

Step 2: Preparing amino acid, polyphosphates, and maltodextrin-based energy solutions for cell-free reactions

Version 2

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Abstract

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Protocol

Prepare individual amino acid stock solutions

Step 1.

Dissolve the given amount of each amino acid with 1 ml of 5M KOH in a 3 ml screw-cap tube according to the following list.

Aminoacid	Amount of powder needed
Alanine	445.45 mg
Arginine	644.6502 mg
Asparagine	660.6 mg
Aspartic acid	665.5 mg
Cysteine	370.7496 mg
Glutamic acid	735.65 mg
Glutamine	447.219 mg
Glycine	375.35 mg
Histidine	775.75 mg
Isoleucine	655.9 mg
Leucine	401.4108 mg
Lysine	447.3414 mg
Methionine	456.5826 mg
Phenylalanine	330.38 mg
Proline	575.65 mg
Serine	529.5 mg

Threonine	595.6 mg
Tryptophan	408.46 mg
Tyrosine	554.4414 mg
Valine	358.479 mg

Vortex to dissolve. Each solution can be stored at -20 °C.



REAGENTS

L-aminoacids [LAA21-1KT](#) by [Sigma Aldrich](#)

L-Proline [81709-25G](#) by [Sigma Aldrich](#)

L-Cysteine [30089](#) by [Sigma Aldrich](#)

✓ L-histidine 53319-25G by Contributed by users

✓ L-lysine L5501-5G by Contributed by users

Prepare amino acid mix solution (~17 nM each)

Step 2.

In a 50 mL Falcon tube add the following volumes of the individual amino acid stock solutions

Aminoacid Stock solution in 5M KOH	Volume needed
Alanine	136 ul
Arginine	222 ul
Asparagine	136 ul
Aspartic acid	136 ul
Cysteine	222 ul
Glutamic acid	136 ul
Glutamine	222 ul
Glycine	136 ul
Histidine	136 ul
Isoleucine	136 ul
Leucine	222 ul
Lysine	222 ul
Methionine	222 ul
Phenylalanine	340 ul
Proline	136 ul
Serine	136 ul
Threonine	136 ul
Tryptophan	340 ul
Tyrosine	222 ul
Valine	222 ul
TOTAL	3816 µL

Prepare amino acid mix solution (~17 nM each)

Step 3.

Add 35.084 µL of sterile water and 1.100 µL of Acetic acid (glacial) to the amino acid mix. Vortex well and aliquot in 2.0 ml Eppendorf tubes. Aliquots can be stored at -80°C

Prepare maltodextrin-based energy solution

Step 4.

Prepare the following stock solutions:

- **1M DTT:** Put 2.31 g DTT in a 15 ml Falcon tube and fill with water to 15 ml. Sterilize using a 0.22 µm filter. Aliquot in 1.5 ml Eppendorf tubes. Store at -20 °C for later use.
- **5.3 M HEPES pH 8:** Weight 19.1 g HEPES (MW 238.21). Dissolve with 30ml water. Adjust pH to 8.0 with KOH. Fill with water to 40 ml.
- **5 mg/ml tRNA solution:** Put 30 mg of tRNA in a 1.5 ml Eppendorf tube. Fill with water to 600 µl.
- **CoA stock solution:** Put 30 mg of CoA (MW 767.53) in a 1.5 ml Eppendorf tube and fill with water to 600 µl.
- **38.3 mM NAD solution:** Put 34.83 mg of NAD (MW 663.43) in a 1.5 ml Eppendorf tube, add 27 µl of Tris at 2 M (to bring the solution to pH 8.0). Finally, fill with water to 300 µl.
- **23 mM cAMP solution:** Put 42.80 mg of cAMP (MW 329.22) in a 1.5 ml Eppendorf tube, add 73 µl of Tris at 2 M (to bring the solution to pH 8.0). Finally, fill with water to 200 µl.
- **40 mM Folinic acid solution:** To 20 mg of solid folinic acid calcium salt (MW 511.5), add 1.15 ml of water.
- **Spermidine stock solution:** Briefly warm spermidine (two minutes at 37°C) in order to melt it. Then, put 23.55 µl of spermidine (MW 145.25) into a 1.5 Eppendorf tube and fill with water to 150 µl.
- **240 mg/ml maltodextrin solution:** Put 2.4 g of maltodextrin in a 15 ml Falcon tube. Dissolve, and fill with water to 10 ml.
- **Nucleotide Mix solution:** Put 145 mg of ATP dipotassium salt dihydrate (MW 619.4), 133 mg of GTP disodium salt dihydrate (MW 567.14), 79.4 mg of CTP disodium salt dihydrate (MW 563.16), 82.6 mg of UTP trisodium salt dihydrate (MW 586.12) in a 1.5 Eppendorf tube. Add 353 µl of KOH (15 w/v %) .Finally, fill with water to 1.5 ml.



REAGENTS

DTT D0632 by [Sigma Aldrich](#)

CoA C4282 by [Sigma Aldrich](#)

Folinic Acid F7878 by [Sigma Aldrich](#)

Spermidine 85558 by [Sigma Aldrich](#)

NAD (β-Nicotinamide adenine dinucleotide hydrate) N6522 by [Sigma Aldrich](#)

HEPES H6147 by [Sigma Aldrich](#)

ATP (Adenosine 5'-triphosphate dipotassium salt hydrate) A8937 by [Sigma Aldrich](#)

GTP (Guanosine 5'-triphosphate sodium salt hydrate) 10106399001 ROCHE by [Sigma Aldrich](#)

UTP (Uridine 5'-triphosphate trisodium salt dihydrate) 94370 by [Sigma Aldrich](#)

Maltodextrin (4.0-7.0 dextrose equivalent) 419672 by [Sigma Aldrich](#)

Prepare maltodextrin-based energy solution

Step 5.

In a 15 mL Falcon tube add the following volumes of the stock solutions prepared before:

Stock solution Volume needed

HEPES pH 8	1000 µl
Nucleotide mix	396 µl
tRNA solution	160 µl
NAD	76.6 µl
CO-A	160 µl
cAMP	46 µl
Folinic acid	80 µl
spermidine	34 µl
Maltodextrin	2000 µl
TOTAL	3952.6 µl

Prepare maltodextrin-based energy solution

Step 6.

Dissolve well the maltodextrin-based energy solution using vortex. Aliquot in 2 ml Eppendorf tubes and store at -80°C prior to use.

Prepare hexametaphosphate solution

Step 7.

Weight 0.15 g of sodium hexametaphosphate and put it into a 15 ml Falcon tube. Dissolve well and fill with water to 5 ml. Put the solution in a boiling water bath for 5 minutes. Kepp in the solution in the lab bench until it reaches room temperature. Aliquot in 1.5 ml Eppendorf tubes and keep at -80°C before use.



REAGENTS

sodium hexametaphosphate 305553 by [Sigma Aldrich](#)