

ALD5, PAD1, ATF1 and ATF2 facilitate the catabolism of coniferyl aldehyde, ferulic acid and p-coumaric acid in *Saccharomyces cerevisiae*

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Supplementary Information

Conversion products of ferulic acid

The 5 most abundant FA conversion intermediates in *APT_1*, *B_CALD* and the control strains were similar in concentrations, except for benzenethanol in *APT_1*. With a peak concentration of 0.50 ± 0.09 mM, this was higher than in the other strains. The 5 most abundant FA conversion products in *SC_ald5Δ* strain were different, they are; 4-Hydroxybenzoic acid, guaiacol, benzenethanol, 4-vinylguaiacol, and isoferulic acid were. Biggest differences were seen in the titres of 4-hydroxybenzoic acid and guaiacol. 4-hydroxybenzoic acid in the *APT_1*, *B_CALD* and the control strains were 0.030 ± 0.003 mM, 0.05 ± 0.03 mM and 0.06 ± 0.03 mM, respectively, while it was 0.17 ± 0.06 mM in the *SC_ald5Δ* strain (Figure S3 ii). Also, the peak concentrations of guaiacol in the *APT_1*,

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B_CALD and the control strains were 0.05 ± 0.01 mM, 0.05 ± 0.01 mM and 0.06 ± 0.00 mM respectively while it was 0.29 ± 0.06 mM in the *SC_ald5Δ* strain. The higher concentration of 4-hydroxybenzoic acid and guaiacol measured in the *SC_ald5Δ* strain cultivation was surprising because the deletion of *ALD5* was not expected to influence the conversion of cinnamic acids.

Conversion products of p-coumaric acid

The overall PCA conversion product profile did not differ between the four strains, however the metabolite levels and the time reached were different (Table S3). The 5 most abundant products for all strains were guaiacol, benzenethanol, benzenoacetic acid, tyrosol, and 4-hydroxybenzoic acid. The overall metabolite profile revealed a conversion pattern very similar to that of CA (Figure S4i). Benzenethanol was the only compound remaining after 96 hours of cultivation with all the strains. It was observed that the peak concentration of the most abundant PCA conversion products varied between the strains. In *APT_1*, the most abundant compounds were guaiacol, which reached a concentration of 1.70 ± 0.23 mM at 24 hours, and benzenethanol, which reached 1.69 ± 0.6 mM at 60 hours. With *B_CALD* strain, the highest titres were recorded for guaiacol, 1.53 ± 0.1 mM at 24 hours, and for tyrosol, 1.34 ± 0.14 mM at 24 hours. In *SC_ald5Δ* strain, the highest titres were recorded for tyrosol, 1.25 ± 0.15 mM at 24 hours, and for benzenoacetic acid, 1.103 ± 0.5 mM at 36 hours. Finally, in the case of the control strain, tyrosol peaked at 24 hours, 1.31 ± 0.18 mM and benzenoacetic acid at 36 hours, 1.25 ± 0.5 mM. The titre of tyrosol during the conversion of PCA to benzenethanol via tyrosol was significantly higher than that of other intermediates, supporting the hypothesis that PCA is mainly converted to benzenethanol (Table S3, Figure S4i).

Supplementary figure Legends

Figure S1. **i** Outline of plasmid assembled via Gibson protocol. **ii.** The principle of Gibson assembly for assembling DNA fragments.

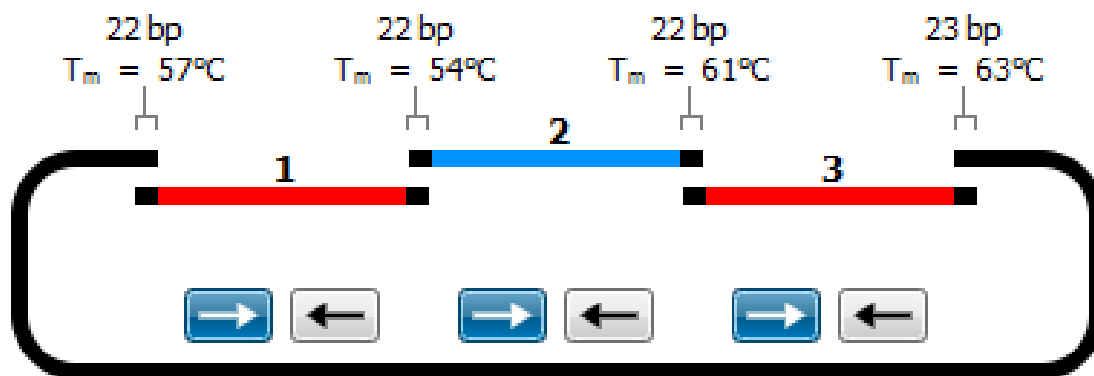
Figure S2. The plasmid maps for **a.** empty Yip 128, **b.** empty Yip 211 for the overexpression of **c.** *ALD5PAD1*, and **d.** Plasmid for the overexpression of *ATF1* and *ATF2*.

Figure S3: Proposed conversion route of ferulic acid into other phenolic compounds. **ii:** Conversion product profile of ferulic acid for **a.** *APT_1*, **b.** *B_CALD*, **c.** *SC_ald5Δ*, and **d.** the control strain

Figure S4: Proposed conversion route of p-coumaric acid into other phenolic compounds. **ii:** Conversion product profile of p-coumaric acid for **a.** *APT_1*, **b.** *B_CALD*, **c.** *SC_ald5Δ*, and **d.** the control strain.

Figure S5. Plots for conversion products of coniferyl aldehyde ferulic acid and p-coumaric acid. **i.** *APT_1* CA products, **ii.** *B_CALD* CA products, **iii.** *SC_ald5Δ* CA products, **iv.** CTRL CA products, **v.** *APT_1* FA products, **vi.** *B_CALD* FA products, **vii.** *SC_ald5Δ* FA and products, **viii.** CTRL FA products, **ix.** *APT_1* pCA products, **x.** *B_CALD* pCA products, **xi.** *SC_ald5Δ* pCA products, **xii.** CTRL FA products.

