NZYMutagenesis kit

Catalogue numbers:

MB01201, 10 mutations
MB01202, 10 mutations plus competent cells
MB01203, 24 mutations
MB01204, 24 mutations plus competent cells

Description

NZYMutagenesis kit is designed to make point mutations and delete or insert single or multiple nucleotides in a DNA sequence. The system requires the provision of two synthetic oligonucleotide primers containing the desired mutation. Incorporation of the oligonucleotide primers with NZYProof DNA polymerase generates a mutated plasmid containing staggered nicks, which resists *Dpn* I digestion (as the synthetic DNA is not methylated). The resulting mutated plasmid is recovered through transformation of NZYStar competent cells. For a schematic presentation of the mutagenesis protocol, see Figure 1. DNA isolated from dam$^-$ *Escherichia coli* strains, including JM101 and SCS110, is not a suitable template for the mutagenesis reaction.

Storage temperature

Store competent cells at -80 °C on receipt. Other kit components may be stored at -20 °C. NZYMutagenesis kit components are stable for at least six months when stored under the recommended conditions.

Kit components

Component	Quantity	
	10 mut	**24 mut**
10× Reaction buffer	200 µL	500 µL
dNTP mix	10 µL	25 µL
NZYProof DNA polymerase (2.5 U/µL)	25 U	62.5 U
Dpn I (10 U/µL)	500 U	1250 U
Control plasmid	5 µL	5 µL
Control primer mix	10 µL	10 µL
NZYStar competent cells[a,b]	5×0.20 mL	12×0.20 mL
Competent Cells Control Plasmid (0.1 ng/µL)[a]	10 µL	10 µL

[a]only provided in MB01202 and MB01204 kits
[b]Genotype : *end*A1 *hsd*R17(r_k-, m_k+) *sup*E44 thi -1 *rec*A1 *gyr*A96 *rel*A1 lac[F´ *pro*A^+B^+ $lacI^qZ\Delta M15$:Tn10(Tc^R)].

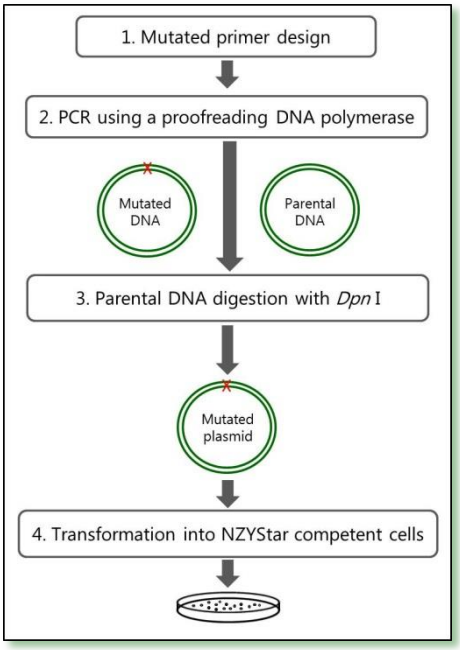

Figure 1. Overview of the NZYMutagenesis kit protocol.

Guidelines for using NZYMutagenesis kit

Primers specifications

Primers must contain the desired mutation and anneal to the same sequence on opposite strands of the plasmid. Primers should be between 30 and 45 bases in length, with a melting temperature (Tm) of at least 78 °C. The desired mutation should be in the middle of the primer with approximately >15 bases of correct sequence on both sides. A minimum GC content of 40% is advisable and primers should terminate in one or more C or G bases. Primer purification (FPLC, PAGE or HPLC) is strongly recommended. The mutagenesis protocol uses 125 ng of each oligonucleotide primer.

Plasmid specifications

The target plasmid DNA may be isolated from any source and purified using DNA purification kits. No special vectors or restriction sites are required. We recommend starting with 25-60 ng of plasmid template. However, some plasmids may require higher amounts depending on the sequence and quality of the nucleic acid.

Control reaction

Control plasmid and control primer mix are included in the NZYMutagenesis kit, allowing blue/white screening of mutagenesis reaction efficiency. The control plasmid, derived from pNZY28 (2.88 Kb), contains a premature stop-codon in the gene coding for *lacZα* and thereby forms white colonies on LB-ampicillin agar plates containing X-Gal and IPTG. The control primer mix is designed to revert the premature stop-codon into a functional codon, thus allowing *lacZα* expression. A positive mutagenesis control reaction forms blue colonies on LB-ampicillin agar plates containing X-Gal and IPTG.

