

Table S1. Biogas production from FPWs by the subcultured DABYS-A microflorae

Substrate	Gas	Biogas yield in each subculture (mL/g-substrate)										Average	Stdev	Biogas composition (%)
		1st subculture	2nd subculture	3rd subculture	4th subculture	5th subculture	6th subculture	7th subculture	8th subculture	9th subculture	10th subculture			
Cattle bone	Methane	12.3	10.4	9.1	9.0	9.3	6.3	6.7	7.4	6.8	7.3	8.4	1.9	46.3% CH ₄
	Hydrogen	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.2	0.1	0.1	0.4% H ₂
	Carbon dioxide	11.5	10.3	10.2	10.3	10.3	9.0	7.1	9.9	9.2	9.5	9.7	1.2	53.3% CO ₂
Fish bone	Methane	12.5	9.4	9.8	6.9	8.0	8.0	9.6	10.3	10.1	9.7	9.4	1.5	51.8% CH ₄
	Hydrogen	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2	1.4	0.0	0.2	0.4	1.0% H ₂
	Carbon dioxide	8.4	8.7	8.6	9.0	8.8	9.0	6.6	9.1	8.9	8.8	8.6	0.7	47.2% CO ₂
Carrot peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	12.6	11.6	9.8	10.2	3.0	5.6	3.7	8.5	8.0	10.0	8.3	3.2	66.8% H ₂
	Carbon dioxide	8.3	5.4	4.2	4.4	2.2	2.7	1.6	3.7	3.9	4.8	4.1	1.9	33.2% CO ₂
White radish peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	7.8	11.6	8.6	6.5	7.8	5.2	8.3	5.6	7.2	6.6	7.5	1.8	52.2% H ₂
	Carbon dioxide	6.1	5.1	8.1	7.6	6.8	6.7	7.8	7.0	6.2	7.6	6.9	0.9	47.8% CO ₂
Cabbage stem	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	12.9	10.2	11.8	10.8	10.5	10.0	12.0	10.8	11.0	11.0	11.1	0.9	56.2% H ₂
	Carbon dioxide	7.0	8.0	9.0	10.1	8.9	9.5	10.0	8.9	7.0	7.9	8.6	1.1	43.8% CO ₂
Lotus root peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	4.2	1.2	2.4	2.4	2.7	0.2	4.3	4.0	3.7	4.0	2.9	1.4	37.6% H ₂
	Carbon dioxide	5.8	6.4	3.9	4.0	4.1	4.7	3.6	5.5	5.1	5.3	4.8	0.9	62.4% CO ₂
Apple core and peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	13.9	7.7	9.9	8.5	9.5	9.1	7.1	9.1	9.0	9.0	9.3	1.8	73.9% H ₂
	Carbon dioxide	4.8	2.8	3.8	3.8	3.4	3.0	0.5	3.5	3.7	3.4	3.3	1.1	26.1% CO ₂
Orange peel	Methane	0.0	0.0	0.0										
	Hydrogen	0.0	0.0	0.0										
	Carbon dioxide	0.0	0.0	0.0										
Grape peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	10.3	9.1	9.1	10.6	11.4	9.1	9.0	10.2	8.2	9.2	9.6	1.0	73.3% H ₂
	Carbon dioxide	5.2	3.1	4.1	3.0	2.9	3.3	3.8	2.8	3.7	3.0	3.5	0.7	26.7% CO ₂
Rice bran	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	10.0	11.8	6.9	5.8	5.4	14.6	8.2	13.6	14.3	12.2	10.3	3.5	55.9% H ₂
	Carbon dioxide	10.7	9.4	1.6	7.2	8.4	9.9	6.0	8.4	9.8	9.6	8.1	2.7	44.1% CO ₂
Wheat bran	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	7.9	10.8	12.6	13.5	17.1	15.2	15.3	14.7	16.3	14.2	13.8	2.7	60.9% H ₂
	Carbon dioxide	8.8	9.9	7.9	8.9	9.6	9.8	8.8	8.5	8.4	7.9	8.9	0.7	39.1% CO ₂
