

**Table S1. Primers used in this study.**

| Plasmid  | Fragments | Primers   | Sequence (5'-3')                                                                               |
|----------|-----------|-----------|------------------------------------------------------------------------------------------------|
| p2-4-6-1 | PGK1p     | PGK1p-F1  | CACTATAGGGCGAATTGGGTACCGGGCCCCCCTCGAGGTCGACGGTATCGATAAG<br>CTTTATTTTAGATTCTGACTTCAACTCAAGAC    |
|          |           | PGK1p-R1  | TACCATTTGTAGTACCCATTGTTTTATATTTGTTGTAAAAAGTAGATAAATTACTTCCTT                                   |
|          | gme       | gme-F2    | TTTACAACAAATATAAAACAATGGGTACTACAAATGGTACTGATTAC                                                |
|          |           | gme-R2    | TTAATAAAAGTGTTTCGCAAATTATTCTTTACCATCAGCAGCTCTTAATG                                             |
|          | HXT7t     | HXT7t-F3  | CTGCTGATGGTAAAGAATAATTTGCGAACACTTTTATTAATTCATGATCAC                                            |
|          |           | HXT7t-R3  | CTTCCTGCTCACAAATCTTAAAGTCATACATTGCACGACTAGAGACCGGTCTCGGACT<br>AATAACTGACTCATTAGACACTTTTTGAAGC  |
|          | GPM1p     | GPM1p-F4  | TTCTGTATCCCGCTTCAAAAAGTGTCTAATGAGTCAGTTATTAGTCCGAGACCGGTCTC<br>TAGTCGTGCAATGTATGACTTTAAGATTG   |
|          |           | GPM1p-R4  | ACTCTTTTAATCTTCAACATTATTGTAATATGTGTGTTTGTGGATTATTAAGAA                                         |
|          | vtc2      | vtc2-F5   | CAAACACACATATTACAATAATGTTGAAGATTAAGAGAGTTCCAACAGTTG                                            |
|          |           | vtc2-R5   | GTGACATAACTAATTACATGTTATTGCAAACTAAACATTCAGCAGCAG                                               |
|          | CYC1t     | CYC1t -F6 | AATGTTTAGTTTTGCAATAACATGTAATTAGTTATGTCACGCTTACATTC                                             |
|          |           | CYC1t-R6  | TTAATTATTACGTATTCTTTGAAATGGCAGTATTGATAATGATAAACTGAGACCGGTCTC<br>GAAACTAAAGCCTTCGAGCGTCCCAAAA   |
|          | TDH3p     | TDH3p-F7  | AACCTTGCTTGAGAAGGTTTTGGGACGCTCGAAGGCTTTAGTTTCGAGACCGGTCTCA<br>GTTTATCATTATCAATACTGCCATTTCAAAAG |
|          |           | TDH3p-R7  | AATTGATCATTATCTGCCATTTTGTTTGTTTATGTGTGTTTATTCGAACTAAG                                          |
|          | vtc4      | vtc4-F8   | AACACACATAAAACAAACAAAATGGCAGATAATGATCAATTTTTGGCTG                                              |
|          |           | vtc4-R8   | AAATCATTCAATCTTCAGACTTAAGCACCTGTTAATCTCAATGCTTCT                                               |
|          | GPM1t     | GPM1t-F9  | TGAGATTAACAGGTGCTTAAGTCTGAAGAATGAATGATTTGATGATTCT                                              |
|          |           | GPM1t-R9  | GAAGCGCCTACGCTTGACATCTACTATATGTAAGTATACGGCCCCGAGACCGGTCTCG<br>GCCCTATTTCGAACTGCCCATTCAGCTTTTC  |
|          | TEF2p     | TEF2p-F10 | GAGTGCACCAATTGCAAAGGGAAAAGCTGAATGGGCAGTTCGAATAGGGGCCGAGAC<br>CGGTCTCGGGGCCGTATACTTACATATAGTAG  |
|          |           | TEF2p-R10 | AACAACAAAGATCTCAACATGTTTAGTTAATTATAGTTCGTTGACCGTATATTCTAAAAAC                                  |
|          | gldh      | gldh-F11  | CGAACTATAATTAATAAACATGTTGAGATCTTTGTTGTTGAGGAGG                                                 |
|          |           | gldh-R11  | AATTCTTAGTTAAAAGCACTTTAAGCAGTAGTAGAGACTGGGAACA                                                 |
|          | ENO2t     | ENO2t-F12 | CAGTCTCTACTACTGCTTAAAGTGCTTTTAACTAAGAATTATTAGTCTTTTCTGC                                        |
|          |           | ENO2t-R12 | ATAGAGGAAGCTGAAAAGTCTTAGAACGGTAATCTTCCACCAACCTGATGGGTTCTTA<br>GATATAAGGTATCATCTCCATCTCCCATATG  |
|          | TPI1p     | TPI1p-F13 | GATGGAAGGAAATGCGGGCCACGACCACAGTGATATGCATATGGGAGATGGAGATGAT<br>ACCTTATATCTAGGAACCCATCAGGTTGGTG  |
|          |           | TPI1p-R13 | TTAATTCAATCTTTGTCATTTTAGTTTATGTATGTGTTTTGTAGTTATAGATTTAAGCAA                                   |
|          | galdh     | galdh-F14 | AACACATACATAAACTAAAAATGACAAAGATTGAATTAAGGGCTTTGG                                               |
|          |           | galdh-R14 | CGATTTCAATTCAATTCAATTTAGTTCTGGTGAATACCAGATGGC                                                  |
|          | PGK1t     | PGK1t-F15 | CTGGTATTCACCAGAACTAAATTGAATTGAATTGAAATCGATAGATCAATTTTTCTT                                      |
|          |           | PGK1t-R15 | AGCTCCACCGCGGTGGCGGCCGCTCTAGAAGTAGTGATCCCCGGGCTGCAGGAAT<br>TCAACGAACGCAGAATTTTCGAGTTATTAAC     |