i



ii

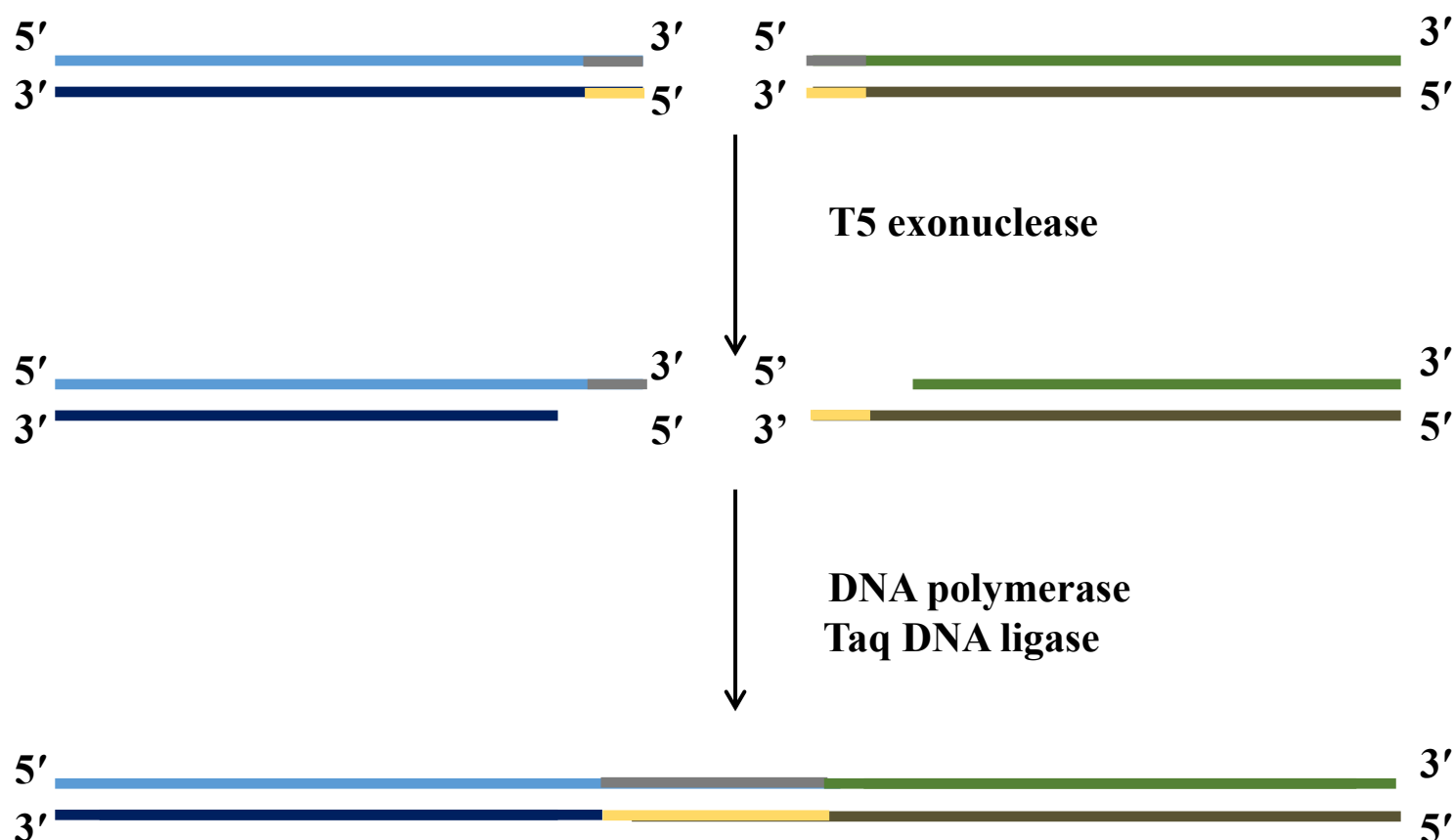


Figure S1. i Outline of plasmid assembled via Gibson protocol. ii. The principle of Gibson assembly for assembling DNA fragments.

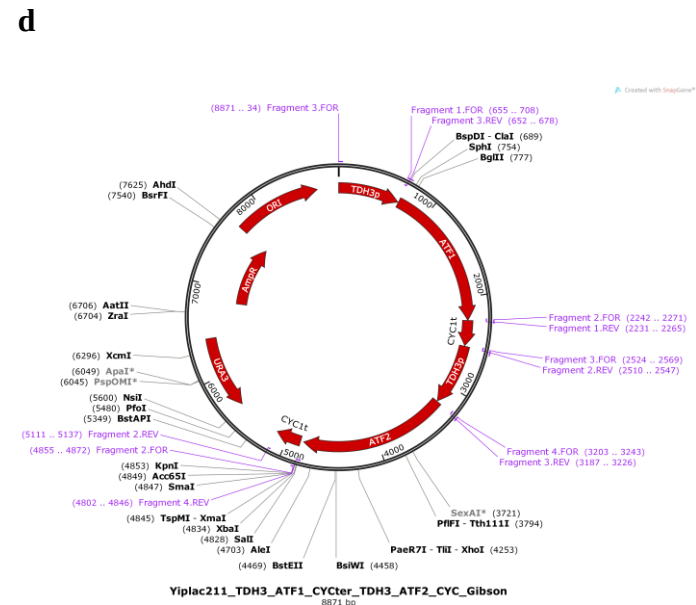
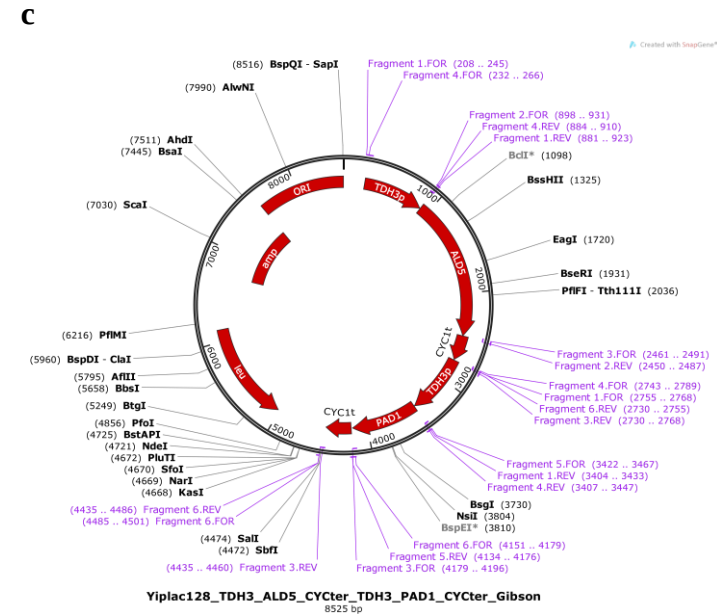
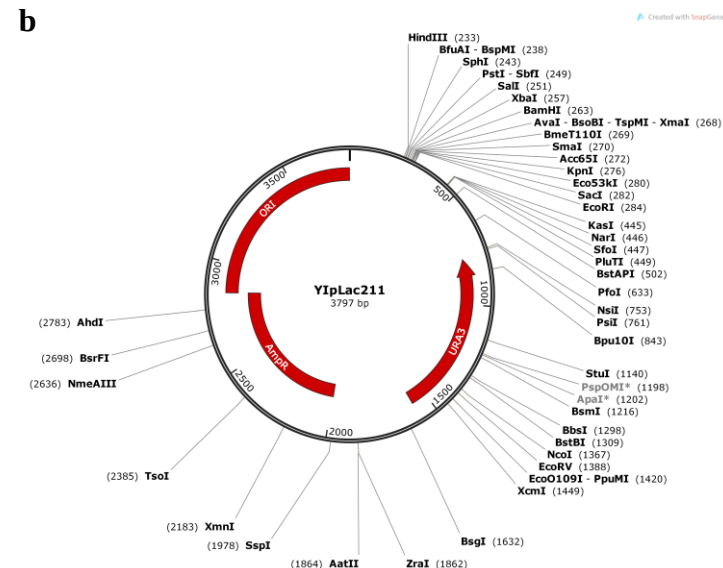
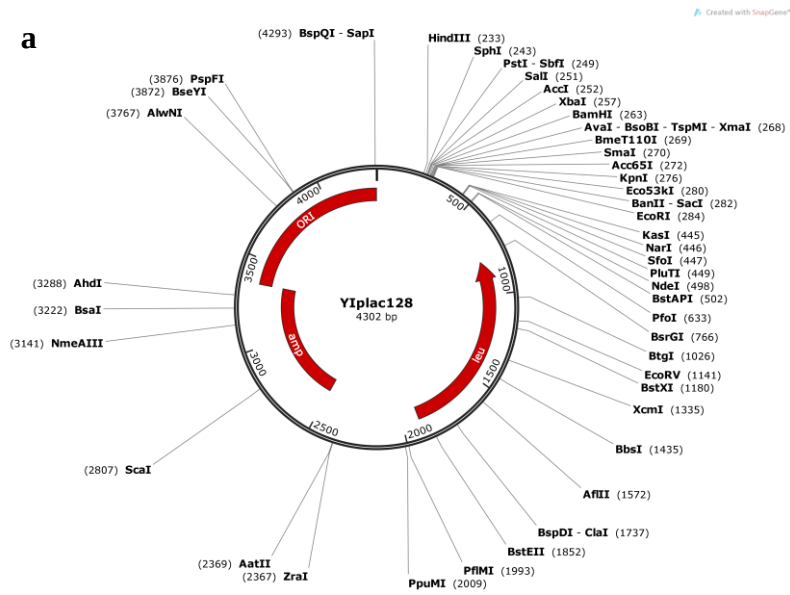
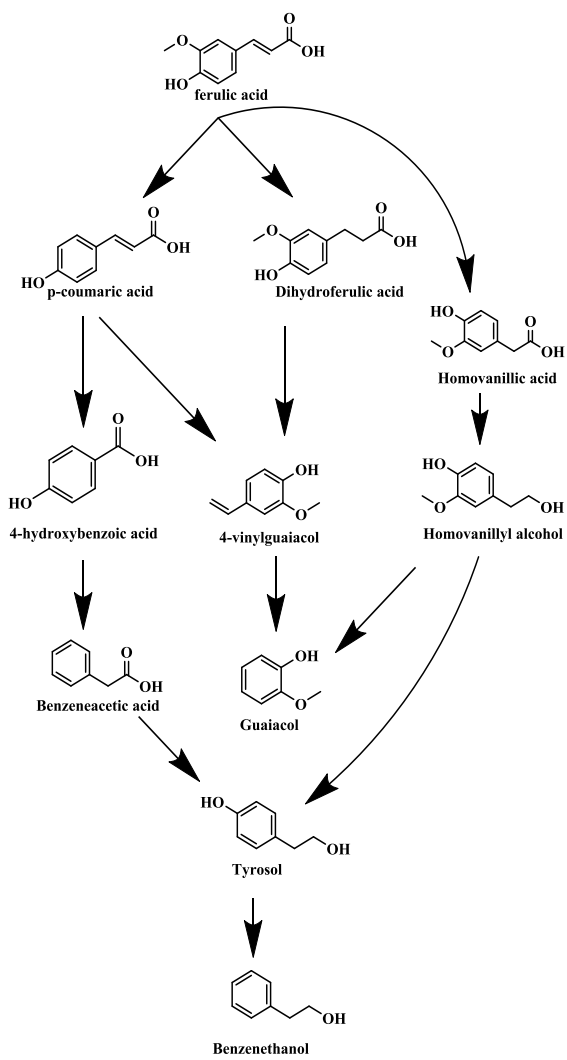
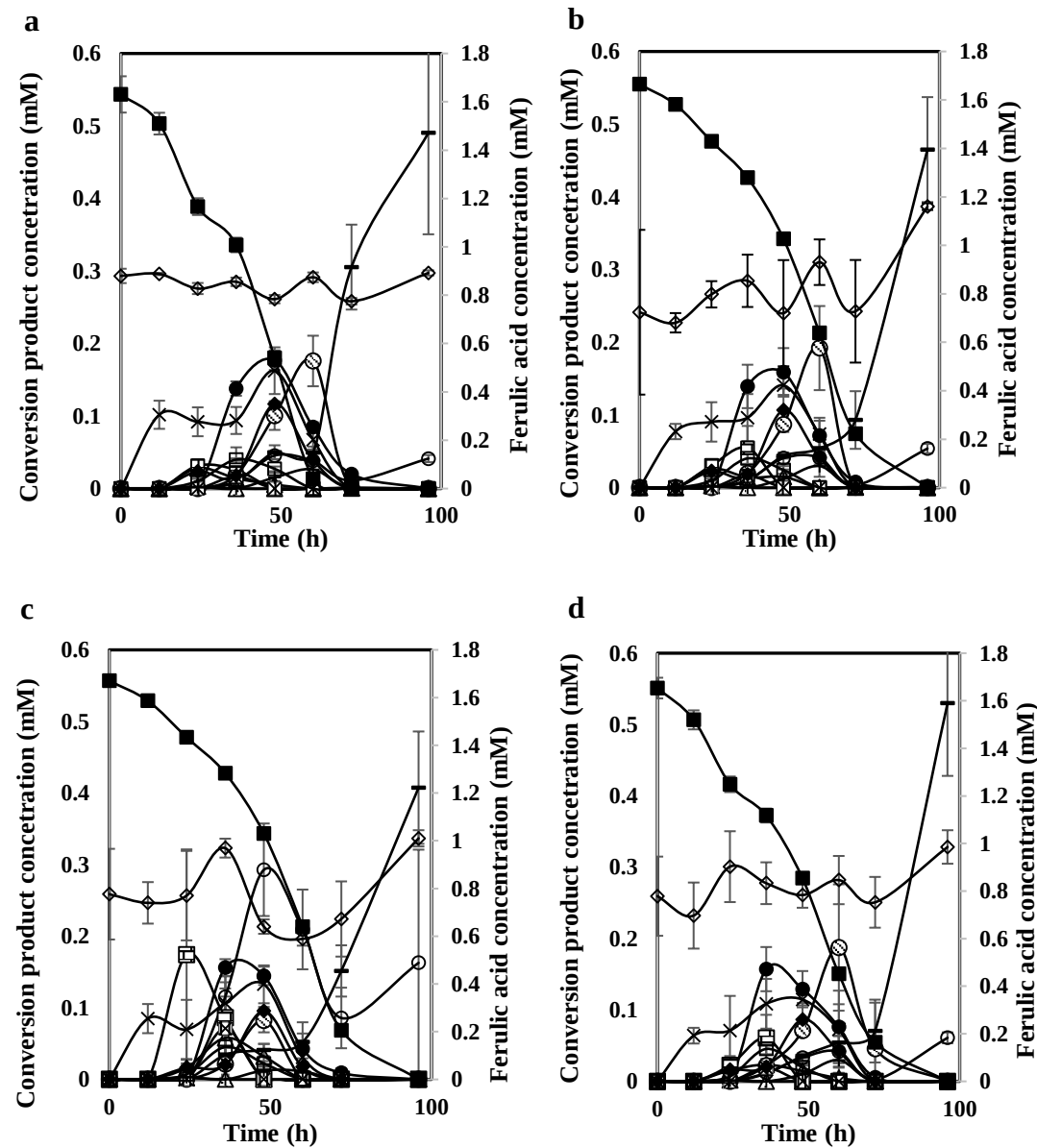