Rice hull	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	1.3	1.3	1.0	1.3	0.7	0.6	0.9	0.6	0.7	1.0	0.9	0.3	64.3% H ₂
	Carbon dioxide	0.6	0.5	0.6	0.3	0.7	0.3	0.6	0.6	0.4	0.6	0.5	0.1	35.7% CO ₂
Soy sauce lees	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	1.1	1.9	1.6	1.8	2.0	2.1	2.0	1.8	2.1	2.2	1.8	0.3	44.8% H ₂
	Carbon dioxide	2.7	3.0	2.7	2.4	2.7	2.0	2.2	2.0	1.3	1.8	2.3	0.5	55.2% CO ₂
Spent bonito flakes	Methane	12.4	12.0	12.0	12.4	11.9	10.3	11.0	11.1	12.0	11.8	11.7	0.7	58.8% CH ₄
	Hydrogen	0.1	0.1	0.2	0.3	0.1	0.3	0.2	0.9	0.2	0.3	0.3	0.2	1.3% H ₂
	Carbon dioxide	7.1	6.6	7.0	7.5	7.1	8.0	7.8	8.7	9.1	10.3	7.9	1.1	39.9% CO ₂
Spent dried kelp	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	6.7	10.7	10.0	10.5	9.0	8.5	6.5	10.5	9.8	9.1	9.1	1.5	90.7% H ₂
	Carbon dioxide	0.7	0.9	0.8	1.0	1.1	0.7	0.3	1.2	1.1	1.5	0.9	0.3	9.3% CO ₂
Spent tea leaf	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	2.9	3.0	2.5	3.1	3.1	3.0	2.7	3.1	2.8	3.0	2.9	0.2	48.9% H ₂
	Carbon dioxide	2.8	2.9	3.1	3.1	3.0	2.7	2.6	3.5	3.1	3.7	3.0	0.3	51.1% CO ₂
Spent coffee ground	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	2.1	2.4	3.1	3.3	3.9	2.9	3.2	3.0	2.8	2.2	2.9	0.5	49.7% H ₂
	Carbon dioxide	3.0	2.7	3.1	2.6	2.2	4.0	3.1	3.0	2.6	3.0	2.9	0.5	50.3% CO ₂
Rapeseed oil cake	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	14.1	7.4	7.4	8.0	7.7	12.8	6.8	15.8	17.7	16.1	11.4	4.3	54.1% H ₂
	Carbon dioxide	12.1	9.8	10.2	9.3	3.4	7.5	5.4	11.0	13.7	14.1	9.7	3.4	45.9% CO ₂

Substrate	Gas	Biogas yield in each subculture (mL/g-substrate)										Average	Stdev	Biogas composition (%)
		1st subculture	2nd subculture	3rd subculture	4th subculture	5th subculture	6th subculture	7th subculture	8th subculture	9th subculture	10th subculture			
Cattle bone	Methane	12.1	11.5	13.0	10.0	12.6	10.7	13.5	14.2	8.8	8.7	11.5	1.9	63.7% CH ₄
	Hydrogen	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.3	0.1	0.1	0.1	0.1	0.4% H ₂
	Carbon dioxide	5.7	6.6	6.1	7.0	6.8	7.5	7.1	6.5	5.6	5.9	6.5	0.6	35.9% CO ₂
Fish bone	Methane	11.1	9.5	8.8	10.5	8.4	8.8	8.5	6.8	8.3	8.6	9.0	1.2	57.3% CH ₄
	Hydrogen	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.3	0.0	0.1	0.1	0.5% H ₂
	Carbon dioxide	6.5	7.0	5.9	6.7	6.5	7.3	6.5	6.8	6.8	6.0	6.6	0.4	42.2% CO ₂
Carrot peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	7.5	8.4	9.0	9.5	8.7	10.0	7.7	10.3	9.5	9.2	9.0	0.9	74.0% H ₂
	Carbon dioxide	4.3	3.0	3.0	3.5	3.0	2.8	3.2	2.1	3.7	3.0	3.2	0.6	26.0% CO ₂
White radish peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	6.5	8.1	7.7	6.9	7.3	7.4	6.1	6.3	6.8	6.3	6.9	0.7	50.0% H ₂
