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Product Information

Glycerol 3-Phosphate Dehydrogenase Activity Colorimetric Assay Kit

Catalog Number **MAK208**
Storage Temperature –20 °C

TECHNICAL BULLETIN

Product Description

Glycerol 3-phosphate dehydrogenase (GPDH; EC 1.1.1.8) catalyzes the reversible conversion of dihydroxyacetone phosphate and NADH to glycerol 3-phosphate and NAD^+. It forms a glycerol phosphate shuttle and facilitates the transfer of reduced equivalents across the mitochondria to the cytosol. GPDH is important for both carbohydrate and lipid metabolism.[1,2] Mutations in GPDH gene result in transient infantile hypertriglyceridemia.[3]

The Glycerol 3-Phosphate Dehydrogenase Activity Colorimetric Assay Kit provides a simple and sensitive procedure for measuring GPDH activity in a variety of tissues and cells. GPDH activity is determined by measuring a colorimetric product with absorbance at 450 nm (A_{450}) proportional to the enzymatic activity present. One unit of GPDH is the amount of enzyme required to generate 1.0 μmole of NADH per minute at pH 8 at 37 °C.

Components

The kit is sufficient for 100 assays in 96 well plates.

GPDH Assay Buffer Catalog Number MAK208A	27 mL
GPDH Substrate Catalog Number MAK208B	1 vl
GPDH Probe Catalog Number MAK208C	1 vl
NADH Standard Catalog Number MAK208D	1 vl
GPDH Positive Control Catalog Number MAK208E	1 vl

Reagents and Equipment Required but Not Provided

- 96 well flat-bottom plate – It is recommended to use clear plates for colorimetric assays.
- Spectrophotometric multiwell plate reader

Precautions and Disclaimer

This product is for R&D use only, not for drug, household, or other uses. Please consult the Safety Data Sheet for information regarding hazards and safe handling practices.

Preparation Instructions

Briefly centrifuge vials before opening. Use ultrapure water for the preparation of reagents. To maintain reagent integrity, avoid repeated freeze/thaw cycles.

GPDH Assay Buffer – Warm to room temperature before use.

GPDH Substrate – Reconstitute with 220 μL of GPDH Assay Buffer. Store at –20 °C. Keep on ice during use. Use within 2 months.

GPDH Probe – Reconstitute with 220 μL of water. Mix well by pipetting. Store at –20 °C. Use within 2 months.

NADH Standard – Reconstitute with 100 μL of GPDH Assay Buffer to generate a 5 mM NADH Standard Solution. Aliquot and store at –20 °C. Keep on ice during use. Use within 2 months.

GPDH Positive Control – Reconstitute with 100 μL of GPDH Assay Buffer. Mix well by pipetting. Aliquot and store at –20 °C.

Storage/Stability

The kit is shipped on wet ice and storage at –20 °C, protected from light, is recommended.

Procedure
All samples and standards should be run in duplicate.

NADH Standards
Dilute 20 µL of the 5 mM (5 nmole/µL) NADH Standard Solution with 80 µL of GPDH Assay Buffer and mix well to prepare a 1 mM (1 nmole/µL) NADH Standard Solution. Add 0, 2.5, 5, 7.5, 10 and 12.5 µL of the 1 mM (1 nmole/µL) NADH Standard Solution into a 96 well plate, generating 0 (blank), 2.5, 5.0, 7.5, 10, and 12.5 nmole/well standards. Add GPDH Assay Buffer to each well to bring the volume to 50 µL.

Sample Preparation
Tissue samples (10 mg) or cells (1×10^6) can be homogenized in 200 µL of ice cold GPDH Assay Buffer. Keep on ice for 10 minutes. Centrifuge the samples at 12,000 × *g* for 5 minutes to remove insoluble material. Transfer supernatant to a fresh tube.

Add 1–50 µL of the samples into duplicate wells. Bring samples to a final volume of 50 µL using GPDH Assay Buffer.
Note: For unknown samples, it is suggested to test several sample dilutions to ensure the readings are within the linear range of the standard curve.

For samples exhibiting significant background, especially background caused by NADH in the sample, include a Sample Blank for each sample by omitting the GPDH Substrate. The Sample Blank readings can then be subtracted from the sample readings.

For a positive control (optional), add 1–10 µL of the GPDH Positive Control solution to the desired wells. Adjust the final volume to 50 µL with the GPDH Assay Buffer.

Assay Reaction
1. Set up the Reaction Mixes according to the scheme in Table 1. 50 µL of Reaction Mix is required for each reaction (well).

Table 1.
Reaction Mixes

Reagent	Standards, Controls, and Samples	Sample Blank
GPDH Assay Buffer	46 µL	48 µL
GPDH Probe	2 µL	2 µL
GPDH Substrate	2 µL	–

2. Add 50 µL of the appropriate Reaction Mix to each of the wells. Mix well using a horizontal shaker or by pipetting.

3. Measure the absorbance (A_{450}) in a microplate reader in kinetic mode for 20–60 minutes at 37 °C. Protect the plate from light during the incubation. It is recommended to take absorbance readings every minute.
   Note: Incubation time depends on the activity of GPDH in the samples.