Figure S2. The plasmid maps for **a.** empty Yip 128, **b.** empty Yip 211 for the overexpression of **c.** *ALD5PAD1*, and **d.** Plasmid for the overexpression of *ATF1* and *ATF2*.

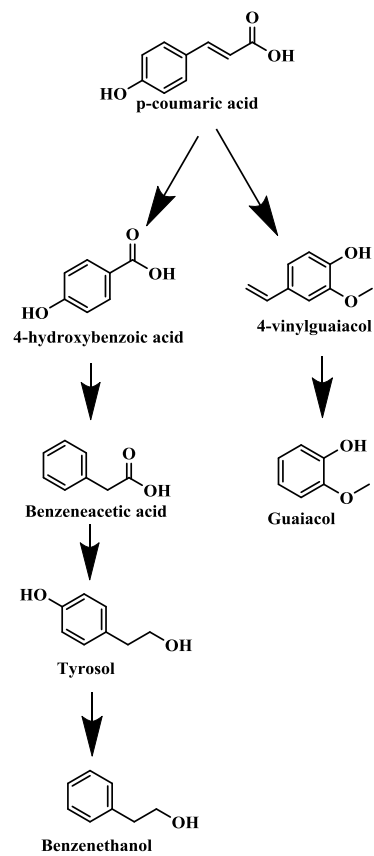
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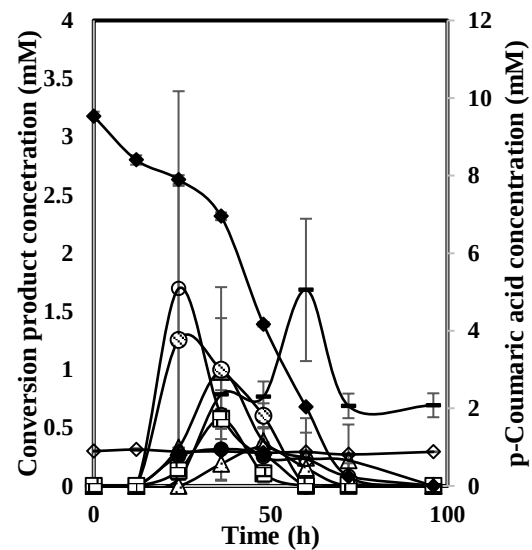
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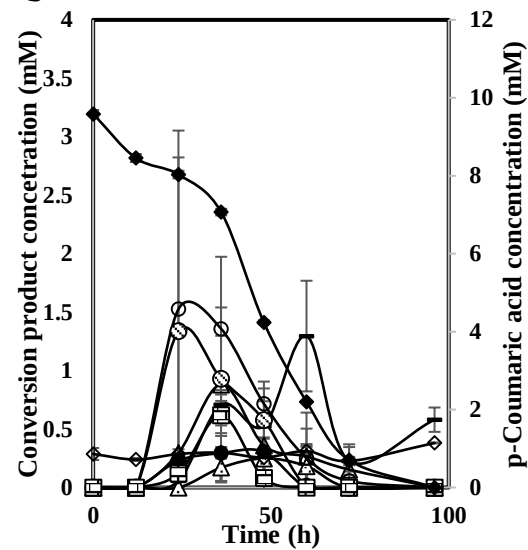
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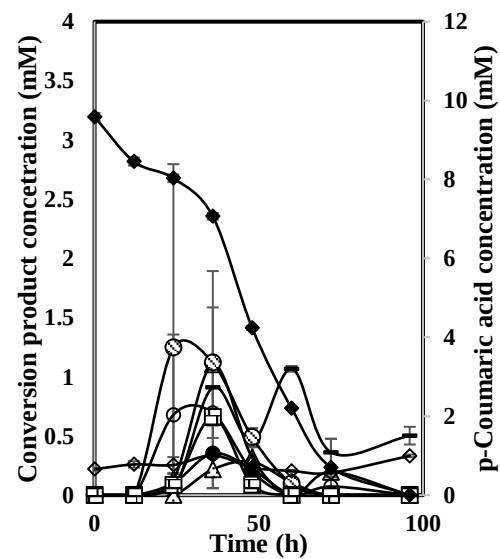
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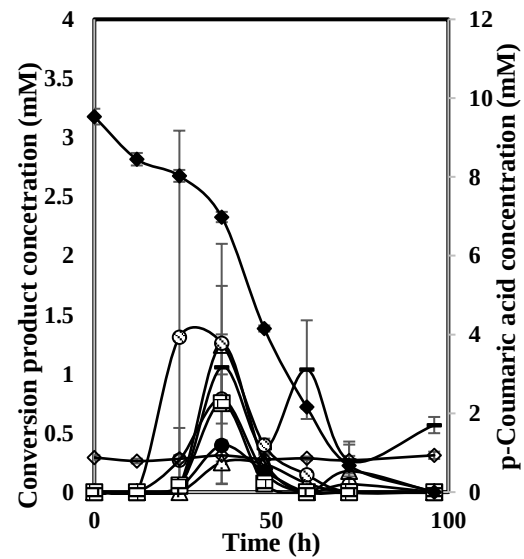
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c