Mutagenesis protocol

1. Synthesize and purify two complementary oligonucleotides containing the desired mutation flanked by an unmodified nucleotide sequence.
2. On ice, in a sterile, nuclease-free microcentrifuge tube, prepare a reaction mixture, combining the following components (for a 50 µL reaction):

Component	Volume
Reaction buffer, 10×	5 µL
dNTP mix	1 µL
dsDNA template (25-60 ng)*	x µL
Oligonucleotide primer #A (125 ng)*	y µL
Oligonucleotide primer #B (125 ng)*	z µL
Nuclease-free water	up to 49 µL

Then add,

NZYProof DNA polymerase (2.5 U/ µL)	1 µL

**Control reaction: To test the efficiency of the system use 1 µL of control plasmid and 2 µL of control primer mix provided.*

3. Gently mix and centrifuge the reactions in a microcentrifuge for 5 seconds. If using a thermal cycler without a heated lid, overlay the reaction mix with 1-2 drops of mineral oil to prevent evaporation during the thermal cycling.
4. Proceed with the amplification following the cycling parameters outlined in Table 1.

Table 1. Cycling parameters for the NZYMutagenesis method.

Segment	Cycles	Temperature	Time
1	1	95 ºC	2 min
2	18	95 ºC	1 min
		60 ºC	1 min
		68 ºC	1.5 min/kb plasmid length
3	1	68 ºC	15 min

Note: *control plasmid is 2.88 kb in size and, therefore, use a 4.5 minutes elongation period for the control reactions.*

5. Place reaction tubes on ice for 2 minutes. Check the efficiency of the amplification by analysing 10 µL of the reaction on a 0.7-1% agarose gel. Proceed with the *Dpn* I digestion even if a band is not visualized at this stage.
6. Add 5 µL of *Dpn* I directly into the reaction (below the mineral oil if used). Gently mix, spin down the reaction and incubate at 37 °C for 1 hour to digest the non-mutated template DNA.
7. Transfer 5-10 µL of the *Dpn* I treated DNA to 100 µL of the ultracompetent cells. NZYStar cells are resistant to tetracycline. If the mutagenized plasmid contains only a tet^R resistance marker, an alternative tetracycline-sensitive strain of competent cells must be used.
8. To determine the transformation efficiency, add 1 µL (10 ng) competent cells control plasmid DNA to one tube containing 100 µL competent cells. Gently tap tube to mix. Do not mix cells by pipetting.
9. Incubate transformation reaction for 30 min on ice.
10. Heat shock cells at 42 °C for exactly 40 seconds.
11. Place on ice for 2 minutes.
12. Add 900 µL of pre-warmed SOC medium (not provided).
13. Shake the tubes at 200 rpm at 37 °C for 1 hour.
14. Centrifuge at 5000 rpm for 1 min. Remove 900 µL of the supernatant.
15. Re-suspend cells by gently pipetting. Plate 100 µL of cells onto LB agar plates containing the appropriate antibiotic. For control reaction, plate 100 µL of cells onto LB agar plates containing 100 µg/mL ampicillin, 15 µg/mL tetracycline, 100 µg/mL X-gal and 0.5 mM IPTG.
16. For competent cells control plasmid transformation directly plate 100 µL without spinning, onto LB agar plates containing 100 µg/µL ampicillin.
17. Incubate inverted plates overnight at 37 °C.
18. Select 3-5 colonies and analyse by plasmid isolation, PCR, or sequencing.

Additional guidelines

- PCR efficacy may be improved by increasing the amount of template DNA used (to a maximum of 100-150 ng of plasmid DNA *per* reaction). In this circumstance increase the incubation time with *Dpn* I to 2 hours.
- The levels of dNTPs may affect the efficiency of the PCR reaction. You may proceed to an optimization by varying the levels of dNTPs in the reaction from 0.5 to 2 µL. Avoid multiple freeze-thaw cycles for the dNTP mix. Thaw the dNTP mix once and prepare single aliquots for storage at -20 °C.
- The amount of reaction used for transformation may be increased to a maximum of 10 µL to 100 µL of cells.
- False priming and the formation of secondary structures may affect the mutagenesis reaction. Increasing the annealing temperature up to 68 °C may help improving the efficacy of the PCR reaction.

Quality control assays

Functional assay

All components of the NZYMutagenesis kit are tested following the mutagenesis protocol described above. The mutagenesis system must generate mutants with an efficiency ≥ 80% of the colonies screened.

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Certificate of Analysis

Test	Result
Functional assay	Pass

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