# Supporting information for:

**A high-efficiency artificial synthetic pathway for 5-aminovalerate production from biobased L-lysine in *Escherichia coli***

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**Supplementary Table S1**

**List of primers for saturation mutation of KivD used in this study.**

|  |  |
| --- | --- |
| Primers names | Nucleotide sequence (5’-3’) |
| F381A-F | GCTTTCGGTGCAAGCAGCATCTTC |
| F381C-F | TGCTTCGGTGCAAGCAGCATCTTC |
| F381D-F | GACTTCGGTGCAAGCAGCATCTTC |
| F381E-F | GAGTTCGGTGCAAGCAGCATCTTC |
| F381G-F | GGATTCGGTGCAAGCAGCATCTTC |
| F381H-F | CATTTCGGTGCAAGCAGCATCTTC |
| F381I-F | ATCTTCGGTGCAAGCAGCATCTTC |
| F381K-F | AAGTTCGGTGCAAGCAGCATCTTC |
| F381L-F | CTGTTCGGTGCAAGCAGCATCTTC |
| F381M-F | ATGTTCGGTGCAAGCAGCATCTTC |
| F381N-F | AACTTCGGTGCAAGCAGCATCTTC |
| F381P-F | CCTTTCGGTGCAAGCAGCATCTTC |
| F381Q-F | CAGTTCGGTGCAAGCAGCATCTTC |
| F381R-F | CGTTTCGGTGCAAGCAGCATCTTC |
| F381S-F | AGTTTCGGTGCAAGCAGCATCTTC |
| F381T-F | ACGTTCGGTGCAAGCAGCATCTTC |
| F381V-F | GTCTTCGGTGCAAGCAGCATCTTC |
| F381W-F | TGGTTCGGTGCAAGCAGCATCTTC |
| F381Y-F | TACTTCGGTGCAAGCAGCATCTTC |
| F381-R | GCTGGTGCCCTGCTCTGCCACGATG |
| V461A-F | GCTGAACGTGAGATTCACGGCCCGAAC |
| V461C-F | TGCGAACGTGAGATTCACGGCCCGAAC |
| V461D-F | GACGAACGTGAGATTCACGGCCCGAAC |
| V461E-F | GAGGAACGTGAGATTCACGGCCCGAAC |
| V461F-F | TTCGAACGTGAGATTCACGGCCCGAAC |
| V461G-F | GGCGAACGTGAGATTCACGGCCCGAAC |
| V461H-F | CATGAACGTGAGATTCACGGCCCGAAC |
| V461I-F | ATCGAACGTGAGATTCACGGCCCGAAC |
| V461K-F | AAGGAACGTGAGATTCACGGCCCGAAC |
| V461L-F | CTGGAACGTGAGATTCACGGCCCGAAC |
| V461M-F | ATGGAACGTGAGATTCACGGCCCGAAC |
| V461N-F | AACGAACGTGAGATTCACGGCCCGAAC |
| V461P-F | CCTGAACGTGAGATTCACGGCCCGAAC |
| V461Q-F | CAGGAACGTGAGATTCACGGCCCGAAC |
| V461R-F | CGTGAACGTGAGATTCACGGCCCGAAC |
| V461S-F | AGTGAACGTGAGATTCACGGCCCGAAC |
| V461T-F | ACGGAACGTGAGATTCACGGCCCGAAC |
| V461W-F | TGGGAACGTGAGATTCACGGCCCGAAC |
| V461Y-F | TACGAACGTGAGATTCACGGCCCGAAC |
| V461-R | GGTCTAGCCGTCGTTGTTGATG |

**Supplementary Table S2**

**Plasmids for saturation mutation of KivD used in this study.**

|  |  |  |
| --- | --- | --- |
|  | Relevant genotype or description | Sources |
| pETaRPK\*( F381A/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381A/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381C/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381C/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381D/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381C/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381E/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381E/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381G/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381G/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381H/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381H/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381I/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381I/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381K/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381K/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381L/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381L/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381M/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381M/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381N/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381N/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381P/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381P/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381Q/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381Q/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381R/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381R/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381S/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381S/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381T/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381T/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381V/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381V/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381W/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381W/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381Y/V461) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381Y/V461) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461A) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461A) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461C) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461C) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461D) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461D) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461E) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461E) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461F) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461F) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461G) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461G) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461H) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461H) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461I) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461I) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461K) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461K) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461L) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461L) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461M) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461M) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461N) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461N) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461P) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461P) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461Q) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461Q) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461R) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461R) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461S) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461S) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461T) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461T) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461W) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461W) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| pETaRPK\*( F381/V461Y) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381/V461Y) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |
| PETaRPK#( F381A/V461A) | pET21a carries a L-lysine α-oxidase gene (*raiP*) from *S. japonicus*, a α-ketoacid decarboxylase mutant (F381A/V461A) gene from *L. lactis* and a aldehyde dehydrogenase gene (*padA*) from *E. coli*, AmpR | This study |