Supplementary Information

Next-generation circular waste biorefineries based on biogas utilization using renewable energy: Process composition and economic analysis

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Table S1. Total capital investment calculations

Total Capital Investment: DFC + Working capital + Startup and validation cost	
Direct fixed capital (DFC, direct cost (DC) + indirect cost (IC) + other costs (OC)	
✓ Direct cost (DC) is the sum of the total equipment purchase cost (PC), installation costs, piping, instrumentation, insulation, electrical facility, buildings and yard improvement, and auxiliary facilities.	
• Piping	0.31 × PC
• Instrumentation	0.43 × PC
• Insulation	0.03 × PC
• Electrical facilities	0.10 × PC
• Buildings	0.15 × PC
• Yard improvement	0.12 × PC
• Auxiliary facilities	0.20 × PC
✓ IC are the sum of engineering and construction costs, estimated based on direct cost.	
• Engineering cost	0.25 × PC
• Construction	0.35 × PC
✓ OC is the contractor's fee and contingency.	
• Contractor's fee	0.05 × PC
• Contingency	0.35 × PC
Working capital : 30 days of labor, Raw materials, ,Utilities, Waste treatment	
Startup and validation cost : 0.5% × DFC	

Fig. S1. Daily production of succinate (SA), PHB, and methane for each combination process.