Product Manual

Methionine Assay Kit

Catalog Number

MET-5158 **100 assays**

FOR RESEARCH USE ONLY
Not for use in diagnostic procedures

Introduction

Methionine is an essential amino acid in animals and therefore must be obtained through dietary sources. High methionine levels can be detected in eggs, meat, and fish as well as sesame seeds, Brazil nuts, and some other plant seeds. Most fruits and vegetables contain low levels of methionine. In addition to its conventional role in protein structure and function, methionine acts as substrate in the synthesis pathway for other amino acids such as cysteine and taurine as well as the important antioxidant glutathione. Methionine is critical for the metabolism of humans and many other species. Methionine plays an important role in the process of angiogenesis which is the growth of new blood vessels. The consumption of methionine supplements may benefit in cases of copper poisoning. Consuming too much methionine, however, has been linked to cancer growth in a number of studies.

Cell Biolabs' Methionine Assay Kit is a simple fluorometric assay that measures the amount of total methionine present in biological samples in a 96-well microtiter plate format. Each kit provides sufficient reagents to perform up to 100 assays*, including blanks, methionine standards, and unknown samples. Sample methionine concentrations are determined by comparison with a known methionine standard. The kit has a detection sensitivity limit of 1.5 µM methionine.

Note: Each sample replicate requires 2 assays, one treated with s-adenosylmethionine synthetase (+AdoMetS) and one without (-AdoMetS). Methionine is calculated from the difference in RFU readings from the 2 wells.

Assay Principle

Cell Biolabs' Methionine Assay Kit measures total methionine within biological samples. Methionine and ATP are converted by s-adenosylmethionine synthetase to s-adenosylmethionine, inorganic phosphate, and pyrophosphate. Phosphoenolpyruvate and pyrophosphate are converted by phosphate pyruvate dikinase to pyruvate. Pyruvate is converted by pyruvate oxidase in the presence of phosphate and oxygen into acetyl phosphate, carbon dioxide, and hydrogen peroxide. The resulting hydrogen peroxide is then detected with a highly specific fluorometric probe. Horseradish peroxidase catalyzes the reaction between the probe and hydrogen peroxide, which bind in a 1:1 ratio. Samples are compared to a known concentration of methionine standard within the 96-well microtiter plate format. Samples and standards are incubated for 30 minutes and then read with a standard 96-well fluorometric plate reader (Figure 1).

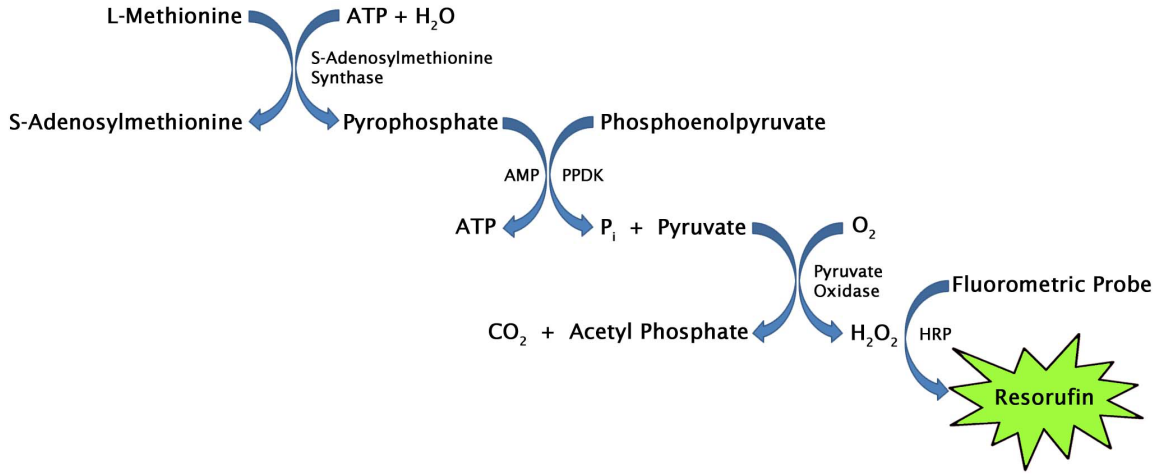

Figure 1. Methionine Assay Principle

Related Products

1. MET-5029: Pyruvate Assay Kit (Fluorometric)
2. MET-5001: Lactose Assay Kit (Fluorometric)
3. MET-5013: Lactate Assay Kit (Fluorometric)
4. MET-5023: Glycogen Assay Kit (Fluorometric)
5. STA-399: Free Glycerol Assay Kit (Fluorometric)