**Table S1 (continue)**

| Plasmid    | Fragments              | Primers      | Sequence (5'-3')                                                                               |
|------------|------------------------|--------------|------------------------------------------------------------------------------------------------|
|            | PGK1p-gme-HXT7t        | PGK1p-F1     | CACTATAGGGCGAATTGGGTACCGGGCCCCCCTCGAGGTCGACGGTATCGATAAGCTT<br>TATTTTAGATTCTGACTTCAACTCAAGAC    |
|            |                        | HXT7t-R3     | CTTCCTGCTCACAAATCTTAAAGTCATACATTGCACGACTAGAGACCGGTCTCGGACTAA<br>TAACTGACTCATTAGACACTTTTTGAAGC  |
|            | GPM1p-vtc2-CYC1t       | GPM1p-F4     | TTCTGTATCCCGCTTCAAAAAGTGTCTAATGAGTCAGTTATTAGTCCGAGACCGGTCTCT<br>AGTCGTGCAATGTATGACTTTAAGATTG   |
|            |                        | CYC1t-R6     | TTAATTATTTACGTATTCTTTGAAATGGCAGTATTGATAATGATAAACTGAGACCGGTCTCG<br>AAACTAAAGCCTTCGAGCGTCCCAAAA  |
|            | TDH3p-vtc4-GMP1t       | TDH3p-F7     | AACCTTGCTTGAGAAGGTTTTGGGACGCTCGAAGGCTTTAGTTTCGAGACCGGTCTCAG<br>TTTATCATTATCAATACTGCCATTTCAAAG  |
|            |                        | GPM1t-R9     | GAAGCGCCTACGCTTGACATCTACTATATGTAAGTATACGGCCCCGAGACCGGTCTCGG<br>CCCCTATTGCAACTGCCCATTCAGCTTTTC  |
|            | TEF2p-gldh-ENO2t       | TEF2p-F10    | GAGTGCACCAATTGCAAAGGGAAAAGCTGAATGGGCAGTTCGAATAGGGGGCCGAGACC<br>GGTCTCGGGGCCGTATACTTACATATAGTAG |
|            |                        | ENO2t-R12    | ATAGAGGAAGCTGAAAAGTCTTAGAACGGGTAATCTTCCACCAACCTGATGGGTTCTTA<br>GATATAAGGTATCATCTCCATCTCCCATATG |
|            | TPI1p-galdh-PGK1t      | TPI1p-F13    | GATGGAAGGAAATGCGGGCCACGACCACAGTGATATGCATATGGGAGATGGAGATGATA<br>CCTTATATCTAGGAACCCATCAGGTTGGTG  |
|            |                        | PGK1t-R15    | AGCTCCACCGCGGTGGCGGCCGCTCTAGAAGTGTGATCCCCCGGGCTGCAGGAATT<br>CAACGAACGCAGAATTTTCGAGTTATTAAAC    |
| pGLDH-1/2  | TEF2p-gldh-ENO2t       | NotI-TEF2p-F | AAGGAAAAAAGCGGCCGCGGGGCCGTATACTTACATATAGTAG                                                    |
|            |                        | ENO2t-SacI-R | CGAGCTCAGGTATCATCTCCATCTCCCATATG                                                               |
| p2-4-6-1-2 | L-PGK1p-gme-HXT7t      | L-F          | AGGGTTGAGTGTTGTTCCAGTT                                                                         |
|            |                        | HXT7t-R3     | CTTCCTGCTCACAAATCTTAAAGTCATACATTGCACGACTAGAGACCGGTTTCGA<br>CTAATAACTGACTCATTAGACACTTTTTGAAGC   |
|            | HXT7t-GPM1p-vtc2-CYC1t | HXT7t-F3     | CTGCTGATGGTAAAGAATAATTTGCGAACACTTTTATTAATTCATGATCAC                                            |
|            |                        | CYC1t-R6     | TTAATTATTTACGTATTCTTTGAAATGGCAGTATTGATAATGATAAACTGAGACCGGTCT<br>CGAAACTAAAGCCTTCGAGCGTCCCAAAA  |
|            | CYC1t-TDH3p-vtc4-GPM1t | CYC1t-F6     | AATGTTTAGTTTTGCAATAACATGTAATT AGTTATGTCACGCTTACATTC                                            |
|            |                        | GPM1t-R9     | GAAGCGCCTACGCTTGACATCTACTATATGTAAGTATACGGCCCCGAGACCGGTCTCG<br>GCCCCTATTGCAACTGCCCATTCAGCTTTTC  |
|            | GPM1t                  | GPM1t-F9     | TGAGATTAACAGGTGCTTAAGTCTGAAGAATGAATGATTTGATGATTTCT                                             |
|            |                        | GPM1t-R9     | GAAGCGCCTACGCTTGACATCTACTATATGTAAGTATACGGCCCCGAGACCGGTCTCG<br>GCCCCTATTGCAACTGCCCATTCAGCTTTTC  |
|            | TEF2p                  | TEF2p-F10    | GAGTGCACCAATTGCAAAGGGAAAAGCTGAATGGGCAGTTCGAATAGGGGGCCGAGAC<br>CGGTCTCGGGGCCGTATACTTACATATAGTAG |
|            |                        | TEF2p-R10    | AACAACAAAGATCTCAACATGTTTAGTTAATTATAGTTCGTTGACCGTATATTCTAAAAAC                                  |
|            | GPM1t-TEF2p            | GPM1t-F9     | TGAGATTAACAGGTGCTTAAGTCTGAAG AATGAATGATTTGATGATTTCT                                            |
|            |                        | TEF2p-R10    | AACAACAAAGATCTCAACATGTTTAGTTAATTATAGTTCGTTGACCGTATATTCTAAAAAC                                  |

**Table S1 (continue)**

| Plasmid   | Fragments                 | Primers      | Sequence (5'-3')                                                                                |
|-----------|---------------------------|--------------|-------------------------------------------------------------------------------------------------|
|           | TEF2p-gldh-ENO2t          | TEF2p-R10    | AACAACAAAGATCTCAACATGTTTAGTTAATTATAGTTCGTTGACCGTATATTCTAAAAAC                                   |
|           |                           | ENO2t-R12    | ATAGAGGAAGCTGAAAAGTCTTAGAACGGGTAATCTTCCACCAACCTGATGGGTTTCCT<br>AGATATAAGGTATCATCTCCATCTCCCATATG |
|           | ENO2t-TPI1p-galdh-PGK1t-R | ENO2t-F12    | CAGTCTCTACTACTGCTTAAAGTGCTTTTAACTAAGAATTATTAGTCTTTTCTGC                                         |
|           |                           | R-R          | CTGCGTTATCCCCTGATTCTGT                                                                          |
| pGME-VTC2 | L-GPM1p-vc2               | L-F          | AGGGTTGAGTGTTGTTCCAGTT                                                                          |
|           |                           | vc2-gme-R    | AGAACCACCACCACCAGAACCACCACCACCAGAACCACCACCACCTTGCAAACTAA<br>ACATTGAGCAGCAG                      |
|           | vc2(gme)                  | vc2-F5       | CAAACACACATATTACAATAATGTTGAAGAT TAAAAGAGTTCCAACAGTTG                                            |
|           |                           | vc2-gme-R    | AGAACCACCACCACCAGAACCACCACCACCAGAACCACCACCACCTTGCAAACTAA<br>ACA TTCAGCAGCAG                     |
|           | (vc2)gme                  | vc2-gme-F    | GGTGGTGGTGGTTCTGGTGGTGGTGGTTCTGGTGGTGGTGGTTCTGGTACTACAAAT<br>GGTACTGATTACGGT                    |
|           |                           | gme-R2       | TTAATAAAAGTGTTTCGCAAATTATTCTTTACC ATCAGCAGCTCTTAATG                                             |
|           | vc2-gme                   | vc2-F5       | CAAACACACATATTACAATAATGTTGAAGAT TAAAAGAGTTCCAACAGTTG                                            |
|           |                           | gme-R2       | TTAATAAAAGTGTTTCGCAAATTATTCTTTACC ATCAGCAGCTCTTAATG                                             |
|           | gme(CYC1t)                | vc2-gme-F    | GGTGGTGGTGGTTCTGGTGGTGGTGGTTCTGGTGGTGGTGGTTCTGGTACTACAAAT<br>GGTACTGATTACGGT                    |
|           |                           | gme(CYC1t)-R | GTGACATAACTAATTACATGTTATTCTTTACC ATCAGCAGCTCTTAATGAAC                                           |
|           | (gme)CYC1t                | gme(CYC1t)-F | CTGCTGATGGTAAAGAATAACATGTAATTAG TTATGTCACGCTTACATTC                                             |
|           |                           | CYC1t-R6     | TTAATTATTTACGTATTCTTTGAAATGGCAGTATTGATAATGATAAACTGAGACCGGTCTC<br>GAAACTAAAGCCTTCGAGCGTCCCCAAA   |
|           | gme-CYC1t                 | vc2-gme-F    | GGTGGTGGTGGTTCTGGTGGTGGTGGTTCTGGTGGTGGTGGTTCTGGTACTACAAAT<br>GGTACTGATTACGGT                    |
|           |                           | CYC1t-R6     | TTAATTATTTACGTATTCTTTGAAATGGCAGTATTGATAATGATAAACTGAGACCGGTCTC<br>GAAACTAAAGCCTTCGAGCGTCCCCAAA   |
|           | L-GPM1p-vc2-gme-CYC1t     | L-F          | AGGGTTGAGTGTTGTTCCAGTT                                                                          |
|           |                           | CYC1t-R6     | TTAATTATTTACGTATTCTTTGAAATGGCAGTATTGATAATGATAAACTGAGACCGGTCTC<br>GAAACTAAAGCCTTCGAGCGTCCCCAAA   |
|           | CYC1t-TDH3p-vc4-GPM1t     | CYC1t-F6     | AATGTTTAGTTTTGCAATAACATGTAATTAGTTATGTCACGCTTACATTC                                              |
|           |                           | GPM1t-R9     | GAAGCGCTACGCTTGACATCTACTATATGTAAGTATACGGCCCCGAGACCGGTCTC<br>GGCCCCATTTCGAACTGCCCATTGAGCTTTTC    |
|           | GPM1t-TEF2p               | GPM1t-F9     | TGAGATTAACAGGTGCTTAAGTCTGAAG AATGAATGATTGATGATTCT                                               |
|           |                           | TEF2p-R10    | AACAACAAAGATCTCAACATGTTTAGTTAATTATAGTTCGTTGACCGTATATTCTAAAA<br>AC                               |
|           | TEF2p-gldh-ENO2t          | TEF2p-R10    | AACAACAAAGATCTCAACATGTTTAGTTAATTATAGTTCGTTGACCGTATATTCTAAAAAC                                   |
|           |                           | ENO2t-R12    | ATAGAGGAAGCTGAAAAGTCTTAGAACGGGTAATCTTCCACCAACCTGATGGGTTTCCT<br>AGATATAAGGTATCATCTCCATCTCCCATATG |