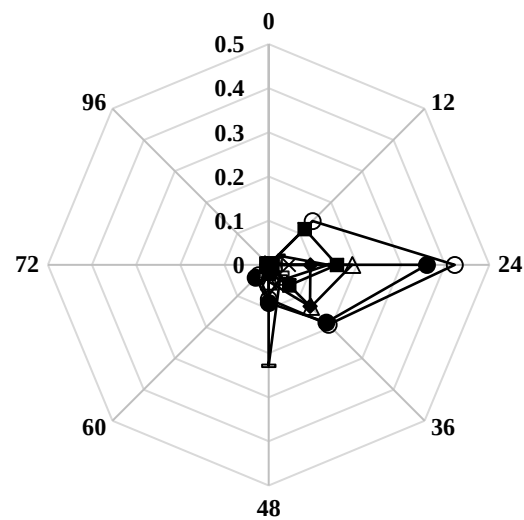


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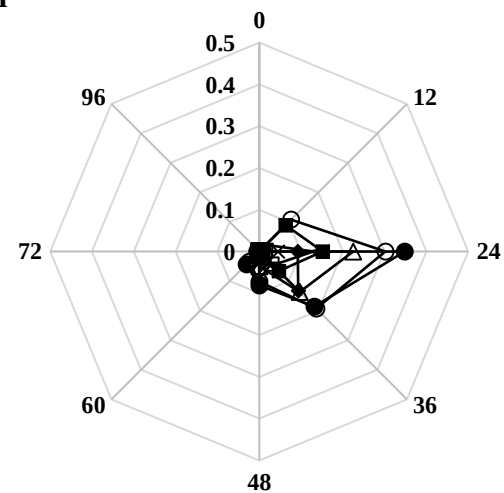


- △ coumaran
- Guaiacol
- Benzenethanol
- △ Benzenecetic acid
- Tyrosol
- 4-Vinylguaiacol
- ◇ ortho-Vanillin
- 4-Hydroxybenzoic acid
- p-Coumaric acid

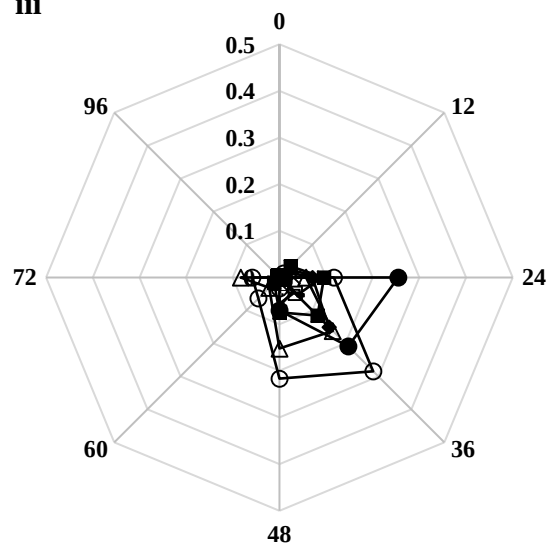
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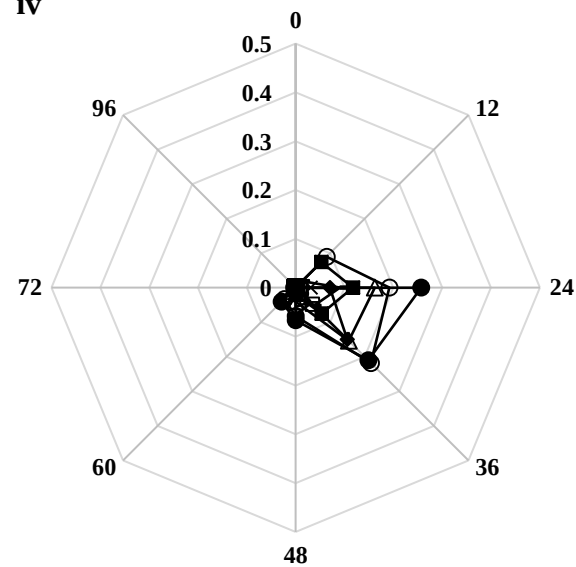
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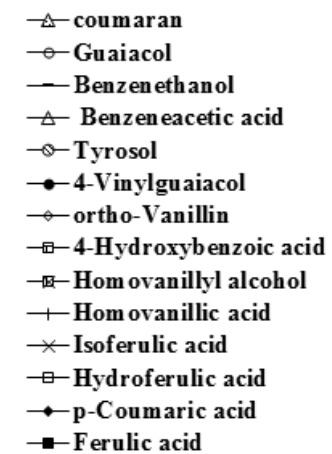
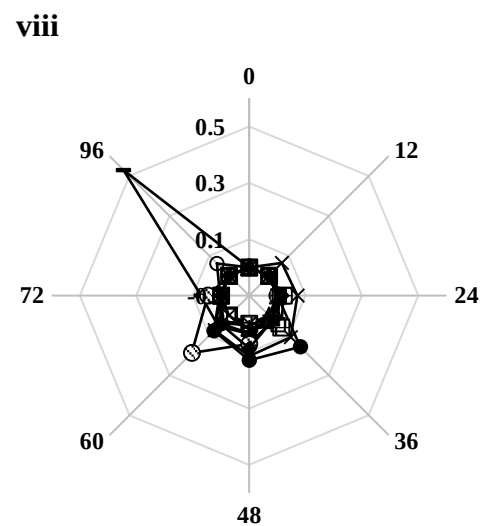
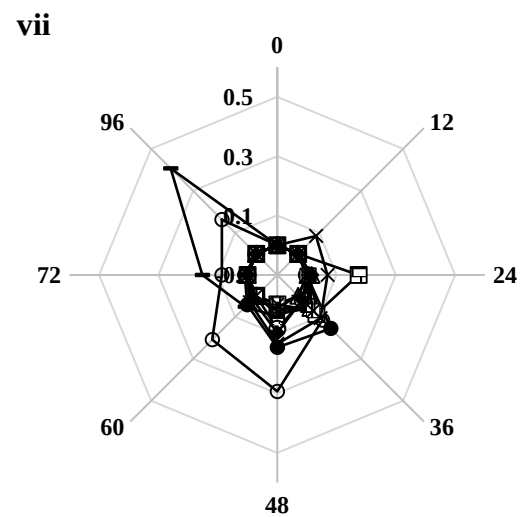
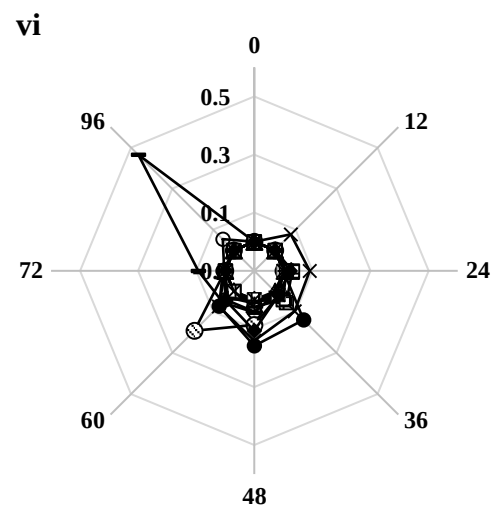
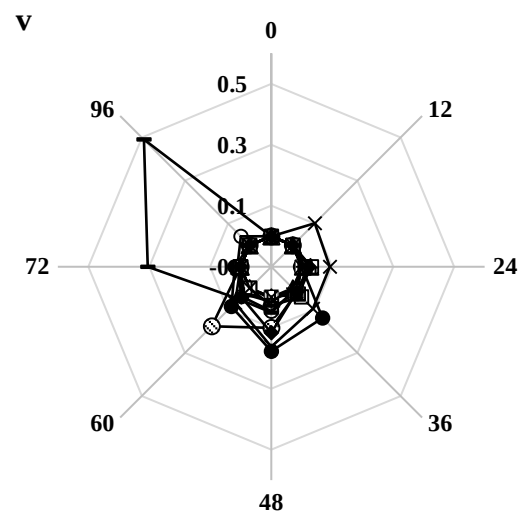
iii