	Carbon dioxide	7.5	6.9	7.1	6.5	5.5	8.7	7.1	6.7	7.0	6.0	6.9	0.9	50.0% CO ₂
Cabbage stem	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	7.0	6.5	8.0	6.2	6.0	6.9	6.8	7.1	6.7	7.0	6.8	0.5	60.8% H ₂
	Carbon dioxide	5.9	5.8	4.8	4.6	4.0	5.1	3.8	3.0	3.1	4.0	4.4	1.0	39.2% CO ₂
Lotus root peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	4.3	4.0	2.7	2.9	3.1	3.6	3.1	2.9	2.8	3.2	3.2	0.5	43.5% H ₂
	Carbon dioxide	5.3	5.1	4.8	3.9	2.9	4.3	3.9	3.7	4.2	4.2	4.2	0.7	56.5% CO ₂
Apple core and peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	10.0	10.7	10.4	3.6	8.5	6.1	5.9	6.3	8.0	7.8	7.7	2.3	65.0% H ₂
	Carbon dioxide	5.1	5.3	4.7	4.3	2.5	3.8	3.3	3.8	4.4	4.3	4.2	0.8	35.0% CO ₂
Orange peel	Methane	0.0	0.0	0.0										
	Hydrogen	0.0	0.0	0.0										
	Carbon dioxide	0.0	0.0	0.0										
Grape peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	6.2	9.7	11.3	8.5	6.6	8.0	8.3	8.3	7.1	9.4	8.4	1.5	66.5% H ₂
	Carbon dioxide	4.2	4.3	4.0	4.1	3.8	5.2	3.7	4.2	4.9	3.6	4.2	0.5	33.5% CO ₂
Rice bran	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	25.8	16.2	14.6	15.4	15.7	15.2	14.3	16.0	13.1	12.0	15.8	3.7	74.7% H ₂
	Carbon dioxide	9.1	9.0	8.3	4.8	4.2	3.8	3.8	4.1	3.4	2.9	5.4	2.5	25.3% CO ₂
Wheat bran	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	12.1	18.6	14.1	11.2	15.5	15.3	12.6	11.0	13.9	13.5	13.8	2.3	79.7% H ₂
	Carbon dioxide	2.8	4.7	3.3	2.8	4.5	4.2	3.5	2.5	3.6	3.3	3.5	0.7	20.3% CO ₂
Rice hull	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	0.7	1.4	2.6	2.2	0.8	1.0	0.5	0.5	0.2	0.3	1.0	0.8	73.9% H ₂
	Carbon dioxide	0.5	0.6	0.2	0.3	0.3	0.5	0.3	0.4	0.1	0.3	0.4	0.1	26.1% CO ₂
Soy sauce lees	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	2.0	0.8	1.3	1.8	1.9	1.7	2.0	2.0	2.0	2.1	1.8	0.4	45.5% H ₂
	Carbon dioxide	1.9	2.0	2.1	2.0	2.0	2.6	2.1	2.0	2.0	2.3	2.1	0.2	54.5% CO ₂
Spent bonito flakes	Methane	13.4	14.9	13.9	13.7	14.5	13.2	18.8	17.4	12.2	10.8	14.3	2.3	60.6% CH ₄
	Hydrogen	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.4	0.2	0.1	0.1	0.4% H ₂
	Carbon dioxide	8.6	10.2	9.4	9.4	9.6	8.6	10.7	7.5	9.7	8.1	9.2	1.0	39.0% CO ₂
Spent dried kelp	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	9.4	10.7	10.8	11.3	11.3	11.0	11.1	10.5	12.3	11.0	10.9	0.7	76.7% H ₂
	Carbon dioxide	3.5	3.7	3.1	3.0	3.1	3.5	3.3	3.3	3.7	3.0	3.3	0.3	23.3% CO ₂
Spent tea leaf	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	4.0	3.2	3.3	4.2	4.9	3.7	4.0	4.1	4.3	4.7	4.0	0.5	48.8% H ₂
	Carbon dioxide	4.8	4.4	3.6	3.7	4.0	4.0	4.2	4.6	4.1	4.9	4.2	0.4	51.2% CO ₂