**Table S1 (continue)**

| Plasmid         | Fragments                  | Primers      | Sequence (5'-3')                                                                                 |
|-----------------|----------------------------|--------------|--------------------------------------------------------------------------------------------------|
|                 | ENO2t-TPI1p-galdh-PGK1t-R  | ENO2t-F12    | CAGTCTCTACTACTGCTTAAAGTGCTTTTAACTAAGAATTATTAGTCTTTTCTGC                                          |
|                 |                            | R-R          | CTGCGTTATCCCCTGATTCTGT                                                                           |
| pVTC2-VTC4      | L-PGK1p-gme-HXT7t          | L-F          | AGGGTTGAGTGTTGTTCCAGTT                                                                           |
|                 |                            | HXT7t-R3     | CTTCCTGCTCACAAATCTTAAAGTCATACATTGCACGACTAGAGACCGGTTCCGACTA<br>ATAACTGACTCATTAGACACTTTTTGAAGC     |
|                 | HXT7t-GPM1p-<br>vtc2       | HXT7t-F3     | CTGCTGATGGTAAAGAATAATTTGCGAACACTTTTATTAATTCATGATCAC                                              |
|                 |                            | vtc2-vtc4-R  | AGAACCACCACCACCAGAACCACCACCACCAGAACCACCACCACCTTGCAAACTAA<br>ACATTGAGCAGCAGT                      |
|                 | vtc2(vtc4)                 | vtc2-F5      | CAAACACACATATTACAATAATGTTGAAGATTAAGAAGAGTTCCAACAGTTG                                             |
|                 |                            | vtc2-vtc4-R  | AGAACCACCACCACCAGAACCACCACCACCAGAACCACCACCACCTTGCAAACTAA<br>ACATTGAGCAGCAGT                      |
|                 | (vtc2)vtc4                 | vtc2-vtc4-F  | GGTGGTGGTGGTTCTGGTGGTGGTGGTTCTGGTGGTGGTGGTTCTGCAGATAATGAT<br>CAATTTTGGCTGC                       |
|                 |                            | vtc4-R8      | AAATCATTCACTTCTTCAGACTTAAGCACCTGTTAATCTCAATGCTTCT                                                |
|                 | vtc2-vtc4                  | vtc2-F5      | CAAACACACATATTACAATAATGTTGAAGATTAAGAAGAGTTCCAACAGTTG                                             |
|                 |                            | vtc4-R8      | AAATCATTCACTTCTTCAGACTTAAGCACCTGTTAATCTCAATGCTTCT                                                |
|                 | vtc4-GPM1t                 | vtc2-vtc4-F  | GTGGTGGTGGTTCTGCAGATAATGATCAATT TTTGGCTGC                                                        |
|                 |                            | GPM1t-R9     | GAAGCGCCTACGCTTGACATCTACTATATGTAAGTATACGGCCCCGAGACCGGTCTCG<br>GCCCTATTGCAACTGCCCATTCAGCTTTTC     |
|                 | GPM1t-TEF2p                | GPM1t-F9     | TGAGATTAACAGGTGCTTAAGTCTGAAG AATGAATGATTTGATGATTTCT                                              |
|                 |                            | TEF2p-R10    | AACAACAAAGATCTCAACATGTTTAGTTAATTATAGTTGCGTTGACCGTATATTCTAAAA<br>AC                               |
|                 | TEF2p-gldh-<br>ENO2t       | TEF2p-R10    | AACAACAAAGATCTCAACATGTTTAGTTAATTATAGTTGCGTTGACCGTATATTCTAAAAAC                                   |
|                 |                            | ENO2t-R12    | ATAGAGGAAGCTGAAAAGTCTTAGAACGGGTAATCTTCCACCAACCTGATGGGTTCTCCT<br>AGATATAAGGTATCATCTCCATCTCCCATATG |
|                 | ENO2t-TPI1p-galdh-PGK1t-R  | ENO2t-F12    | CAGTCTCTACTACTGCTTAAAGTGCTTTTAACTAAGAATTATTAGTCTTTTCTGC                                          |
|                 |                            | R-R          | CTGCGTTATCCCCTGATTCTGT                                                                           |
| pGalDH-<br>GLDH | L-PGK1p-gme-HXT7t          | L-F          | AGGGTTGAGTGTTGTTCCAGTT                                                                           |
|                 |                            | HXT7t-R3     | CTTCCTGCTCACAAATCTTAAAGTCATACATTGCACGACTAGAGACCGGTTCCGACTA<br>ATAACTGACTCATTAGACACTTTTTGAAGC     |
|                 | HXT7t-GPM1p-<br>vtc2-CYC1t | HXT7t-F3     | CTGCTGATGGTAAAGAATAATTTGCGAACACTTTTATTAATTCATGATCAC                                              |
|                 |                            | CYC1t-R6     | TTAATTATTTACGTATTCTTTGAAATGGCAGTATTGATAATGATAAACTGAGACCGGTC<br>TCGAAACTAAAGCCTTCGAGCGTCCCAAAA    |
|                 | CYC1t-TDH3p-<br>vtc4-GPM1t | CYC1t-F6     | AATGTTTAGTTTTGCAATAACATGTAATTAGTTATGTCACGCTTACATTC                                               |
|                 |                            | GPM1t-R9     | GAAGCGCCTACGCTTGACATCTACTATATGTAAGTATACGGCCCCGAGACCGGTCTC<br>GGCCCCTATTGCAACTGCCCATTCAGCTTTTC    |
|                 | GPM1t-TPI1p-galdh          | GPM1t-F9     | TGAGATTAACAGGTGCTTAAGTCTGAAGAAT GAATGATTTGATGATTTCT                                              |
|                 |                            | galdh-gldh-R | AGAACCACCACCACCAGAACCACCACCACCAGAACCACCACCACCAGCAGTAGTAGA<br>GACTGGGAACAAT                       |