iv



- △ coumaran
- Guaiacol
- Benzenethanol
- Benzoic acid
- △ Benzeneacetic acid
- Tyrosol
- 4-Vinylguaiacol
- ◇ ortho-Vanillin (IS)
- Vanillin
- 4-Hydroxybenzoic acid
- ▣ Homovanillyl alcohol
- Vanillic acid
- + Homovanillic acid
- × Isoferulic acid
- Hydroferulic acid
- ◆ p-Coumaric acid
- Ferulic acid
- ▲ coniferyl aldehyde



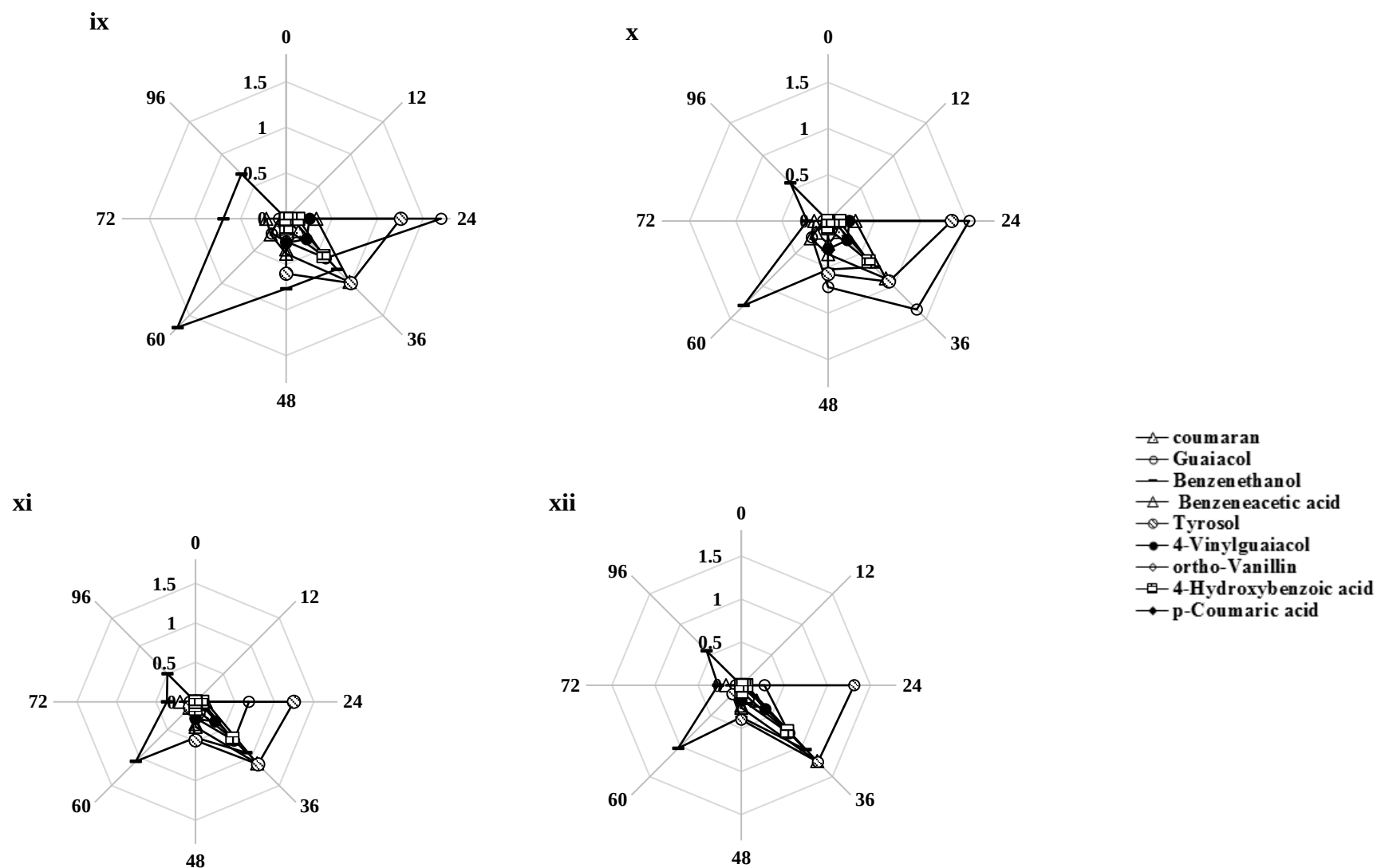


Figure S3. Plots for conversion products of coniferyl aldehyde ferulic acid and p-coumaric acid. **i.** *APT_1* CA products, **ii.** *B_CALD* CA products, **iii.** *SC_ald5Δ* CA products, **iv.** CTRL CA products, **v.** *APT_1* FA products, **vi.** *B_CALD* FA products, **vii.** *SC_ald5Δ* FA and products, **viii.** CTRL FA products, **ix.** *APT_1* pCA products, **x.** *B_CALD* pCA products, **xi.** *SC_ald5Δ* pCA products, **xii.** CTRL FA products.

Table S1. Conversion products of coniferyl aldehyde by *APT_1*, *B_CALD*, *SC_ald5A* and control strains.