Spent coffee ground	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	4.1	3.5	3.3	3.6	3.1	2.9	3.7	3.9	4.1	3.7	3.6	0.4	47.5% H ₂
	Carbon dioxide	4.6	4.1	3.9	3.2	3.6	4.7	3.9	4.0	3.1	4.6	4.0	0.6	52.5% CO ₂
Rapeseed oil cake	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	9.7	14.6	12.8	11.4	11.9	12.0	13.0	11.2	12.6	12.7	12.2	1.3	53.7% H ₂
	Carbon dioxide	10.8	11.9	10.8	11.2	9.8	12.7	12.0	10.4	8.8	6.9	10.5	1.7	46.3% CO ₂

Table S3. Biogas production from FPWs by the subcultured DABYS-G microflorae

Substrate	Gas	Biogas yield in each subculture (mL/g-substrate)										Average	Stdev	Biogas composition (%)
		1st subculture	2nd subculture	3rd subculture	4th subculture	5th subculture	6th subculture	7th subculture	8th subculture	9th subculture	10th subculture			
Cattle bone	Methane	7.3	7.8	7.5	8.0	7.6	7.4	7.7	7.3	6.6	5.9	7.3	0.6	46.9% CH ₄
	Hydrogen	0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.1	0.1	0.1	0.4% H ₂
	Carbon dioxide	7.6	8.2	8.4	8.4	7.9	8.5	8.4	8.2	7.5	9.1	8.2	0.5	52.7% CO ₂
Fish bone	Methane	4.5	4.5	3.2	3.3	3.9	3.9	3.5	3.3	2.8	3.2	3.6	0.6	29.1% CH ₄
	Hydrogen	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.1	0.4	0.1	0.1	1.0% H ₂
	Carbon dioxide	7.9	8.8	9.2	8.2	9.6	9.1	8.5	8.3	9.1	7.9	8.7	0.6	69.9% CO ₂
Carrot peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	10.2	9.7	10.5	9.3	9.6	8.9	6.7	11.0	8.9	15.7	10.1	2.3	68.9% H ₂
	Carbon dioxide	4.6	4.2	4.6	4.0	4.6	4.0	2.9	4.8	4.4	7.4	4.5	1.1	31.1% CO ₂
White radish peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	8.1	7.6	7.6	7.0	6.1	7.6	8.4	7.7	8.0	6.2	7.4	0.8	49.3% H ₂
	Carbon dioxide	7.1	8.6	7.6	7.4	6.6	8.6	7.4	7.6	8.6	7.2	7.6	0.7	50.7% CO ₂
Cabbage stem	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	9.3	9.9	8.9	9.2	9.7	9.0	8.6	10.9	10.4	10.0	9.6	0.7	57.8% H ₂
	Carbon dioxide	6.8	7.1	6.1	6.7	7.0	7.5	6.7	7.5	7.4	7.0	7.0	0.4	42.2% CO ₂
Lotus root peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0% CH ₄
	Hydrogen	0.0	0.0	0.2	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.1	1.1% H ₂
	Carbon dioxide	6.0	6.0	6.7	6.1	6.5	8.2	6.8	7.0	7.3	6.1	6.7	0.7	98.9% CO ₂
Apple core and peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	13.0	9.2	9.7	11.7	9.1	10.6	10.3	9.3	10.2	10.6	10.4	1.2	74.3% H ₂
	Carbon dioxide	4.9	3.5	3.9	2.7	3.6	2.7	3.3	3.8	3.6	4.0	3.6	0.6	25.7% CO ₂
Orange peel	Methane	0.0	0.0	0.0										
	Hydrogen	0.0	0.0	0.0										
	Carbon dioxide	0.0	0.0	0.0										
Grape peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	11.5	10.8	11.4	11.7	9.8	8.9	10.1	10.5	11.6	11.0	10.7	0.9	68.8% H ₂
	Carbon dioxide	5.7	5.4	4.8	4.5	4.9	5.0	4.0	4.1	5.5	4.8	4.9	0.6	31.2% CO ₂