**Table S1 (continue)**

| Plasmid    | Fragments        | Primers      | Sequence (5'-3')                                                                               |
|------------|------------------|--------------|------------------------------------------------------------------------------------------------|
|            | galdh(gldh)      | galdh-F14    | AACACATACATAAACTAAAAATGACAAAGATTGAATTAAGGGCTTTGG                                               |
|            |                  | galdh-gldh-R | AGAACCACCACCACCAGAACCACCACCACCAGAACCACCACCACCAGCAGTAGTAGA<br>GACTGGGAACAAT                     |
|            | (galdh)gldh      | galdh-gldh-F | GGTGGTGGTGGTTCTGGTGGTGGTGGTTCTGGTGGTGGTGGTTCTACAAAGATTGAA<br>TTAAGGGCTTTGGG                    |
|            |                  | gldh-R11     | AATTCTTAGTTAAAAGCACTTTAAGCAGTAGTAGAGACTGGGAACA                                                 |
|            | galdh-gldh       | galdh-F14    | AACACATACATAAACTAAAAATGACAAAGATTGAATTAAGGGCTTTGG                                               |
|            |                  | gldh-R11     | AATTCTTAGTTAAAAGCACTTTAAGCAGTAGTAGAGACTGGGAACA                                                 |
|            | gldh-ENO2t       | TEF2p-R10    | AACAACAAAGATCTCAACATGTTTAGTTAATTATAGTTTCGTTGACCGTATATTCTAAAAAC                                 |
|            |                  | ENO2t-R12    | ATAGAGGAAGCTGAAAAGTCTTAGAACGGGTAATCTTCCACCAACCTGATGGGTTCTTA<br>GATATAAGGTATCATCTCCATCTCCCATATG |
|            | gldh-ENO2t-R     | galdh-gldh-F | GGTGGTGGTGGTTCTGGTGGTGGTGGTTCTGGTGGTGGTGGTTCTACAAAGATTGAA<br>TTAAGGGCTTTGGG                    |
|            |                  | R-R          | CTGCGTTATCCCCTGATTCTGT                                                                         |
| pVTC2-GLDH | TEF1p            | TEF1p-F      | AATTGGGTACCGGGCCCCCCTCGAGCGCTCGAAGGCTTTAGATCTAATGT                                             |
|            |                  | TEF1p-R      | ACTCTTTTAATCTTCAACATTTTGTAAATTAAGCTTAGATTAGATTGCTATGCTTTCT                                     |
|            | vtc2-CYC1t       | TEF1p-vtc2-F | ATCTAAGTTTTAATTACAAAATGTTGAAGATTAAGAGATTCCAACAGTTG                                             |
|            |                  | CYC1t-gldh-R | GATAATGATAAACTGAGACCCTAAAGCCTTCGAGCGTCCC                                                       |
|            | TDH3p            | TDH3p-F8     | GGGACGCTCGAAGGCTTTAGGGTCTCAGTTTATCATTATCAATACTGCCAT                                            |
|            |                  | TDH3p-R8     | AACAACAAAGATCTCAACATTTTGTGTTTATGTGTGTTTATTGAACTAAGTTC                                          |
|            | gldh-ENO2t       | CYC1t-gldh-F | AACACACATAAACAAACAAAATGTTGAGATCTTTGTTGTTGAGGAGG                                                |
|            |                  | CYC1t-gldh-R | ATATCAAGCTTATCGATACCGTCGACAGGTATCATCTCCATCTCCCATATGC                                           |
|            | TEF1p-vtc2-CYC1t | TEF1p-F      | AATTGGGTACCGGGCCCCCCTCGAGCGCTCGAAGGCTTTAGATCTAATGT                                             |
|            |                  | CYC1t-gldh-R | GATAATGATAAACTGAGACCCTAAAGCCTTCGAGCGTCCC                                                       |
|            | TDH3p-gldh-ENO2t | TDH3p-F8     | GGGACGCTCGAAGGCTTTAGGGTCTCAGTTTATCATTATCAATACTGCCAT                                            |
|            |                  | CYC1t-gldh-R | ATATCAAGCTTATCGATACCGTCGACAGGTATCATCTCCATCTCCCATATGC                                           |
| pALO1-VTC2 | GPM1p            | GPM1p-F5     | AATTGGGTACCGGGCCCCCCTCGAGTAGTCGTGCAATGTATGACTTTAAGATTTGTG                                      |
|            |                  | GPM1p-R5     | TGGGATAGTAGACATTATTGTAATATGTGTGTTTGTGTTGATTATTAAGAAGAATAAT                                     |
|            | alo1             | alo1-F       | CCAAACAAACACACATATTACAATAATGTCTACTATCCCATTAGAAAGAACTATGTGT                                     |
|            |                  | alo1-R       | TTAATAAAAGTGTTTCGCAAAGTAGTCGGACAACCTCACTAGGATCTATAATACC                                        |
|            | HXT7t            | alo1-HXT7t-F | CTAGTGAGTTGTCCGACTAGTTTGCGAACACTTTTATTAATTCATGATCACG                                           |
|            |                  | alo1-HXT7t-R | AGATCTAAAGCCTTCGAGCGCTAATAACTGACTCATTAGACACTTTTTGAAGCG                                         |
|            | vtc2             | HXT7p-vtc2-F | TCTAATGAGTCAGTTATTAGCGCTCGAAGGCTTTAGATCTAATGT                                                  |
|            |                  | CYC1t-425-R  | GGCTGCAGGAATTCGATATCAAGCTTCTAAAGCCTTCGAGCGTCCC                                                 |
|            | GPM1p-ALO1       | GPM1p-F5     | AATTGGGTACCGGGCCCCCCTCGAGTAGTCGTGCAATGTATGACTTTAAGATTTGTG                                      |
|            |                  | ALO1-R       | TTAATAAAAGTGTTTCGCAAAGTAGTCGGACAACCTCACTAGGATCTATAATACC                                        |
|            | HXT7p-vtc2       | HXT7p-F      | CTAGTGAGTTGTCCGACTAGTTTGCGAACACTTTTATTAATTCATGATCACG                                           |
|            |                  | CYC1t-425-R  | GGCTGCAGGAATTCGATATCAAGCTTCTAAAGCCTTCGAGCGTCCC                                                 |