Kit Components

Box 1 (shipped on dry ice)

1. Methionine Standard (Part No. 51581C): One 50 µL tube at 10 mM.
2. ATP (Part No. 51583C): One 50 µL tube of adenosine triphosphate (ATP) at 200 mM.
3. AMP (Part No. 51584C): One 50 µL tube of adenosine monophosphate (AMP) at 20 mM.
4. PEP (Part No. 51585C): One 50 µL tube of phosphoenolpyruvate (PEP) at 100 mM.
5. Fluorometric Probe (Part No. 50231C): One 50 µL tube in DMSO.
6. HRP (Part No. 234402-T): One 10 µL tube of a 100 U/mL solution in glycerol.
7. FAD (Part No. 50293C): One 50 µL tube of 2 mM Flavin Adenine Dinucleotide (FAD).
8. TPP (Part No. 50294C): One 50 µL tube of 2 mM Thiamine Pyrophosphate (TPP).
9. Pyruvate Oxidase (Part No. 50295C): One 300 µL tube.
10. AdoMetS (Part No. 51587D): One 150 µL tube of s-adenosylmethionine synthetase (AdoMetS).
11. PPDK (Part No. 51588D): One 200 µL tube of phosphate pyruvate dikinase (PPDK).

Box 2 (shipped on dry ice)

1. 10X Assay Buffer (Part No. 51582A): One 25 mL bottle.
2. Na_2HPO_4 (Part No. 51586A): One 50 µL tube of sodium phosphate dibasic (Na_2HPO4) at 100 mM.

Materials Not Supplied

1. Distilled or deionized water
2. 10 kDa molecular weight cutoff (MWCO) centrifuge spin filter (e.g. Amicon Ultra 0.5mL)
3. Standard 96-well fluorescence black microtiter plate and/or black cell culture microplate

Storage

Store the 10X Assay Buffer and the Na_2HPO_4 at room temperature. Store the AdoMetS and the PPDK at -80ºC. Store all other components at -20ºC. The Fluorometric Probe is light sensitive and must be stored accordingly. Avoid multiple freeze/thaw cycles.

Preparation of Reagents

- 1X Assay Buffer: Dilute the 10X Assay Buffer 1:10 with deionized water for a 1X solution. Stir or vortex to homogeneity. Store at 4°C.

- Reaction Mix and Negative Control Mix: Prepare two separate mixtures according to the table below. The AdoMetS is omitted from the Negative Control Mix.

Component	Reaction Mix (20 assays)	Negative Control Mix (20 assays)
AdoMetS	30 µL	------
PPDK	40 µL	40 µL
ATP	10 µL	10 µL
AMP	10 µL	10 µL
PEP	10 µL	10 µL
HRP	2 µL	2 µL
Pyruvate Oxidase	60 µL	60 µL
FAD	10 µL	10 µL
TPP	10 µL	10 µL
Na_2HPO_4	10 µL	10 µL
Fluorometric Probe	10 µL	10 µL
1X Assay Buffer	798 µL	828 µL
Total	**1000 µL**	**1000 µL**

Note: Prepare only enough for immediate use and scale proportionally as needed.

Preparation of Samples

- Cell culture supernatants: Cell culture media formulated with pyruvate should be avoided. To remove insoluble particles, centrifuge at 10,000 rpm for 5 min. Collect the supernatant and filter the solution with a 10kDa spin filter to deproteinate the sample. Collect flow through. The flow through may be assayed directly or diluted as necessary into PBS.