Rice bran	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	8.9	15.7	14.1	13.8	14.9	15.1	12.3	18.1	13.6	15.9	14.2	2.4	64.8% H ₂
	Carbon dioxide	6.1	6.5	8.3	7.5	7.7	8.4	7.5	8.5	7.6	9.1	7.7	0.9	35.2% CO ₂
Wheat bran	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	10.1	14.0	12.6	15.0	11.5	10.8	10.8	15.9	18.2	20.4	13.9	3.5	66.5% H ₂
	Carbon dioxide	5.1	7.3	7.9	6.9	6.5	6.1	5.9	5.5	9.5	9.6	7.0	1.6	33.5% CO ₂
Rice hull	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	0.7	0.8	0.9	1.3	0.2	0.8	0.8	0.7	2.6	1.5	1.0	0.7	60.7% H ₂
	Carbon dioxide	1.1	0.3	0.5	0.5	0.6	1.7	0.3	0.4	0.4	0.8	0.7	0.4	39.3% CO ₂
Soy sauce lees	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	2.0	2.2	2.0	3.0	1.7	2.0	2.0	1.9	1.9	2.1	2.1	0.3	48.9% H ₂
	Carbon dioxide	2.8	2.6	2.0	2.3	1.6	2.0	2.1	2.2	2.2	1.9	2.2	0.3	51.1% CO ₂
Spent bonito flakes	Methane	10.4	8.1	7.5	7.6	8.4	8.3	6.5	7.8	8.4	7.3	8.0	1.0	48.5% CH ₄
	Hydrogen	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.1	0.4% H ₂
	Carbon dioxide	9.8	9.3	8.8	7.9	9.1	7.6	8.3	7.3	8.6	8.1	8.5	0.8	51.2% CO ₂
Spent dried kelp	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	9.4	10.5	8.8	9.8	11.4	11.3	9.2	9.5	11.3	11.0	10.2	1.0	75.6% H ₂
	Carbon dioxide	3.3	3.3	3.8	3.0	3.5	3.2	3.2	3.1	3.5	3.0	3.3	0.3	24.4% CO ₂
Spent tea leaf	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	3.6	3.4	4.8	4.5	4.0	4.1	3.7	4.6	4.5	3.8	4.1	0.5	49.5% H ₂
	Carbon dioxide	4.1	3.8	4.8	3.1	4.9	4.5	4.6	4.8	3.7	3.8	4.2	0.6	50.5% CO ₂
Spent coffee ground	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	3.9	3.8	4.1	4.0	3.8	3.5	4.4	4.1	3.8	4.0	3.9	0.2	55.8% H ₂
	Carbon dioxide	3.5	2.8	3.8	3.1	3.0	3.1	3.1	2.6	2.6	3.6	3.1	0.4	44.2% CO ₂
Rapeseed oil cake	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	9.6	11.3	9.6	10.3	10.0	10.4	11.3	9.9	10.4	11.4	10.4	0.7	58.3% H ₂
	Carbon dioxide	8.6	8.2	7.5	8.8	7.8	6.9	6.8	6.8	6.5	6.7	7.5	0.8	41.7% CO ₂

Substrate	Gas	Biogas yield in each subculture (mL/g-substrate)										Average	Stdev	Biogas composition (%)
		1st subculture	2nd subculture	3rd subculture	4th subculture	5th subculture	6th subculture	7th subculture	8th subculture	9th subculture	10th subculture			
Cattle bone	Methane	6.8	4.1	4.0	5.2	6.8	7.2	6.1	6.7	5.9	6.1	5.9	1.1	41.7% CH ₄
	Hydrogen	0.0	0.2	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.5% H ₂
	Carbon dioxide	7.1	7.8	7.9	7.4	9.5	8.9	8.2	8.5	8.4	7.8	8.2	0.7	57.8% CO ₂
Fish bone	Methane	5.0	3.8	3.8	3.5	3.9	3.8	4.1	2.7	3.7	3.0	3.7	0.6	31.5% CH ₄
	Hydrogen	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.2	0.0	0.1	0.4% H ₂