**Table S1 (continue)**

| Plasmid    | Fragments             | Primers       | Sequence (5'-3')                                                   |
|------------|-----------------------|---------------|--------------------------------------------------------------------|
|            | alo1-vtc2             | GPM1p-F5      | AATTGGGTACCGGGCCCCCCCCCTCGAGTAGTCGTGCAATGTATGACTTTAAGATTTGTG       |
|            |                       | CYC1t-425-R   | GGCTGCAGGAATTCGATATCAAGCTTCTAAAGCCTTCGAGCGTCCC                     |
| pALO1-GLDH | alo1                  | GPM1p-F6      | AATTGGGTACCGGGCCCCCCCCCTCGAGTAGTCGTGCAATGTATGACTTTAAGATTTGTG       |
|            |                       | HXT7t-TDH3p-R | GATAATGATAAACTGAGACCCCTAATAACTGACTCATTAGACACTTTTTGAAGCG            |
|            | gldh                  | HXT7t-TDH3p-F | TCTAATGAGTCAGTTATTAGGGTCTCAGTTTATCATTATCAATACTGCCAT                |
|            |                       | ENO2t-425-R   | GGCTGCAGGAATTCGATATCAAGCTTAGGTATCATCTCCATCTCCCATATGC               |
|            | alo1-gldh             | GPM1p-F6      | AATTGGGTACCGGGCCCCCCCCCTCGAGTAGTCGTGCAATGTATGACTTTAAGATTTGTG       |
|            |                       | ENO2t-425-R   | GGCTGCAGGAATTCGATATCAAGCTTAGGTATCATCTCCATCTCCCATATGC               |
| pALO1      | TDH3p                 | TDH3p-F9      | AATTGGGTACCGGGCCCCCCCCCTCGAGGGTCTCAGTTTATCATTATCAATACTGCCAT        |
|            |                       | TDH3p-R9      | CTAAATGGGATAGTAGACATTTTGTTTGTTTATGTGTGTTTATTCGAAACT                |
|            | alo1                  | TDH3p-alo1-F  | AACACACATAAAACAAACAAAATGTCTACTATCCCATTAGAAAGAACTATGTGT             |
|            |                       | TDH3p-alo1-R  | AATTCTTAGTTAAAAGCACTCTAGTCGGACAACCTACTAGGATCTATAATAC               |
|            | ENO2t                 | alo1-ENO2t-F  | CTAGTGAGTTGTCCGACTAGAGTGCTTTTAACTAAGAATTATTAGTCTTTTCTGCT           |
|            |                       | alo1-ENO2t-R  | ATATCAAGCTTATCGATACCGTCGACAGGTATCATCTCCATCTCCCATATGC               |
|            | TDH3p-alo1-ENO2t      | TDH3p-F9      | AATTGGGTACCGGGCCCCCCCCCTCGAGGGTCTCAGTTTATCATTATCAATACTGCCAT        |
|            |                       | alo1-ENO2t-R  | ATATCAAGCTTATCGATACCGTCGACAGGTATCATCTCCATCTCCCATATGC               |
| pHE-GAL    | GAL1p                 | GAL1p-F1      | CCGGAATTCTGGAACCTTCAGTAATACGCTTAACTGC                              |
|            |                       | GAL1p-R1      | CGATTTGTGAGACCGGTCTCTATAGTTTTTCTCCTTGACGTAAAGTATAGAGGTATATT<br>AAC |
|            | PGI1t                 | PGI1t-F2      | AAACTATAGAGACCGGTCTCACAAATCGCTCTTAAATATATACCTAAAGAACATTAAAGC       |
|            |                       | PGI1t -R2     | CGCGGATCCGTAGTTTAGTGTTTTTCTTCCAGTGCG                               |
|            | GAL1p-PGI1t           | GAL1p-F1      | CCGGAATTCTGGAACCTTCAGTAATACGCTTAACTGC                              |
|            |                       | PGI1t -R2     | CGCGGATCCGTAGTTTAGTGTTTTTCTTCCAGTGCG                               |
| pGME-GAL   | (GAL1p) gme (PGI1t)   | GAL-gme-F     | GGTCTCCCTATAATGGGTACTACAAATGGTACTGATTACGG                          |
|            |                       | GAL-gme-R     | GGTCTCGTTTGTTTATTCTTTACCATCAGCAGCTCTTAATGAAC                       |
| pVTC2-GAL  | (GAL1p) vtc2 (PGI1t)  | GAL-vtc2-F    | GGTCTCCCTATAATGTTGAAGATTAAGAGTTCCAACAGTTGT                         |
|            |                       | GAL-vtc2-R    | GGTCTCGTTTGTTTATTGCAAACTAAACATTCAGCAGCAG                           |
| pVTC4-GAL  | (GAL1p) vtc4 (PGI1t)  | GAL-vtc4-F    | GGTCTCCCTATAATGGCAGATAATGATCAATTTTTGGCTG                           |
|            |                       | GAL-vtc4-R    | GGTCTCGTTTGTTTAAGCACCTGTTAATCTCAATGCTTCT                           |
| pGalDH-GAL | (GAL1p) galdh (PGI1t) | GAL-galdh-F   | GGTCTCCCTATAATGACAAAGATTGAATTAAGGGCTTTGGG                          |
|            |                       | GAL-galdh-R   | GGTCTCGTTTGTTTAGTTCTGGTGAATACCAGATGGCC                             |
| pGLDH-GAL  | (GAL1p) gldh (PGI1t)  | GAL-gldh-F    | GGTCTCCCTATAATGTTGAGATCTTTGTTGTTGAGGAGG                            |
|            |                       | GAL-gldh-R    | GGTCTCGTTTGTTTAAGCAGTAGTAGAGACTGGAACAAT                            |
| pGME-425   | PGK1p-gme-HXT7t       | 2-gme-F       | AAGGAAAAAAGCGGCCGCTATTTTAGATTCCCTGACTTCAACTCAAGAC                  |
|            |                       | 2-gme-R       | CATAACTGACTCATTAGACACTTTTTGAAGC                                    |
| pVTC2-425  | GPM1p-vtc2-HXT7t      | 2-vtc2-F      | AAGGAAAAAAGCGGCCGCTAGTCGTGCAATGTATGACTTTAAGATTTG                   |
|            |                       | 2-vtc2-R      | CAAAGCCTTCGAGCGTCCCAAAA                                            |
| pVTC4-425  | TDH3p-vtc4-GPM1t      | 2-vtc4-F      | AAGGAAAAAAGCGGCCGCGAGTTTATCATTATCAATACTGCCATTTCAAAG                |
|            |                       | 2-vtc4-R      | CTATTCGAACTGCCCATTCAGCTTTTC                                        |

**Table S1 (continue)**

| Plasmid    | Fragments             | Primers   | Sequence (5'-3')                                                    |
|------------|-----------------------|-----------|---------------------------------------------------------------------|
| pGalDH-425 | TPI1p-galdh-<br>PGK1t | 2-galdh-F | AAGGAAAAAAGCGGCCGCTATATCTAGGAACCCATCAGGTTGGT                        |
|            |                       | 2-galdh-R | CAACGAACGCAGAATTTTCGAGTTATTAAACTTAA                                 |
| pGLDH-425  | TEF2p-gldh-<br>ENO2t  | 2-gldh-F  | AAGGAAAAAAGCGGCCGCGGGGCCGTATACTTACATATAGTAGATGTCAAG<br>CGTAGGCGCTTC |
|            |                       | 2-gldh-R  | CAGGTATCATCTCCATCTCCCATATGC                                         |

**Table S2. Primers used for qPCR.**

| Gene  | Primers      | Sequence (5'-3')           |
|-------|--------------|----------------------------|
| PMI40 | pmi40-qPCR-F | CGCTGTGACTGACTTTGAAG       |
|       | pmi40-qPCR-R | TGTTTTGCTCATCTTCTGGGG      |
| SEC50 | sce53-qPCR-F | GGGGAAAACGTCGAAAGAGAT      |
|       | sce53-qPCR-R | TGGTATGATCAACGTTTCCCC      |
| PSA1  | psa1-qPCR-F  | GGAGGAAATCTTAGCGGTTGG      |
|       | psa1-qPCR-R  | GGTTTCTGGATGGATGTTGGT      |
| ARA1  | ara1-qPCR-F  | AGCCTCAACCGAAAACATAGTC     |
|       | ara1-qPCR-R  | GGCCCAAGCAGTATCAATGT       |
| ALO1  | alo-qPCR-F   | GGATAGAGTAACCTTTCGCACC     |
|       | alo-qPCR-R   | CGGGCCATTCTCCTAGTAAC       |
| GME   | gme-qPCR-F   | GAAAAATTGGGTTGGGCTCC       |
|       | gme-qPCR-R   | CAGCAGCTCTTAATGAACCC       |
| VTC2  | vtc2-qPCR-F  | GGTGCTTGTTGTTTGAATGGTG     |
|       | vtc2-qPCR-R  | CTATCTTCCCATTCAACCCAAAAC   |
| VTC4  | vtc4-qPCR-F  | TTGGCTGCTGCTATTGATGC       |
|       | vtc4-qPCR-R  | AGCTGCTGTAGTTTCTTCACC      |
| GalDH | galdh-qPCR-F | GCTACAGTCAGGGAGGCATT       |
|       | galdh-qPCR-R | GCTGAAAAGTCGAAACCCTCC      |
| GLDH  | gldh-qPCR-F  | GAGGAGGTCTGTCCGGTCATT      |
|       | gldh-qPCR-R  | CATACTTCCTGAACTGTGCCTC     |
| TDH3  | tdh3-qPCR-F  | TCTACCACCTCTCCAGTCCTTGTGGG |
|       | tdh3-qPCR-R  | ACCGCCCCAATGTTTCGTCATGG    |