<i>APT_1</i>																		
Time (h)	coumaran	Guaia col	Benzenethanol	Benzoic acid	Benzenecarboxylic acid	Tyrosol	4-Vinylguaiacol	ortho-Vanillin (IS)	Vanillin	4-Hydroxybenzoic acid	Homo vanillyl alcohol	Vanillic acid	Homo vanillic acid	Isoferulic acid	coniferyl aldehyde	Hydroferulic acid	p-Coumaric acid	Ferulic acid
0	0	0	0	0	0	0	0	0.311 ± 0.013	0	0	0	0	0	0	0.90.02	0	0	0
12	0	0.14 ± 0.012	0	0	0	✓	0	0.321 ± 0.01	0.03 ± 0.01	0	0	✓	0	0.008 ± 0.002	0.4 ± 0.17	0	0	0.115 ± 0.03
24	✓	0.421 ± 0.04	✓	✓	0.189 ± 0.027	0.01 ± 0.000	0.358 ± 0.015	0.312 ± 0.01	0.135 ± 0.013	✓	0	✓	✓	0.046 ± 0.02	0.065 ± 0.04	0.015 ± 0.004	0.095 ± 0.01	0.155 ± 0.03
36	✓	0.192 ± 0.011	0.037 ± 0.008	0.04 ± 0.007	0.135 ± 0.02	0.015 ± 0.004	0.184 ± 0.012	0.306 ± 0.01	0.048 ± 0.013	0.007 ± 0.001	✓	✓	0.006 ± 0.001	0	0	0.042 ± 0.005	0.132 ± 0.003	0.066 ± 0.01
48	0	0.078 ± 0.007	0.228 ± 0.037	0.07 ± 0.001	0.038 ± 0.002	0	0.087 ± 0.01	0.3 ± 0.004	✓	✓	0.013 ± 0.01	0	0.009 ± 0.001	0	0	0	0	0.019 ± 0.01
60	0	0.033 ± 0.004	✓	✓	0.016 ± 0.002	0	0.042 ± 0.003	0.293 ± 0.005	0	0	✓	0	0	0	0	0	0	0
72	0	0	0	✓	0	0	✓	0.286 ± 0.01	0	0	✓	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0.289 ± 0.01	0	0	0	0	0	0	0	0	0	0

“✓” implies the presence of a compound in quantities that cannot be reliably quantified

“0” implies the complete absence of a compound

B_CALD

Time (h)	coumaran	Guaia col	Benzenethanol	Benzoic acid	Benzenoic acid	Tyrosol	4-Vinylguaia col	ortho-Vanillin	Vanillin	4-Hydroxybenzoic acid	Homo vanillyl alcohol	Vanillic acid	Homo vanillic acid	Isoferulic acid	coniferyl aldehyde	Hydroferulic acid	p-Coumaric acid	Ferulic acid
0	0	0	0	0	0	0	0	0.269 ± 0.03	0	0	0	0	0	0	0.924 ± 0.01	0	0	0
12	0	0.108 ± 0.015	0	0	0	✓	0	0.246 ± 0.02	0.022 ± 0.03	0	0	✓	0	0.006 ± 0.002	0.637 ± 0.01	0	0	0.089 ± 0.03
24	✓	0.302 ± 0.05	✓	✓	0.225 ± 0.02	0.009 ± 0.000	0.348 ± 0.05	0.279 ± 0.01	0.129 ± 0.01	✓	0	✓	✓	0.044 ± 0.02	0.116 ± 0.001	0.014 ± 0.004	0.092 ± 0.02	0.152 ± 0.04
36	✓	0.193 ± 0.04	0.04 ± 0.014	0.036 ± 0.01	0.137 ± 0.04	0.015 ± 0.002	0.186 ± 0.04	0.283 ± 0.01	0.046 ± 0.01	0.007 ± 0.0002	✓	✓	0.005 ± 0.0001	0	0	0.042 ± 0.01	0.132 ± 0.02	0.066 ± 0.01
48	0	0.072 ± 0.02	0.067 ± 0.01	0.049 ± 0.000	0.035 ± 0.01	0	0.081 ± 0.03	0.233 ± 0.02	✓	✓	0.011 ± 0.004	0	0.006 ± 0.0001	0	0	0	0	0.017 ± 0.005
60	0	0.035 ± 0.004	0.014 ± 0.000	✓	0.017 ± 0.002	0	0.043 ± 0.003	0.29 ± 0.02	0	0	✓	0	0	0	0	0	0	0
72	0	0.005 ± 0.001	✓	✓	0	0	✓	0.233 ± 0.04	0	0	✓	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0.288 ± 0.04	0	0	0	0	0	0	0	0	0	0

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SC_ald5A

Time (h)	coumaran	Guaia col	Benzenethanol	Benzoic acid	Benzenecarboxylic acid	Tyrosol	4-Vinylguaiacol	ortho-Vanillin	Vanillin	4-Hydroxybenzoic acid	Homo vanillyl alcohol	Vanillic acid	Homo vanillic acid	Isoferulic acid	coniferyl aldehyde	Hydroferulic acid	p-Coumaric acid	Ferulic acid
0	0	0	0	0	0	0	0	0.254 ± .03	0	0	0	0	0	0	0.9 ± 0.01	0	0	0
12	0	0.013 ± 0.01	0	0	0	✓	0	0.268 ± .03	0.025 ± 0.01	0	0	✓	0	0.006 ± 0.003	0.621 ± 0.01	0	0	0.029 ± 0.01
24	✓	0.117 ± 0.02	✓	✓	0.057 ± 0.02	0.004 ± 0.002	0.255 ± 0.12	0.282 ± 0.02	0.091 ± 0.03	✓	0	✓	✓	0.03 ± 0.01	0.213 ± 0.01	0.011 ± 0.005	0.071 ± 0.03	0.09 ± 0.03
36	✓	0.284 ± 0.09	0.041 ± 0.01	0.046 ± 0.01	0.162 ± 0.06	0.013 ± 0.003	0.209 ± 0.01	0.302 ± 0.04	0.054 ± 0.014	0.007 ± 0.001	✓	✓	0.007 ± 0.001	0	0	0.048 ± 0.01	0.15 ± 0.01	0.11 ± 0.01
48	0	0.217 ± 0.01	0.062 ± 0.01	0.056 ± 0.000	0.152 ± 0.02	0.024 ±	0.071 ± 0.01	0.245 ± 0.005	✓	✓	0.01 ± 0.005	0	0.007 ± 0.001	0	0	0	0	0.07 ± 0.01
60	✓	0.064 ± 0.01	✓	✓	0.031 ± 0.001	0	✓	0.257 ± 0.03	✓	✓	✓	✓	✓	✓	0	✓	✓	0.011 ± 0.01
72	0	0.058 ± 0.05	0	✓	0.083 ± 0.01	✓	✓	0.287 ± 0.02	0	0	✓	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0.285 ± 0.04	0	0	0	0	0	0	0	0	0	0

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Ctrl																		
Time (h)	coumaran	Guaia col	Benzenethanol	Benzoic acid	Benzenoic acid	Tyrosol	4-Vinylguaiacol	ortho-Vanillin	Vanillin	4-Hydroxybenzoic acid	Homo vanillyl alcohol	Vanillic acid	Homo vanillic acid	Isoferulic acid	coniferyl aldehyde	Hydroferulic acid	p-Coumaric acid	Ferulic acid
0	0	0	0	0	0	0	0	0.316 ± 0.04	0	0	0	0	0	0	0.884 ± 0.01	0	0	0
12	0	0.09 ± 0.02	0	0	0	✓	0	0.248 ± 0.05	0.019 ± 0.004	0	0	✓	0	0.005 ± 0.002	0.498 ± 0.01	0	0	0.074 ± 0.03
24	✓	0.192 ± 0.08	✓	✓	0.162 ± 0.08	0.004 ± 0.002	0.257 ± 0.14	0.261 ± 0.08	0.091 ± 0.04	✓	0	✓	✓	0.03 ± 0.02	0.131 ± 0.001	0.01 ± 0.005	0.07 ± 0.04	0.117 ± 0.08
36	✓	0.218 ± 0.04	0.045 ± 0.01	0.041 ± 0.01	0.154 ± 0.04	0.017 ± 0.000	0.21 ± 0.04	0.323 ± 0.01	0.052 ± 0.008	0.008 ± 0.003	✓	✓	0.006 ± 0.0002	0	0	0.048 ± 0.008	0.149 ± 0.02	0.075 ± 0.01
48	0	0.058 ± 0.02	0.054 ± 0.01	0.039 ± 0.000	0.028 ± 0.01	0	0.066 ± 0.02	0.251 ± 0.05	✓	✓	0.009 ± 0.003	0	0.005 ± 0.000	0	0	0	0	0.014 ± 0.004
60	0	0.032 ± 0.01	✓	✓	0.016 ± 0.004	0	0.041 ± 0.01	0.281 ± 0.02	0	0	✓	0	0	0	0	0	0	0
72	0	0.004 ± 0.003	✓	✓	0	0	✓	0.269 ± 0.07	0	0	✓	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0.295 ± 0.04	0.002 ± 0.	0	0	0	0	0	0	0	0	0

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Table S2. Conversion products of ferulic acid by *APT_1*, *B_CALD*, *SC_ald5A* and control strains.

