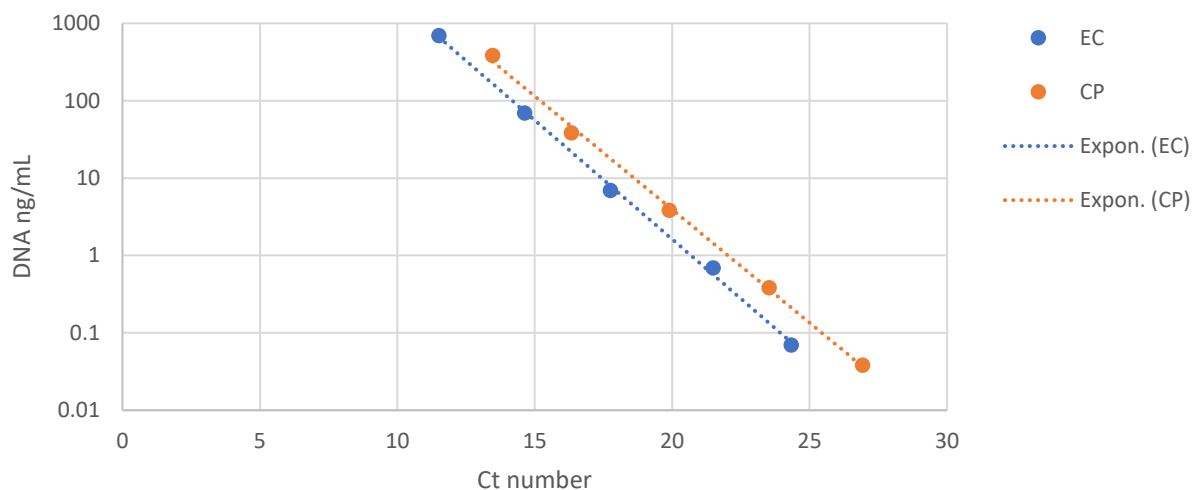
Supplementary Figure 3. Planktonic growth properties for *E. coli* (Ec) and *C. phytofermentans* (Cp) monocultures and a binary consortium (EcCp) grown on mGS-2 medium without glycerol but with supplements of nitrogen and sulfur sources ($\text{MgSO}_4 = 10 \text{ mM}$, $\text{NH}_4\text{Cl} = 10 \text{ mM}$.) (A) Optical density (O.D._{600}), (B) pH was not measured for this condition, (C) cellobiose concentration, (D) ethanol concentration, (E) acetate concentration, (F) glucose concentration, (G) formate concentration, (H) lactate concentration, and (I) citrate concentration. Ec+Cp indicates the sum of *E. coli* and *C. phytofermentans* monoculture properties. Error bars represent the standard deviation from three biological replicates.



Supplementary Figure 4. Planktonic growth properties for *E. coli* (Ec) and *C. phytofermentans* (Cp) monocultures and a binary consortium (EcCp) grown on mGS-2 medium without glycerol and without urea (**A**) Optical density (O.D.₆₀₀), (**B**) pH was not measured for this condition, (**C**) cellobiose concentration, (**D**) ethanol concentration, (**E**) acetate concentration, (**F**) glucose concentration, (**G**) formate concentration, (**H**) lactate concentration, and (**I**) citrate concentration. Ec+Cp indicates the sum of *E. coli* and *C. phytofermentans* monoculture properties. Error bars represent the standard deviation from three biological replicates.



Supplementary Figure 5. Optical coherence tomography (OCT) analysis of coculture biofilm comprised of *E. coli* (Ec) and *C. phytofermentans* (Cp) grown under different conditions. **(A)** and **(D)** anoxic to oxic shift (AOS) growth conditions, **(B)** and **(E)** anoxic (AN) growth conditions, and **(C)** and **(F)** oxic (OX) growth conditions. Analysis performed after 10 days of cultivation.



E.coli

$$y = 2E+06e^{-0.708x} \quad R^2 = 0.9987$$

C. phytofermentans

$$y = 3E+06e^{-0.674x} \quad R^2 = 0.9985$$

Supplementary Figure 6. qPCR calibration curves for relationship between DNA mass (ng/ml) and Ct number for *E. coli* and *C. phytofermentans* cultures. DNA mass was quantified using Qubit analysis.