**Table S3. The genes synthesized in this study**

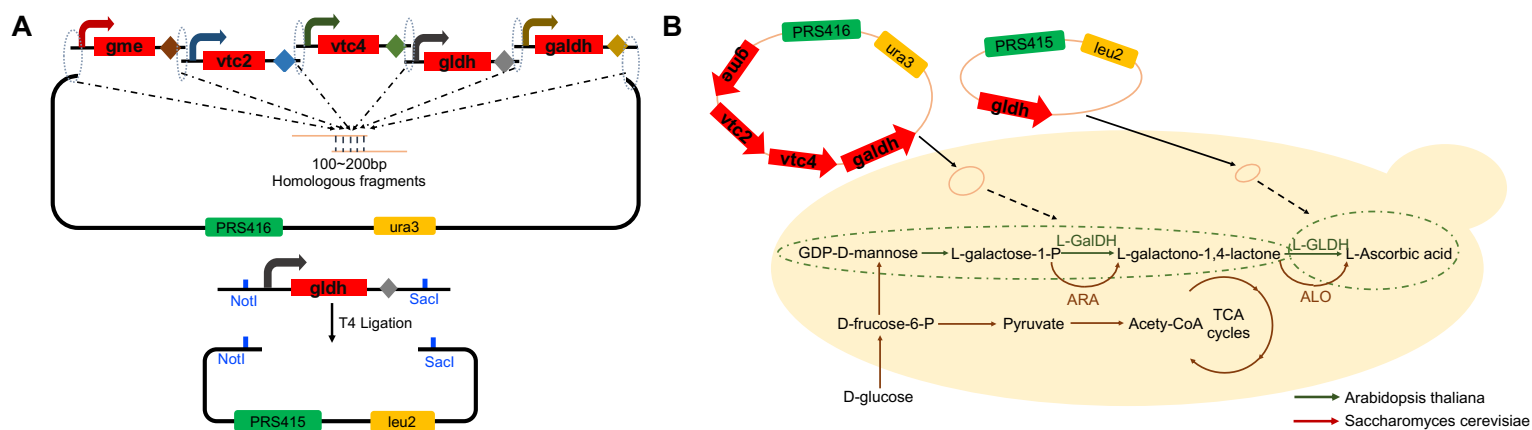
| Genes | Source                      | Sequence (5'-3')                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| gme   | <i>Arabidopsis thaliana</i> | ATGGGTACTACAAATGGTACTGATTACGGTGCTTACACATACAAGGAATTGGAAAGAGAACAATACTGGCC<br>ATCTGAAAATTTGAAAATTTCAATCACTGGTGGTGGTGGTTTATTGCTTCTCATATCGCAAGAAGATTGAA<br>GCATGAAGGTCATTACGTTATCGCATCAGATTGGAAGAAAAATGAACATATGACTGAAGATATGTTCTGTGA<br>TGAATTTCAATTTGGTTGATTTGAGAGTTATGGAAAAGCTGTTTGAAGGTTACAGAAGGTGTTGATCATGTTTT<br>TAATTTGGCTGCTGATATGGGTGGTATGGGTTTTATTCAATCTAATCATTCAAGTTATTATGTACAACAACACA<br>ATGATTTCTTTTAATATGATCGAAGCTGCAAGAATTAATGGTATTAAGGATTTTTCTATGCTTCTTCAGCATG<br>TATCTATCCAGAGTTTAAACAATTGGAACTACAAATGTTTCTTTAAAGAATCAGATGCTTGGCCAGCAGA<br>ACCACAAGATGCTTATGGTTTGGAAAAATTGGCAACTGAAGAATTGTGTAAGCATTACAATAAGGATTTTCG<br>GTATCGAATGTAGAATCGGTAGATTCCATAATATCTATGGTCCATTTGGTACATGGAAAGGTGGTAGAGAAA<br>AAGCTCCAGCTGCATTTTGTAGAAAAGCACAACTTCTACAGATAGATTTGAAATGTGGGGTGACGGTTTG<br>CAAAGTAGATCCTTTACTTTTATTGATGAATGTGTTGAAGGTGTTTTGAGATTAAGTCTGATTTTCAGAG<br>AACCAGTTAACATCGGTTCTGATGAAATGGTTTCAATGAACGAAATGGCTGAAATGGTTTGTCTTTTGAA<br>GAAAAGAAATTGCCAATCCATCATATTCCAGGTCCAGAAGGTGTTAGAGGTAGAAAATTCAGATAACAATTTG<br>ATTAAAGAAAAATTGGGTTGGGCTCCAAATATGAGATTGAAAGAAGGTTTAAGAATCACTTACTTCTGGATC<br>AAGGAACAAATTGAAAAGGAAAAGGCTAAGGGTTCTGATGTTTCATTATACGGTTCTTCAAAAGTTGTTGG<br>TACACAAGCACCAAGTTCAATTGGGTTCAATTAAGAGCTGCTGATGGTAAAGAATAA                                                                                                                                                                                                             |
| vtc2  | <i>Arabidopsis thaliana</i> | ATGTTGAAGATTAAAAGAGTTCCAACAGTTGTTTCTAACTACCAAAGGATGATGGTGCTGAAGATCCAGT<br>TGTTGTGGTAGAAATTGTTTAGGTGCTTGTGTTTGAATGGTGAAGATTACCATTGTACGCTTGTAAGA<br>ATTTGGTTAAGTCTGGTGAAAATTGGTTATTTACATGAAGCAATTGAACCACCAGTTGCATTTTTGGAAT<br>CTTTAGTTTTGGGTGAATGGGAAGATAGATTCCAAAGAGGTTTGTGTTAGATACGATGTTACAGCATGTGAAA<br>CTAAAGTTATTCCTGGTAAATACGGTTTCGTTGCTCAATTGAACGAAGGTAGACATTTGAAGAAAAGACCA<br>ACAGAGTTTAGAGTTGATAAGGTTTTACAATCTTTTGATGGTTCAAAGTTAATTTTACTAAGGTTGGTCAA<br>GAAGAATTGTTGTTCCAATTTGAAGCTGGTGAAGATGCACAAGTTCAATTTTCCCATGTATGCCAATTGAT<br>CCAGAAAATTCTCCATCAGTTGTTGCAATTAATGTTTCTCCAATCGAATACGGTCATGTTTTGTTGATCCCA<br>AGAGTTTTGGATTGTTTGGCACAAGAATCGATCATAAATCTTTGTTGTTGGCTGTTTCATATGGCTGCTGAA<br>GCTGCAAACCCATACTTCAGATTAGGTTACAACCTCATTGGGTGCTTTCGCAACAATTAATCATTTGCATTTT<br>CAAGCATATTACTTAGCAATGCCATTTCCATTGGAAAAGGCTCCAACTAAGAAAATTACTACAACCTGTTTCT<br>GGTGTTAAAAATTTCTGAATTATTGTCATACCCAGTTAGATCATTATTGTTTGAAGGTGGTTCTTCAATGCAAG<br>AATTATCTGATACTGTTTCAGATTGTTGTGTTTGTGTTTACAAAACAACAACATCCCTTTTAATATTTTGATTTCT<br>GATTGTGGTAGACAAATTTCTTGATGCCACAATGTTATGCTGAAAAACAAGCATTAGGTGAAGTTTCACCA<br>GAAGTTTTGGAAACACAAGTTAATCCAGCAGTTTGGGAAATTTCTGGTCATATGGTTTTGAAGAGAAAGGA<br>AGATTACGAAGGTGCTTCAGAAGATAATGCATGGAGATTATTGGCTGAAGCATCTTGTGAGAAGAAAGAT<br>TCAAAGAAGTTACTGCTTTAGCATTTGAAGCTATCGGTTGTTCTAACCAAGAAGAAGATTGGAAGGTACA<br>ATCGTTCATCAACAAAATTTCTTCTGGTAACGTTAACCAAAAATCAAATAGAATCATGGTGGTCCAATTACA<br>AATGGTACTGCTGCTGAATGTTTAGTTTTGCAATAA |