	Carbon dioxide	8.0	7.3	8.0	7.6	8.1	8.6	7.5	8.3	8.4	8.9	8.1	0.5	68.1% CO ₂
Carrot peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	8.2	6.1	8.7	5.4	5.2	4.9	4.3	4.8	5.0	8.1	6.1	1.6	64.4% H ₂
	Carbon dioxide	5.0	3.3	4.0	2.7	3.2	3.0	2.4	2.7	3.0	4.3	3.3	0.8	35.6% CO ₂
White radish peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	6.1	6.7	6.6	7.0	6.9	7.3	7.1	7.9	7.6	7.0	7.0	0.5	59.8% H ₂
	Carbon dioxide	8.1	3.5	3.8	6.1	4.6	4.9	4.8	3.2	4.4	3.7	4.7	1.5	40.2% CO ₂
Cabbage stem	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	10.0	9.2	9.3	9.6	10.0	9.7	9.4	9.4	9.8	9.4	9.6	0.3	58.8% H ₂
	Carbon dioxide	7.8	7.1	6.3	6.7	7.0	6.5	6.7	6.6	6.0	6.5	6.7	0.5	41.2% CO ₂
Lotus root peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	0.4	0.7	0.6	0.3	0.3	1.0	0.9	0.5	0.7	0.8	0.6	0.2	10.7% H ₂
	Carbon dioxide	6.8	6.0	6.4	5.2	0.0	5.1	5.0	5.0	5.6	5.9	5.1	1.9	89.3% CO ₂
Apple core and peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	11.9	10.2	7.2	9.6	9.0	8.3	8.3	9.1	9.1	9.6	9.2	1.3	73.3% H ₂
	Carbon dioxide	4.6	3.3	2.5	3.1	3.5	3.2	3.2	3.0	3.4	3.7	3.3	0.5	26.7% CO ₂
Orange peel	Methane	0.0	0.0	0.0										
	Hydrogen	0.0	0.0	0.0										
	Carbon dioxide	0.0	0.0	0.0										
Grape peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	8.3	9.3	9.3	10.2	10.0	9.3	9.0	8.1	11.0	11.7	9.6	1.1	74.3% H ₂
	Carbon dioxide	4.2	3.7	2.1	3.6	3.4	3.1	3.4	3.2	3.0	3.6	3.3	0.5	25.7% CO ₂
Rice bran	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	6.5	4.1	6.8	7.4	8.3	6.7	8.2	6.2	8.5	5.3	6.8	1.4	60.9% H ₂
	Carbon dioxide	6.5	3.5	2.7	4.1	5.1	5.3	4.3	3.4	4.5	4.3	4.4	1.1	39.1% CO ₂
Wheat bran	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	2.3	2.7	4.2	6.8	7.8	7.3	9.2	11.6	10.6	11.2	7.4	3.4	64.0% H ₂
	Carbon dioxide	6.5	6.1	5.1	4.6	3.1	2.2	2.4	2.0	5.0	4.5	4.1	1.6	36.0% CO ₂
Rice hull	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	0.6	0.7	0.9	0.1	0.2	0.0	1.1	1.1	1.0	1.2	0.7	0.4	61.3% H ₂
	Carbon dioxide	0.6	0.3	0.3	0.4	0.5	0.5	0.4	0.3	0.5	0.4	0.4	0.1	38.7% CO ₂
Soy sauce lees	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	2.1	3.0	2.5	1.9	2.0	2.0	2.8	2.1	2.6	2.0	2.3	0.4	50.1% H ₂
	Carbon dioxide	2.3	2.6	3.0	2.5	1.9	1.7	2.0	2.0	2.0	2.8	2.3	0.4	49.9% CO ₂
Spent bonito flakes	Methane	5.3	10.7	8.0	7.4	8.6	8.6	7.4	7.4	6.8	4.9	7.5	1.7	47.6% CH ₄
	Hydrogen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1% H ₂
	Carbon dioxide	7.6	8.7	8.0	8.1	8.4	9.1	8.0	8.3	7.8	8.6	8.3	0.4	52.3% CO ₂
Spent dried kelp	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	8.7	8.2	9.2	8.9	8.8	9.1	8.6	9.5	8.6	6.7	8.6	0.8	71.3% H ₂