<i>APT_1</i>														
Ti me (h)	coumar an	Guaia col	Benzeneth anol	Benzeneac etic acid	Tyros ol	4- Vinylguai acol	ortho- Vanill in	4- Hydroxyben zoic acid	Homovani llyl alcohol	Homovani llic acid	Isoferu lic acid	Hydrofer ulic acid	p- Couma ric acid	Ferul ic acid
0	0	0	0	0	0	0	0.293 ± 0.01	0	0	0	0	0	0	1.631 ± 0.08
12	0	✓	✓	✓	0	✓	0.296 ± 0.002	0	0	0	0.102 ± 0.02	✓	✓	1.510 ± 0.05
24	0.003 ± 0.003	✓ 0.010 ± 0.002	✓ 0.009 ± 0.003	0.028 ± 0.01 0.014 ± 0.002	✓ 0.019 ± 0.005	✓ 0.138 ± 0.01	0.276 ± 0.01	0.032 ± 0.003	✓ 0.016 ± 0.001	0.002 ± 0.003	0.092 ± 0.02	0.010 ± 0.003	0.024 ± 0.004	1.167 ± 0.04
36	✓	0.006 0.038 ± 0.005	0.050 ± 0.009	0.006 ± 0.005	0.100 ± 0.02	0.177 ± 0.01	0.261 ± 0.01	✓	✓	0.015 ± 0.007	0.163 ± 0.03	0.027 ± 0.003	0.117 ± 0.004	0.540 ± 0.02
48	✓	0.005 0.011 ± 0.001	0.050 ± 0.008	0	0.176 ± 0.04 0.001	0.085 ± 0.007	0.291 ± 0.01	0	0	0.027 ± 0.01	0.068 ± 0.01	0	0.039 ± 0.003	0.041 ± 0.001
60	✓	0.001 ± 0.001	0.305 ± 0.06	0.001 ± 0.001	± 0.001	0.020 ± 0.004	± 0.004	0.001 ± 0.001	0.001 ± 0.001	✓	0.001 ± 0.001	0.001 ± 0.001	0.001 ± 0.001	0
72	0.001 ± 0.001	0.005 0.041 ± 0.005	0.491 ± 0.1	0	0	0	0.004 ± 0.004	0	0	0	0	0	0	0
96		0.005	0.491 ± 0.1	0	0	0	0.004	0	0	0	0	0	0	0

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B_CALD

Ti me (h)	coumar an	Guaia col	Benzeneth anol	Benzeneac etic acid	Tyros ol	4- Vinylguai acol	ortho- Vanill in	4- Hydroxyben zoic acid	Homovani llyl alcohol	Homovani llic acid	Isoferu lic acid	Hydrofer ulic acid	p- Couma ric acid	Ferul ic acid
0	0	0	0	0	0	0	0.241 ± 0.1 0.227 ±	0	0	0	0	0	0	1.665 ± 0.0 1.581 ±
12	0	✓	✓	✓	0	✓	0.001	0	0	0	0.077 ± 0.01	✓	✓	0.02 1.429 ±
24	0.003 ± 0.004	✓ 0.011 ±	✓ 0.010 ± 0.004	0.026 ± 0.01 0.014 ± 0.003	✓ 0.019 ±	✓ 0.139 ± 0.03	0.266 ± 0.02 0.285 ± 0.04	0.031 ± 0.005 0.055 ± 0.03	✓ 0.017 ± 0.003	0.002 ± 0.003 ✓	0.090 ± 0.03 0.096 ± 0.03	0.010 ± 0.003 0.040 ± 0.007	0.023 ± 0.003 0.018 ± 0.003	± 0.02 1.279 ± 0.01 1.026 ± 0.01 0.638 ± 0.006 0.222 ± 0.02
36	✓	0.004 0.041 ±	0.043 ± 0.003	0.015 ± 0.01	± 0.007 0.192	0.159 ± 0.03	0.240 ± 0.07	✓	✓	0.012 ± 0.003	0.141 ± 0.02	0.024 ± 0.005	0.106 ± 0.03	± 0.01 0.638 ±
48	✓	0.008 0.041 ±	0.054 ± 0.014	0	± 0.006 0.001	0.072 ± 0.02	0.310 ± 0.03	0	0	0.030 ± 0.02	0.074 ± 0.02	0	0.042 ± 0.006	± 0.006 0.222 ±
60	✓	0.009 0.004 ±	0.093 ± 0.004	0.001 ± 0.001	± 0.001	0.008 ± 0.002	0.243 ± 0.07 0.387 ±	0.001 ± 0.001	0	✓	0	0	0	± 0.02
72	0	0.001 0.054 ±	0.465 ± 0.007	0	0	0	0.005	0	0	0	0	0	0	0
96	0	0.006	0.007	0	0	0	0.005	0	0	0	0	0	0	0

“✓” implies the presence of a compound in quantities that cannot be reliably quantified

“0” implies the complete absence of a compound

SC_ald5A

Time (h)	coumaran	Guaiaicol	Benzenethanol	Benzeneacetic acid	Tyrosol	4-Vinylguaiacol	ortho-Vanillin	4-Hydroxybenzoic acid	Homovanillyl alcohol	Homovanillic acid	Isoferullic acid	Hydroferullic acid	p-Coumaric acid	Ferulic acid
0	0	0	0	0	0	0	0.259 ± 0.06	0	0	0	0	0	0	1.670 ± 0.02
12	0	✓	✓	✓	0	✓	0.247 ± 0.03	0	0	0	0.085 ± 0.02	✓	✓	1.587 ± 0.02
24	0.004 ± 0.003	✓	✓	0.016 ± 0.004	✓	✓	0.257 ± 0.06	0.174 ± 0.15	✓	0.003 ± 0.005	0.070 ± 0.04	0.007 ± 0.003	0.016 ± 0.006	1.434 ± 0.02
36	✓	0.115 ± 0.02	0.034 ± 0.03	0.058 ± 0.05	0.021 ± 0.005	0.156 ± 0.01	0.323 ± 0.01	0.086 ± 0.06	0.071 ± 0.07	✓	0.106 ± 0.02	0.045 ± 0.001	0.020 ± 0.001	1.283 ± 0.02
48	✓	± 0.070	0.041 ± 0.008	0.032 ± 0.02	0.082 ± 0.02	0.145 ± 0.01	0.213 ± 0.01	✓	✓	0.012 ± 0.006	0.133 ± 0.03	0.022 ± 0.003	0.095 ± 0.006	1.030 ± 0.01
60	✓	± 0.060	0.052 ± 0.003	0.001 ± 0.001	✓	0.043 ± 0.02	0.196 ± 0.01	0	0	0.011 ± 0.01	0.031 ± 0.02	0	0.017 ± 0.012	0.640 ± 0.01
72	0.001 ± 0.001	0.086 ± 0.04	0.152 ± 0.04	0	0	0.009 ± 0.007	0.224 ± 0.05	0	0	✓	0	0	0	0.206 ± 0.003
96	0	± 0.020	0.408 ± 0.08	0	0	0	0.337 ± 0.01	0	0	0	0	0	0	0