**Table S3 (continue)**

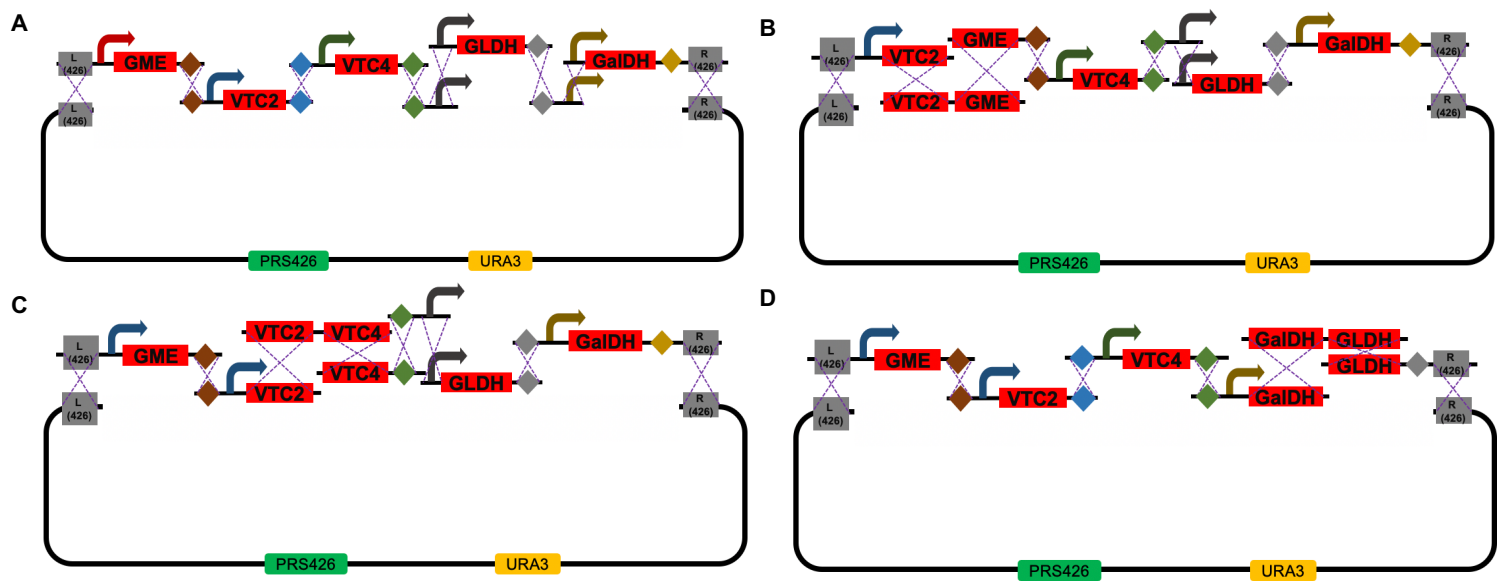
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|-------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| vtc4  | <i>Arabidopsis thaliana</i> | ATGGCAGATAATGATCAATTTTTGGCTGCTGCTATTGATGCAGCTAAGAAAGCTGGTCAAATCATCAGAAA<br>GGGTTTCTACGAAACTAAACATGTTGAACATAAAGGTCAAGTTGATTTGGTTACTGAAACAGATAAAGGTT<br>GTGAAGAATTAGTTTTTAATCATTTGAAGCAATTGTTTCCAAACCATAAGTTTATTGGTGAAGAACTACAG<br>CAGCTTTTGGTGTTACTGAATTGACAGATGAACCAACATGGATTGTTGATCCATTAGATGGTACTACAACT<br>TCGTTTCATGGTTTCCCATTCGTTTGTGTTTCTATCGGTTTAACTATCGGTAAAGTTCCAGTTGTTGGTGTTG<br>TTTACAACCCAATCATGGAAGAATTGTTTACAGGTGTTCAGGGTAAAGGTGCATTTTAAACGGTAAAAGA<br>ATTAAAGTTTCTGCTCAATCAGAATTGTTGACTGCATTGTTGGTTACTGAAGCTGGTACAAAAGAGATAAG<br>GCTACTTTGGATGATACTACAAACAGAATTAATTCTTTGTTGACAAAAGTTAGATCATTAAGAATGTCTGGTT<br>CATGTGCTTTGGATTTGTGTGGTGTGCTTGTGGTAGAGTTGATATTTTCTATGAATTGGGTTTTGGTGGTC<br>CATGGGATATTGCAGCTGGTATTGTTATTGTTAAAGAAGCTGGTGGTTTGATCTTCGATCCATCTGGTAAAG<br>ATTTGGATATTACTTCACAAAGAATTGCAGCTTCTAACGCATCATTGAAGGAATTATTCGCAGAAGCATTGA<br>GATTAACAGGTGCTTAA                                                                                                                                                                     |
| galdh | <i>Arabidopsis thaliana</i> | ATGACAAAGATTGAATTAAGGGCTTTGGGTAACACTGGATTGAAAGTCTCAGCTGTCGGATTTGGTGCATC<br>ACCATTTGGGTTCAAGTCTTTGGACCTGTGCGAGAGGACGACGCAGTCGCTACAGTCAGGGAGGCATTAG<br>GTTGGGTATTAACTTTTTCGATACTTCACCTTACTACGGAGGTACATTGTCAGAAAAGATGTTGGGTAAGG<br>GATTGAAGGCTTTGCAGGTCCCTAGGTGAGACTACATTGTCGCAACAAAGTGCGGAAGATACAAGGAGG<br>GTTTCGACTTTTCAGCAGAGAGGGTCAGGAAGTCTATTGACGAGTCATTAGAGAGGTTGCAATTAGACTAT<br>GTTGATATTTTGCAGTCCCATGACATTGAGTTCGGTTCATTGGATCAGATTGTTTCTGAAACAATTCCTGCT<br>TTGCAGAAAGTTGAAGCAGGAGGGAAAGACAAGGTTTATTGGTATTACAGGTTTGCCATTAGACATTTTCAC<br>TTACGTCTTGGACAGGGTCCCACCTGGTACAGTCGACGTCAATTTGTCATACTGCCACTACGGAGTCAAC<br>GACTCAACTTTGTTGGACTTGTTGCCTTACTTAAAGTCAAAGGGTGTGCGAGTCATTTAGCTTCTCCATT<br>GGCTATGGGATTGTTAACAGAGCAGGGTCCACCAGAGTGGCACCCAGCATCACCTGAGTTGAAGTCAGC<br>TTCTAAGGCAGCTGTCGCTCACTGCAAGTCTAAGGGTAAGAAAATTACTAAGTTGGCATTGCAGTACTCTT<br>TGGCAAATAAAGAGATTTCTTCAGTCTTGGTCGGTATGTCTTCAGTCTCTCAGGTGCAAGAGAACGTCGC<br>AGCTGTCACAGAGTTGGAGTCTTTGGGTATGGACCAAGAGACTTTGTCTGAGGTGAGGCTATTTTGA<br>GCCAGTCAAGAACTTGACTTGGCCATCTGGTATTCACCAGAACTAA |