Note: Maintain pH between 7 and 8 for optimal working conditions as the Fluorometric Probe is unstable at high pH (>8.5).

- Tissue lysates: Sonicate or homogenize tissue sample in PBS and centrifuge at 10,000 x g for 10 minutes at 4°C. Collect the supernatant and filter the solution with a 10kDa spin filter to deproteinate the sample. Collect flow through. The flow through may be assayed directly or diluted as necessary into PBS.
- Cell lysates: Resuspend cells in PBS. Homogenize or sonicate the cells on ice. Centrifuge to remove debris. Collect the supernatant and filter the solution with a 10kDa spin filter to deproteinate the sample. Collect flow through. The flow through may be assayed undiluted or diluted as necessary into PBS.
- Serum, plasma, saliva, or urine: To remove insoluble particles, centrifuge at 10,000 rpm for 5 min. Collect the supernatant and filter the solution with a 10kDa spin filter to deproteinate the sample. Collect flow through. The flow through may be assayed directly or diluted as necessary into PBS.

Notes:

- *All samples should be assayed immediately or stored at -80°C for up to 1-2 months. Run proper controls as necessary. Optimal experimental conditions for samples must be determined by the investigator. Always run a standard curve with samples.*
- *Samples with NADH concentrations above 10 µM and glutathione concentrations above 50 µM will oxidize the Fluorometric Probe and could result in erroneous readings. To minimize this interference, it is recommended that superoxide dismutase (SOD) be added to the reaction at a final concentration of 40 U/mL (Votyakova and Reynolds, Ref. 2).*

- *Avoid samples containing DTT or β-mercaptoethanol since the Fluorometric Probe is not stable in the presence of thiols (above 10 µM).*

Preparation of Standard Curve

Prepare fresh Methionine standards by diluting in 1X Assay Buffer according to Table 1 below.

Standard Tubes	10 mM Methionine Solution (µL)	1X Assay Buffer (µL)	Methionine (µM)
1	5	495	100
2	250 of Tube #1	250	50
3	250 of Tube #2	250	25
4	250 of Tube #3	250	12.5
5	250 of Tube #4	250	6.25
6	250 of Tube #5	250	3.15
7	250 of Tube #6	250	1.56
8	0	250	0

Table 1. Preparation of Methionine Standards.

Assay Protocol

1. Prepare and mix all reagents thoroughly before use. Each sample, including unknowns and standards, should be assayed in duplicate or triplicate.

Note: Each unknown sample replicate requires two paired wells, one to be treated with AdoMetS (+AMS) and one without the enzyme (-AMS) to measure endogenous background.

2. Add 50 µL of each methionine standard or unknown sample into wells of a 96-well microtiter plate.
3. Add 50 µL of Reaction Mix to the standards and to one half of the paired sample wells, and mix the well contents thoroughly.
4. Add 50 µL of Negative Control Mix to the other half of the paired sample wells.
5. Mix the well contents thoroughly and incubate for 30 minutes at 37ºC protected from light.

Note: This assay is continuous (not terminated) and therefore may be measured at multiple time points to follow the reaction kinetics.

6. Read the plate with a fluorescence microplate reader equipped for excitation in the 530-570 nm range and for emission in the 590-600 nm range.

Example of Results

The following figures demonstrate typical Methionine Assay Kit results. One should use the data below for reference only. This data should not be used to interpret or calculate actual sample results.