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CTRL

Time (h)	coumaran	Guaiaicol	Benzenethanol	Benzeneacetic acid	Tyrosol	4-Vinylguaiacol	ortho-Vanillin	4-Hydroxybenzoic acid	Homovanillyl alcohol	Homovanillic acid	Isoferullic acid	Hydroferullic acid	p-Coumaric acid	Ferulic acid
0	0	0	0	0	0	0	0.259 ± 0.06	0	0	0	0	0	0	1.653 ± 0.04
12	0	✓	✓	✓	0	✓	0.232 ± 0.05	0	0	0	0.064 ± 0.01	✓	✓	1.520 ± 0.04
24	0.002 ± 0.002	✓	✓	0.015 ± 0.002	✓	✓	0.301 ± 0.05	0.022 ± 0.01	✓	0.001 ± 0.002	0.071 ± 0.05	0.007 ± 0.003	0.016 ± 0.007	1.249 ± 0.03
36	✓	0.012 ± 0.004	0.011 ± 0.004	0.023 ± 0.008	0.022 ± 0.008	0.157 ± 0.03	0.278 ± 0.03	0.061 ± 0.03	0.019 ± 0.003	✓	0.109 ± 0.04	0.045 ± 0.007	0.020 ± 0.003	1.118 ± 0.03
48	✓	0.033 ± 0.006	0.036 ± 0.003	0.014 ± 0.008	0.071 ± 0.004	0.129 ± 0.03	0.261 ± 0.02	✓	✓	0.010 ± 0.003	0.115 ± 0.01	0.020 ± 0.004	0.087 ± 0.02	0.854 ± 0.02
60	✓	0.042 ± 0.02	0.054 ± 0.03	0.005 ± 0.007	0.188 ± 0.09	0.076 ± 0.05	0.282 ± 0.03	0	0	0.030 ± 0.02	0.073 ± 0.04	0	0.042 ± 0.02	0.453 ± 0.01
72	0	0.003 ± 0.000	0.070 ± 0.04	0	0.05 ± 0.05	0.006 ± 0.002	0.251 ± 0.04	0	0	✓	0	0	0	0.164 ± 0.004
96	0	0.061 ± 0.008	0.530 ± 0.1	0	0	0	0.328 ± 0.02	0	0	0	0	0	0	0

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Table S3. Conversion products of *p*-coumaric acid by *APT_1*, *B_CALD*, *SC_ald5A* and control strains.

<i>APT_1</i>									
Time (h)	coumaran	Guaiacol	Benzenethanol	Benzeneacetic acid	Tyrosol	4-Vinylguaiacol	ortho-Vanillin	4-Hydroxybenzoic acid	p-Coumaric acid
0	0	0	0	0	0	0	0.299 ± 0.01	0	9.529 ± 0.12
12	0	0	0	0	0	0	0.312 ± 0.01	0	8.404 ± 0.12
24	✓	1.696 ± 0.23	0.062 ± 0.06	0.329 ± 0.05	1.254 ± 0.13	0.255 ± 0.00	0.295 ± 0.02	0.131 ± 0.10	7.899 ± 0.11
36	0.189 ± 0.01	0.613 ± 0.21	0.786 ± 0.14	0.979 ± 0.12	0.997 ± 0.07	0.316 ± 0.2	0.297 ± 0.01	0.576 ± 0.09	6.951 ± 0.10
48	0.335 ± 0.02	0.249 ± 0.01	0.766 ± 0.13	0.385 ± 0.03	0.602 ± 0.11	0.265 ± 0.2	0.285 ± 0.02	0.108 ± 0.07	4.169 ± 0.06
60	0.153 ± 0.01	0.229 ± 0.13	1.685 ± 0.61	0.241 ± 0.03	0	0	0.292 ± 0.001	0	2.040 ± 0.03
72	0	0.081 ± 0.01	0.688 ± 0.11	0.219 ± 0.03	0.011 ± 0.01	0	0.271 ± 0.01	0.007 ± 0.01	0.235 ± 0.01
96	0	0	0.693 ± 0.1	0	0	0	0.293 ± 0.03	0	0

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<i>B_CALD</i>									
Time (h)	coumaran	Guaiacol	Benzenethanol	Benzeneacetic acid	Tyrosol	4-Vinylguaiacol	ortho-Vanillin	4-Hydroxybenzoic acid	p-Coumaric acid
0	0	0	0	0	0	0	0.287 ± 0.05	0	9.587 ± 0.10
12	0	0	0	0	0	0	0.239 ± 0.01	0	8.454 ± 0.010
24	✓	1.526 ± 0.10	0.056 ± 0.06	0.296 ± 0.04	1.337 ± 0.14	0.230 ± 0.00	0.287 ± 0.04	0.120 ± 0.01	8.032 ± 0.10
36	0.170 ± 0.12	1.357 ± 0.62	0.707 ± 0.12	0.881 ± 0.02	0.930 ± 0.06	0.294 ± 0.02	0.298 ± 0.05	0.618 ± 0.02	7.067 ± 0.10
48	0.249 ± 0.17	0.717 ± 0.19	0.525 ± 0.20	0.361 ± 0.04	0.577 ± 0.03	0.304 ± 0.03	0.257 ± 0.06	0.081 ± 0.05	4.238 ± 0.05
60	0.183 ± 0.18	0.252 ± 0.03	1.295 ± 0.50	0.265 ± 0.02	0.008 ± 0.008	0	0.311 ± 0.04	0	2.202 ± 0.02
72	0	0.056 ± 0.008	0.227 ± 0.01	0.153 ± 0.0	0	0	0.226 ± 0.04	0	0.701 ± 0.01
96	0	0	0.580 ± 0.01	0	0	0	0.381 ± 0.004	0	0

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<i>SC_ald5A</i>									
Time (h)	coumaran	Guaiacol	Benzenethanol	Benzeneacetic acid	Tyrosol	4-Vinylguaiacol	ortho-Vanillin	4-Hydroxybenzoic acid	p-Coumaric acid
0	0	0	0	0	0	0	0.219 ± 0.01	0	9.587 ± 0.10
12	0	0	0	0	0	0	0.260 ± 0.03	0	8.454 ± 0.10
24	✓	0.678 ± 0.07	0.037 ± 0.004	0.131 ± 0.01	1.247 ± 0.15	0.102 ± 0.03	0.255 ± 0.07	0.084 ± 0.004	8.032 ± 0.10
36	0.218 ± 0.02	0.694 ± 0.02	0.910 ± 0.02	1.103 ± 0.50	1.120 ± 0.08	0.353 ± 0.03	0.337 ± 0.02	0.659 ± 0.07	7.067 ± 0.09
48	0.282 ± 0.02	0.203 ± 0.1	0.454 ± 0.04	0.316 ± 0.11	0.490 ± 0.08	0.216 ± 0.1	0.233 ± 0.02	0.089 ± 0.06	4.238 ± 0.05
60	0.107 ± 0.01	✓	1.067 ± 0.02	0	0.098 ± 0.01	0	0.205 ± 0.001	0	2.202 ± 0.02
72	0	0.073 ± 0.01	0.362 ± 0.12	0.197 ± 0.03	0	0	0.189 ± 0.04	0	0.701 ± 0.01
96	0	0	0.503 ± 0.08	0	0	0	0.332 ± 0.01	0	0

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“0” implies the complete absence of a compound

<i>CTRL</i>									
Time (h)	coumaran	Guaiacol	Benzenethanol	Benzeneacetic acid	Tyrosol	4-Vinylguaiacol	ortho-Vanillin	4-Hydroxybenzoic acid	p-Coumaric acid
0	0	0	0	0	0	0	0.293 ± 0.02	0	9.531 ± 0.20
12	0	0	0	0	0	0	0.263 ± 0.02	0	8.449 ± 0.16
24	✓	0.271 ± 0.03	0.022 ± 0.02	0.053 ± 0.001	1.311 ± 0.18	0.041 ± 0.01	0.281 ± 0.03	0.057 ± 0.005	8.026 ± 0.15
36	0.252 ± 0.02	0.788 ± 0.21	1.057 ± 0.28	1.245 ± 0.50	1.260 ± 0.1	0.395 ± 0.03	0.310 ± 0.05	0.754 ± 0.050	6.982 ± 0.13
48	0.238 ± 0.02	0.166 ± 0.08	0.371 ± 0.03	0.260 ± 0.09	0.398 ± 0.05	0.176 ± 0.02	0.278 ± 0.04	0.074 ± 0.005	4.153 ± 0.08
60	0.075 ± 0.07	✓	1.036 ± 0.42	0	0.147 ± 0.01	0	0.286 ± 0.02	0	2.157 ± 0.04
72	0	0.065 ± 0.01	0.267 ± 0.01	0.177 ± 0.03	0	0	0.269 ± 0.04	0	0.670 ± 0.01
96	0	0	0.567 ± 0.07	0	0	0	0.311 ± 0.03	0	0

“✓” implies the presence of a compound in quantities that cannot be reliably quantified

“0” implies the complete absence of a compound