	Carbon dioxide	3.9	3.4	3.5	3.1	3.6	3.5	3.3	3.5	3.5	3.5	3.5	0.2	28.7% CO ₂
Spent tea leaf	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	5.1	4.8	4.7	5.7	5.0	4.7	4.1	4.9	5.0	5.5	4.9	0.4	54.7% H ₂
	Carbon dioxide	3.9	3.8	4.0	4.1	4.7	3.7	4.7	4.1	4.1	3.8	4.1	0.4	45.3% CO ₂
Spent coffee ground	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	4.7	4.4	4.6	4.4	4.2	4.0	3.9	4.2	4.0	3.8	4.2	0.3	61.6% H ₂
	Carbon dioxide	2.2	2.1	2.9	3.1	2.5	2.8	2.8	3.1	2.7	2.3	2.6	0.4	38.4% CO ₂
Rapeseed oil cake	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	5.8	5.2	3.4	2.6	2.8	3.0	3.2	2.8	5.1	4.3	3.8	1.2	32.4% H ₂
	Carbon dioxide	8.2	6.1	5.4	5.3	6.2	9.6	9.2	11.2	9.4	9.1	8.0	2.1	67.6% CO ₂

Substrate	Gas	Biogas yield in each subculture (mL/g-substrate)										Average	Stdev	Biogas composition (%)
		1st subculture	2nd subculture	3rd subculture	4th subculture	5th subculture	6th subculture	7th subculture	8th subculture	9th subculture	10th subculture			
Cattle bone	Methane	6.0	4.8	5.6	3.9	2.7	3.6	4.5	5.6	5.0	4.9	4.6	1.0	35.0% CH ₄
	Hydrogen	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1% H ₂
	Carbon dioxide	7.9	8.7	9.3	8.5	8.0	8.6	9.2	8.8	8.4	8.8	8.6	0.4	64.9% CO ₂
Fish bone	Methane	2.6	2.4	2.5	2.6	2.0	1.8	1.8	2.2	3.1	2.4	2.3	0.4	38.1% CH ₄
	Hydrogen	0.0	0.0	0.0	0.2	0.2	0.1	0.0	0.1	0.0	0.1	0.1	0.1	1.1% H ₂
	Carbon dioxide	3.0	3.1	3.7	3.1	4.4	4.7	4.6	4.4	2.8	3.4	3.7	0.7	60.8% CO ₂
Carrot peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	10.2	8.9	9.3	9.9	10.5	9.5	6.8	7.9	8.3	8.2	9.0	1.2	65.9% H ₂
	Carbon dioxide	3.6	4.1	3.9	4.2	3.8	3.8	4.3	6.4	6.2	6.0	4.6	1.1	34.1% CO ₂
White radish peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	8.1	6.3	6.7	7.2	6.1	7.1	6.7	6.2	7.7	7.8	7.0	0.7	54.3% H ₂
	Carbon dioxide	5.1	4.6	6.3	5.4	6.1	5.5	6.5	6.4	6.9	5.9	5.9	0.7	45.7% CO ₂
Cabbage stem	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	11.7	10.7	11.6	12.7	9.1	9.7	10.0	10.6	10.3	10.7	10.7	1.0	64.0% H ₂
	Carbon dioxide	5.8	5.9	6.9	7.0	5.8	6.0	5.2	5.0	6.0	6.8	6.0	0.7	36.0% CO ₂
Lotus root peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	0.4	0.1	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.1	1.9% H ₂
	Carbon dioxide	5.8	5.6	5.5	5.4	3.1	2.8	3.2	3.3	6.4	5.5	4.7	1.4	98.1% CO ₂
Apple core and peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	8.3	8.1	9.9	9.2	8.0	5.9	8.8	9.3	6.6	8.0	8.2	1.2	70.9% H ₂
	Carbon dioxide	4.8	2.6	4.0	3.5	2.5	3.3	3.2	3.6	2.9	3.3	3.4	0.7	29.1% CO ₂
Orange peel	Methane	0.0	0.0	0.0										
	Hydrogen	0.0	0.0	0.0										
	Carbon dioxide	0.0	0.0	0.0										