4. Continue taking measurements until the value of the most active sample is greater than the value of the highest standard (12.5 nmole/well). At this time the most active sample is near or exceeds the end of the linear range of the standard curve.

Note: The NADH Standards can be read at the end of the incubation time.

Results

Calculations

Plot the absorbance (A_{450}) for each well versus time.

Choose two time points (T1 and T2) in the linear range of the plot and determine the A_{450} at each time (ABS1 and ABS2).

Note: It is essential that ABS1 and ABS2 fall within the linear range of the standard curve.

Correct for the background by subtracting the measurement obtained for the blank NADH Standard from that of the standards, controls, and samples. Background values can be significant and must be subtracted from all readings. Use the values obtained from the appropriate NADH Standards to plot a standard curve.

Note: A new standard curve must be set up each time the assay is run.

Calculate the change in absorbance from T1 to T2 for the samples.

$$\Delta ABS = ABS2 - ABS1$$

Subtract the Sample Blank ΔABS value from the Sample ΔABS reading to obtain the corrected measurement. Using the corrected measurement, determine the amount of NADH (nmole/well) generated by the GPDH assay between T1 and T2 (S_a).

GPDH activity:

$$\text{GPDH Activity} = \frac{S_a}{(\text{Reaction Time}) \times S_v}$$

where:

S_a = Amount of NADH (nmole) generated in unknown sample well between T1 and T2 from standard curve

Reaction Time = T2 – T1 (minutes)

S_v = sample volume (mL) added to well

GPDH activity is reported as nmole/min/mL = milliunit/mL

One unit of GPDH is the amount of enzyme that generates 1.0 μmole of NADH per minute at pH 8 at 37 °C.

Sample Calculation:

Amount of NADH (S_a) = 5.84 nmole (from standard curve)

(T1) = 3 minutes

(T2) = 32 minutes

Sample volume (S_v) = 0.050 mL

GPDH activity in sample well:

$$\text{nmole/min/mL (milliunits/mL)} = \frac{5.84 \text{ nmole/well}}{(32 \text{ min} - 3 \text{ min}) \times 0.050 \text{ mL /well}} = 4.03$$

One unit of GPDH is the amount of enzyme required to generate 1.0 μmole of NADH per minute at pH 8.0 at 37 °C.

References

1. Crabtree, B., and Newsholme, E.A., The activities of phosphorylase, hexokinase, phospho-fructokinase, lactate dehydrogenase and the glycerol 3-phosphate dehydrogenases in muscles from vertebrates and invertebrates. Biochem. J., **126**, 49–58 (1972).
2. Larsson, C. et al., The importance of the glycerol 3-phosphate shuttle during aerobic growth of *Saccharomyces cerevisiae*. Yeast, **14**, 347–357 (1998).
3. Basel-Vanagaite, L. et al., Transient infantile hypertriglyceridemia, fatty liver, and hepatic fibrosis caused by mutated GPD1, encoding glycerol 3-phosphate dehydrogenase 1. Am. J. Hum. Genet., **90**, 49–60 (2012).

Troubleshooting Guide

Problem	Possible Cause	Suggested Solution
Assay not working	Cold assay buffer	Assay Buffer must be at room temperature
	Omission of step in procedure	Refer and follow Technical Bulletin precisely
	Plate reader at incorrect wavelength	Check filter settings of instrument
	Type of 96 well plate used	For colorimetric assays, use clear plates
Samples with erratic readings	Samples prepared in different buffer	Use the Assay Buffer provided or refer to Technical Bulletin for instructions
	Cell/Tissue culture samples were incompletely homogenized	Repeat the sample homogenization, increasing the length and extent of homogenization step.
	Samples used after multiple freeze-thaw cycles	Aliquot and freeze samples if needed to use multiple times
	Presence of interfering substance in the sample	If possible, dilute sample further
	Use of old or inappropriately stored samples	Use fresh samples and store correctly until use
Lower/higher readings in samples and standards	Improperly thawed components	Thaw all components completely and mix gently before use
	Use of expired kit or improperly stored reagents	Check the expiration date and store the components appropriately
	Allowing the reagents to sit for extended times on ice	Prepare fresh Reaction Mixes before each use
	Incorrect incubation times or temperatures	Refer to Technical Bulletin and verify correct incubation times and temperatures
	Incorrect volumes used	Use calibrated pipettes and aliquot correctly
Non-linear standard curve	Use of partially thawed components	Thaw and resuspend all components before preparing the Reaction Mixes
	Pipetting errors in preparation of standards	Avoid pipetting small volumes
	Pipetting errors in the Reaction Mix	Prepare Reaction Mixes whenever possible
	Air bubbles formed in well	Pipette gently against the wall of the plate well
	Standard stock is at incorrect concentration	Refer to the standard dilution instructions in the Technical Bulletin
	Calculation errors	Recheck calculations after referring to Technical Bulletin
	Substituting reagents from older kits/lots	Use fresh components from the same kit
Unanticipated results	Samples measured at incorrect wavelength	Check the equipment and filter settings
	Samples contain interfering substances	If possible, dilute sample further
	Sample readings above/below the linear range	Concentrate or dilute samples so readings are in the linear range

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