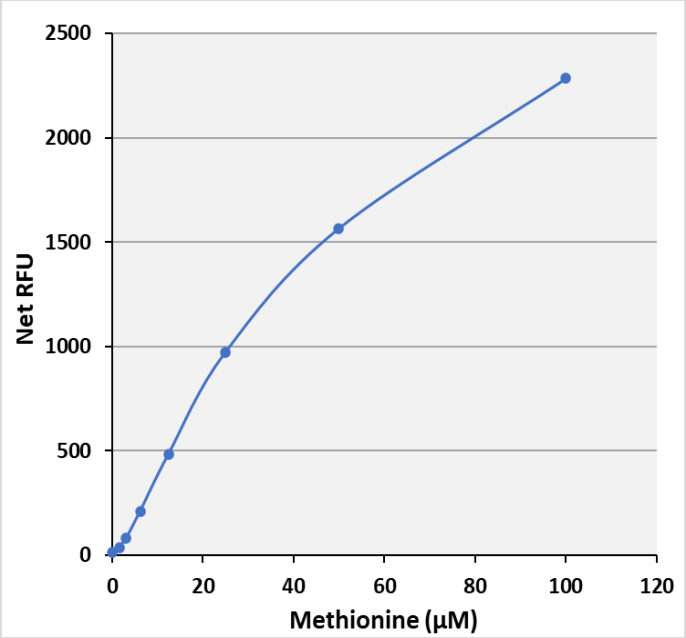

Figure 2: Methionine Standard Curve.

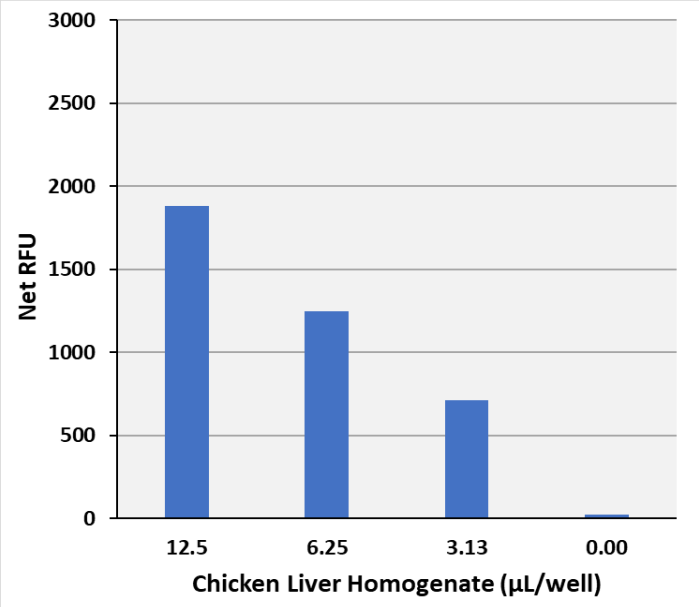

Figure 3: Methionine Detection in Chicken Liver using the Methionine Assay Kit. Chicken Liver was homogenized and deproteinated according to the preparation of samples section above.

Calculation of Results

1. Determine the average Relative Fluorescence Unit (RFU) values for each sample, control, and standard.
2. Subtract the average zero standard value from itself and all standard values.
3. Graph the standard curve (see Figure 2).

4. Subtract the sample well values without AdoMetS (-AMS) from the sample well values containing AdoMetS (+AMS) to obtain the difference. The fluorescence difference is due to the AdoMetS activity.

$$\textbf{Net RFU} = (\textbf{RFU}_{\textbf{+AMS}}) - (\textbf{RFU}_{\textbf{-AMS}})$$

5. Compare the net RFU of each sample to the standard curve to determine and extrapolate the quantity of methionine present in the sample. Only use values within the range of the standard curve.

References

1. Finkelstein JD (1990). J. of Nutr. Biochem. **1**: 228–37.
2. Votyakova TV, and Reynolds IJ (2001) *Neurochem*. **79**:266.
3. Longchamp A, Mirabella T 2, Arduini A, MacArthur MR, Das A, Treviño-Villarreal JH, Hine C, Ben-Sahra I, Knudsen NH, Brace LE, Reynolds J, Mejia P, Tao M, Sharma G, Wang R, Corpataux J-M, Haefliger J-A, Ahn KH, Lee C-H, Manning BD, Sinclair DA, Chen CS, Ozaki CK, and Mitchell JR. (2018) *Cell* **22**:117-129
4. Cavuoto P, Fenech MF (2012). *Cancer Treat. Rev.* **38**: 726–736.
5. Cellarier E, Durando X, Vasson MP, Farges MC, Demiden A, Maurizis JC, Madelmont JC, Chollet P (2003). *Cancer Treat. Rev.* **29**: 489–499.

Warranty

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