Grape peel	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	7.9	7.1	10.5	11.6	9.0	9.9	8.9	10.8	11.2	11.6	9.8	1.6	74.5% H ₂
	Carbon dioxide	4.1	2.8	3.8	3.7	2.9	3.0	3.7	3.1	2.8	3.9	3.4	0.5	25.5% CO ₂
Rice bran	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	4.3	4.0	5.2	4.3	7.5	5.5	3.6	3.6	3.0	4.1	4.5	1.3	40.7% H ₂
	Carbon dioxide	2.0	2.0	2.2	10.0	8.8	9.9	8.5	8.7	3.5	10.1	6.6	3.6	59.3% CO ₂
Wheat bran	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	11.0	12.2	17.6	17.8	17.5	19.9	21.7	18.9	17.1	21.2	17.5	3.5	67.0% H ₂
	Carbon dioxide	7.0	7.1	8.6	9.1	3.5	2.9	10.3	15.2	11.6	10.8	8.6	3.7	33.0% CO ₂
Rice hull	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	1.1	1.5	1.9	1.8	1.9	1.4	1.6	1.5	0.9	1.4	1.5	0.3	61.7% H ₂
	Carbon dioxide	1.0	0.9	1.0	1.1	0.6	0.9	1.5	1.0	0.7	0.8	0.9	0.3	38.3% CO ₂
Soy sauce lees	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	2.6	2.3	3.1	3.1	1.0	0.9	1.4	1.8	1.9	1.4	2.0	0.8	49.8% H ₂
	Carbon dioxide	1.9	2.9	1.9	2.1	2.0	1.0	2.7	1.8	2.0	1.5	2.0	0.5	50.2% CO ₂
Spent bonito flakes	Methane	5.7	10.0	9.4	9.9	7.4	8.5	7.9	7.8	7.5	7.8	8.2	1.3	48.2% CH ₄
	Hydrogen	0.1	0.0	0.4	0.3	0.6	0.0	0.1	0.1	0.3	0.2	0.2	0.2	1.2% H ₂
	Carbon dioxide	5.9	9.1	8.7	8.9	7.0	8.1	9.6	9.7	10.1	8.7	8.6	1.3	50.6% CO ₂
Spent dried kelp	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	6.4	7.4	8.6	6.6	8.6	9.9	8.0	8.8	10.0	9.6	8.4	1.3	72.7% H ₂
	Carbon dioxide	2.7	3.1	2.9	3.5	3.4	3.2	3.2	3.0	3.1	3.5	3.1	0.3	27.3% CO ₂
Spent tea leaf	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	4.2	5.0	4.9	4.8	5.0	5.2	5.8	4.7	4.9	5.0	4.9	0.4	48.7% H ₂
	Carbon dioxide	5.2	5.7	5.7	5.0	4.9	5.0	5.5	4.9	5.0	5.0	5.2	0.3	51.3% CO ₂
Spent coffee ground	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	4.4	4.1	4.7	4.0	3.4	4.2	4.1	3.8	4.2	4.0	4.1	0.4	55.7% H ₂
	Carbon dioxide	3.2	3.7	3.1	3.2	3.7	3.7	3.2	1.8	3.7	3.1	3.2	0.6	44.3% CO ₂
Rapeseed oil cake	Methane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0% CH ₄
	Hydrogen	12.8	10.2	8.0	9.5	17.5	17.2	19.9	17.5	19.7	19.1	15.1	4.6	55.9% H ₂
	Carbon dioxide	11.8	11.2	12.9	12.2	12.2	12.4	11.3	11.9	11.5	11.8	11.9	0.5	44.1% CO ₂

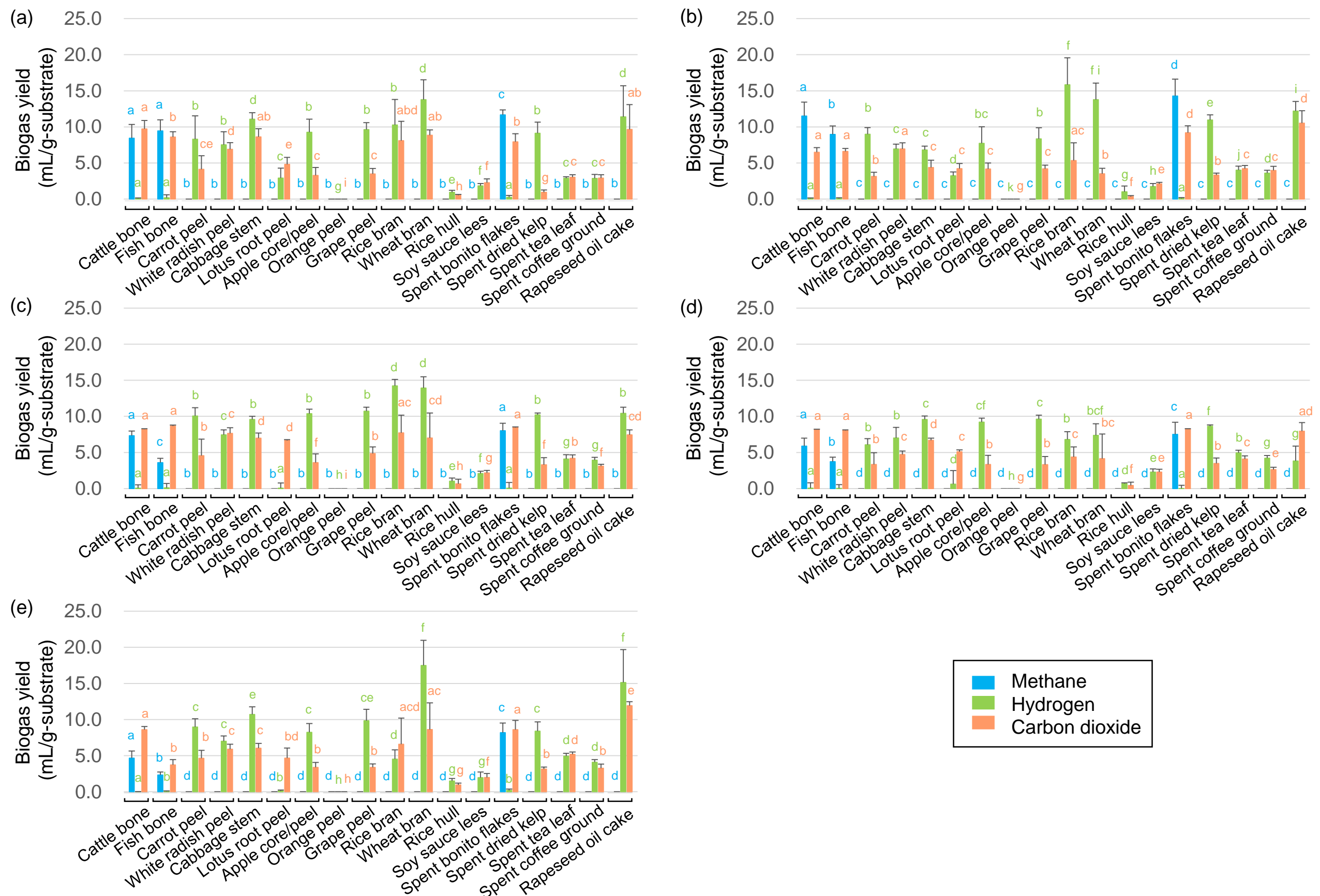


Figure S1. Biogas yield of the subcultures originating from DABYS-A (a), DABYS-B (b), DABYE-G (c), DABYE-S (d), and DABYE-R (e) seed microflorae. The data are presented as the mean \pm standard deviation of independent triplicates. The blue, green, and orange colored letters on the columns indicate significant differences at $P < 0.05$ (Student's t -test) in methane, hydrogen, and carbon dioxide yield, respectively.