**Table S3 (continue)**

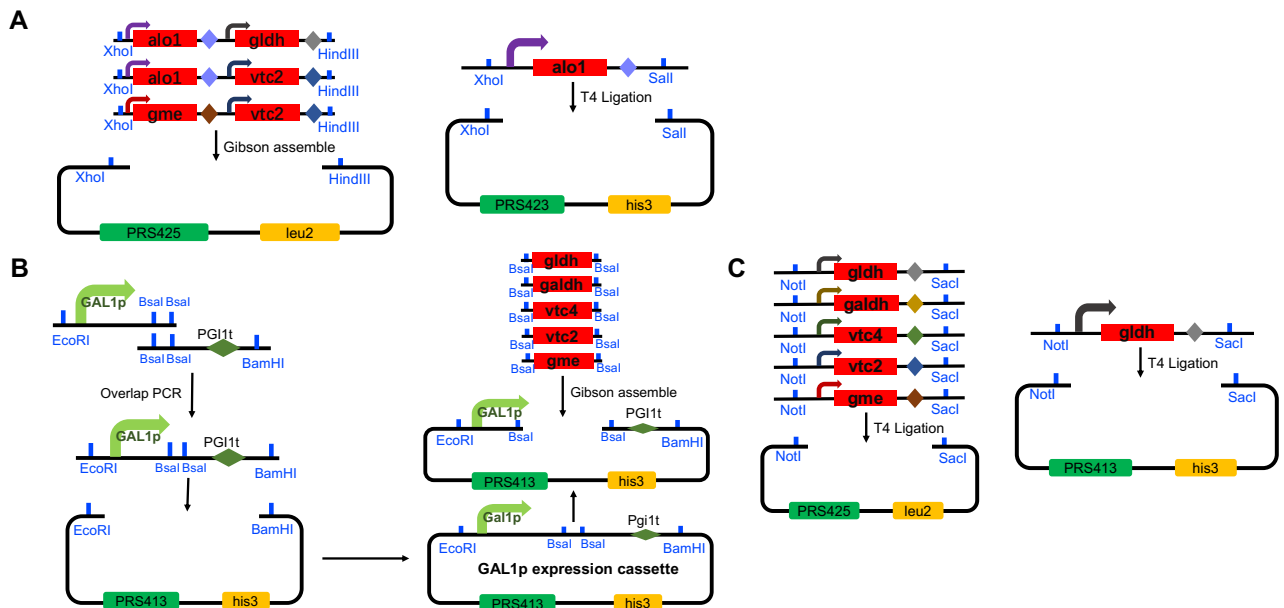
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|------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| gldh | <i>Arabidopsis thaliana</i> | <p>ATGTTGAGATCTTTGTTGTTGAGGAGGTCTGTCTGGTCATTTCATTGGGAACTTTATCACCTTCTTCATCTACT<br/> ATTAGGTCTTCTTTCTCTCCTCACAGGACATTGTGCACTACAGGACAGACTTTAACTCCACCTCCACCTCC<br/> ACCACCAAGACCACCACCACCTCCTCCAGCAACAGCTTCTGAGGCACAGTTCAGGAAGTATGCTGGTTA<br/> CGCAGCATTGGCTATTTTCTCAGGAGTCGCAACATACTTTTCTTTCCCTTTTCCAGAAAACGCAAAACACA<br/> AGAAAGCACAGATTTTCAGGTACGCACCATTCGCTGAGGATTTGCACACTGTCTCAAACCTGGTCTGGAAC<br/> ACACGAGGTCCAGACTAGGAACCTCAACCAGCCTGAGAACTTGGCAGACTTGGAGGCATTGGTCAAAGA<br/> GTCACACGAGAAGAAGTTAAGAATAAGACCAGTTGGTTTCAGGTTTGTACCAAACGGTATTGGATTGTCA<br/> AGGTCTGGTATGGTTAACTTAGCTTTAATGGACAAGGTCTTGGAGGTTCGACAAAGAGAAGAAGAGGGTCA<br/> CTGTCCAGGCTGGTATTAGGGTTTCAGCAGTTGGTCGACGCAATTAAGGACTACGGATTGACTTTGCAAAA<br/> CTTCGCATCTATTAGGGAGCAACAAATTGGTGGTATAATACAGGTCTGGTCTCACGGTACAGGAGCTAGG<br/> TTGCCCTCCTATTGACGAACAGGTTATTTCAATGAAGTTAGTCACACCAGCTAAAGGAACTATAGAGTTATCA<br/> AGGGAGAAGGACCCAGAGTTGTTCCACTTGGCAAGGTGCGGATTGGGTGGATTGGGAGTTGTCGCAGA<br/> GGTCACTTTGCAGTGCGTCGCAAGGCATGAGTTAGTTGAGCACACATATGTCTCAAACCTTGAAGAGATA<br/> AAGAAGAACCATAAGAAGTTGTTATCAGCAAATAAACACGTCAAATATTTGTACATACCTTATACAGACACA<br/> GTCGTCGTCGTCACATGCAACCCTGTCTCAAAGTGGTCTGGACCTCCAAAGGACAAGCCAAAGTACACA<br/> ACAGACGAGGCTGTCCAGCACGTTAGGGACTTGTACAGGGAGTCTATAGTCAAATACAGAGTCCAGGAC<br/> TCTGGAAAGAAGTCTCCAGACTCTTCTGAGCCTGACATTCAGGAGTTATCTTTTACTGAATTGAGAGATAA<br/> GTTGTTGGCATTGGATCCTTTGAATGACGTTACGTTGCAAAAGTCAACCAGGCAGAGGCTGAGTTCTGG<br/> AAGAAGTCAGAGGGTTACAGGGTCGGATGGTCAGACGAGATTTTGGGTTTCGATTGCGGAGGACAGCAG<br/> TGGGTTTCTGAGTCTTGCTTCCCAGCTGGAACCTTGGCTAATCCATCTATGAAGGACTTGGAGTACATTGA<br/> AGAGTTGAAGAAATTGATAGAGAAAGAAGCAATTCCTGCTCCAGCTCCTATAGAGCAGAGATGGACTGCT<br/> AGGTCTAAATCTCCAATTTACCAGCATTCTCAACTTCTGAGGACGACATTTTCTCTTGGGTTGGTATTATA<br/> ATGTATTTGCCAACAGCTGATCCAAGACAGAGGAAGGATATTACTGACGAGTTTTTTTCACTACAGGCACTT<br/> GACTCAGAAGCAGTTGTGGGACCAGTTCTCTGCATACGAGCACTGGGCTAAGATAGAGATACCTAAGGAT<br/> AAGGAGGAATTGGAGGCTTTGCAGGCTAGGATAAGGAAGAGGTTCCAGTCGACGCATACAACAAGGCT<br/> AGAAGGGAGTTGGATCCAAACAGGATTTTGTCAAACAATATGGTCGAAAAATTGTTCCAGTCTCTACTAC<br/> TGCTTAA</p> |
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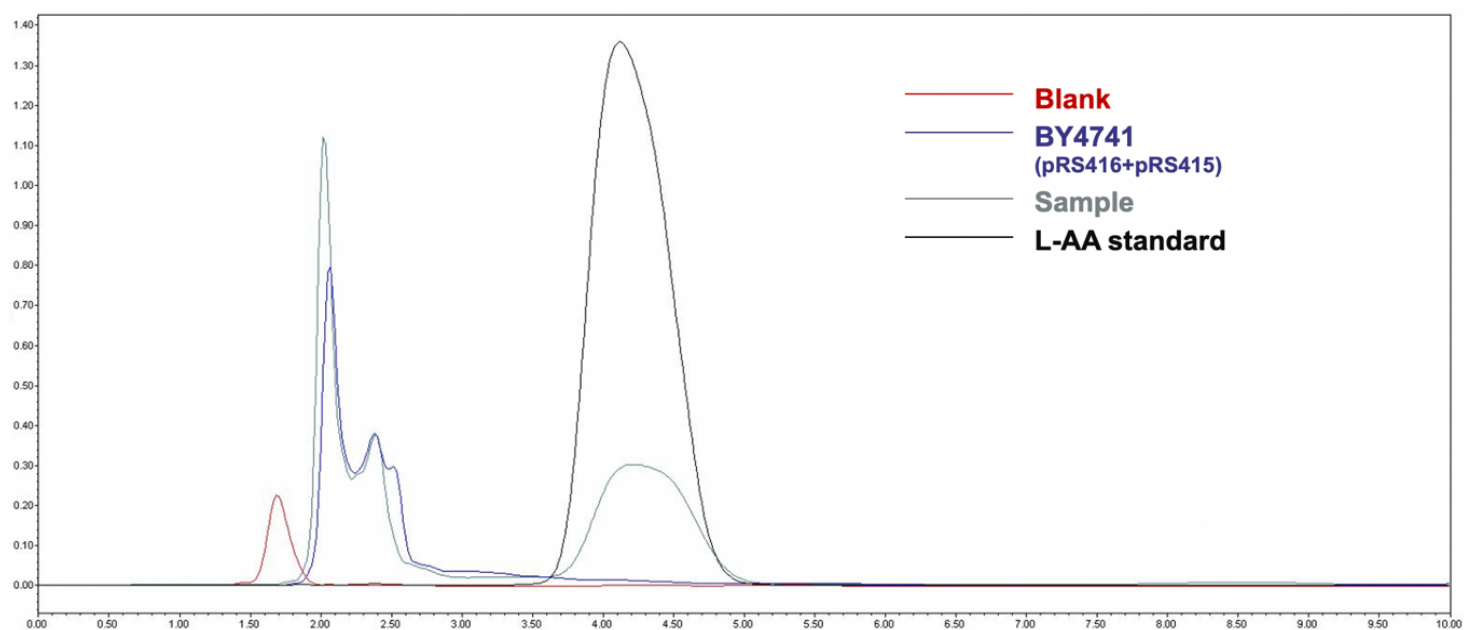
**Fig. S1. The construction of YLAA.** (A) The vector-construction used in YLAA. (B) The stain-construction used in YLAA.



**Fig. S2. The vector construction of strains with expressing exogenous modules and fusion-protein.** (A) The vector construction of the exogenous-module-overexpression strain. (B) The vector construction of the strain with GME and GGP fusion expression, (C) GGP and GPP fusion expression and (D) L-GalDH and GLDH fusion expression.



**Fig. S3. The vector construction of the strains with overexpressing the rate-limiting genes.** (A) The vector constructions of the strains with overexpressing different combinations of the possible rate-limiting genes. (B) The Gal1p-overexpression vector constructions. (C) The multicopy-overexpression vector constructions.



**Fig.S4. Comparison figure of HPLC.** Blank (Red line), BY4741(pRS416+pRS415) (Blue line), Sample (Gray line), L-AA standard (Black line).