Triglyceride Colorimetric Assay Kit

Item No. 10010303

www.caymanchem.com
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GENERAL INFORMATION

Materials Supplied

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Item</th>
<th>Quantity/Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>10010509</td>
<td>Triglyceride Standard</td>
<td>1 vial/400 µl</td>
</tr>
<tr>
<td>700732</td>
<td>Standard Diluent Assay Reagent (5X)</td>
<td>1 vial/12 ml</td>
</tr>
<tr>
<td>700024</td>
<td>NP40 Substitute Assay Reagent (5X)</td>
<td>2 vials/12 ml</td>
</tr>
<tr>
<td>10010511</td>
<td>Triglyceride Enzyme Mixture</td>
<td>1 vial</td>
</tr>
<tr>
<td>700003</td>
<td>Sodium Phosphate Assay Buffer</td>
<td>1 vial/4 ml</td>
</tr>
<tr>
<td>400012</td>
<td>96-Well Cover Sheet</td>
<td>1 cover</td>
</tr>
<tr>
<td>400014</td>
<td>96-Well Solid Plate (Colorimetric Assay)</td>
<td>1 plate</td>
</tr>
</tbody>
</table>

If any of the items listed above are damaged or missing, please contact our Customer Service department at (800) 364-9897 or (734) 971-3335. We cannot accept any returns without prior authorization.

WARNING: THIS PRODUCT IS FOR RESEARCH ONLY - NOT FOR HUMAN OR VETERINARY DIAGNOSTIC OR THERAPEUTIC USE.
Safety Data

This material should be considered hazardous until further information becomes available. Do not ingest, inhale, get in eyes, on skin, or on clothing. Wash thoroughly after handling. Before use, the user must review the complete Safety Data Sheet, which has been sent via email to your institution.

Precautions

Please read these instructions carefully before beginning this assay.

If You Have Problems

Technical Service Contact Information

Phone: 888-526-5351 (USA and Canada only) or 734-975-3888
Fax: 734-971-3641
Email: techserv@caymanchem.com
Hours: M-F 8:00 AM to 5:30 PM EST

In order for our staff to assist you quickly and efficiently, please be ready to supply the lot number of the kit (found on the outside of the box).

Storage and Stability

This kit will perform as specified if stored as directed at -20°C and used before the expiration date indicated on the outside of the box.

Materials Needed But Not Supplied

1. A plate reader with the ability to measure absorbance between 530-550 nm
2. Adjustable pipettes and a multichannel or repeating pipette
3. A source of pure water; glass distilled water or HPLC-grade water is acceptable
4. Test tubes
5. 15 ml centrifuge tube
6. Aluminum foil
Background

Triglycerides are water-insoluble lipids consisting of three fatty acids esterified to a glycerol backbone. Triglycerides are transported in the blood as core constituents of all lipoproteins, but are major components of triglyceride-rich chylomicrons and very low-density lipoproteins (VLDL). A major source of triglycerides is dietary fat. Dietary fats are hydrolyzed in the gut into free fatty acids and mono- and diglycerides and then transported through the intestinal villi. After absorption through the gut, they are resynthesized into new triglycerides and assembled into chylomicrons. Triglycerides are rapidly hydrolyzed in the capillary beds by lipoprotein lipase, releasing glycerol and free fatty acids, which are absorbed by adipose tissue for storage. When required, lipases hydrolyze triglycerides from adipose tissue into fatty acids and glycerol, which enter the blood stream. Fatty acids are oxidized in the mitochondria and peroxisomes to produce energy. Triglycerides play an important role in metabolism by containing more than twice as much energy as carbohydrates and proteins.

The measurement of triglyceride levels is useful in the diagnosis of primary and secondary hyperlipoproteinemia, dyslipidemia, and triglyceridemia. Triglyceride concentrations are also useful in the diagnosis and treatment of diabetes mellitus, nephrosis, liver obstruction, and other diseases involving lipid metabolism or various endocrine disorders. The most common method to determine triglyceride concentrations is by enzymatic hydrolysis of triglycerides to glycerol and free fatty acids followed by either colorimetric or fluorometric measurement of the glycerol released.

About This Assay

Cayman’s Triglyceride Colorimetric Assay provides a simple, reproducible, and sensitive tool for assaying triglycerides in plasma, serum, cell lysates, and tissue homogenate samples. The Triglyceride Colorimetric Assay uses the enzymatic hydrolysis of triglycerides by lipase to produce glycerol and free fatty acids. The glycerol released is subsequently measured by a coupled enzymatic reaction system (Figure 1). The glycerol formed in reaction 1 is phosphorylated to glycerol-3-phosphate in a reaction catalyzed by glycerol kinase (reaction 2). The glycerol-3-phosphate is oxidized by glycerol phosphate oxidase producing dihydroxyacetone phosphate and hydrogen peroxide (reaction 3). Peroxidase catalyzes the redox-coupled reaction of $\text{H}_2\text{O}_2$ with 4-aminoantipyrine (4-AAP) and N-Ethyl-N-(3-sulfopropyl)-m-anisidine (ESPA), producing a brilliant purple color (reaction 4). The absorbance is measured at 530-550 nm.

Triglycerides \[ \xrightarrow{\text{Lipoprotein Lipase}} \] Glycerol + Fatty Acids (1)

Glycerol + ATP \[ \xrightarrow{\text{Glycerol Kinase}} \] Glycerol-3-Phosphate + ADP (2)

Glycerol-3-Phosphate + O$_2$ \[ \xrightarrow{\text{Glycerol Phosphate Oxidase}} \] Dihydroxyacetone Phosphate + H$_2$O (3)

2H$_2$O$_2$ + 4-AAP + ESPA \[ \xrightarrow{\text{Peroxidase}} \] Quinoneimine dye + 4H$_2$O (4)

Figure 1. Triglyceride assay scheme
4. Sodium Phosphate Assay Buffer - (Item No. 700003)
This vial contains 4 ml of 250 mM sodium phosphate buffer, pH 7.2. Prior to use, mix the contents of the vial with 16 ml of HPLC-grade water. This diluted buffer (50 mM sodium phosphate, pH 7.2) is used to prepare the triglyceride enzyme solution. The Assay Buffer may be stored for six months at room temperature.

5. Triglyceride Enzyme Mixture - (Item No. 10010511)
This vial contains a lyophilized enzyme mixture. Reconstitute the contents of the vial with 1 ml of HPLC-grade water. Transfer the reconstituted solution to a 15 ml centrifuge tube wrapped in aluminum foil. Add 14 ml of the diluted Assay Buffer to the reconstituted solution and mix by inversion. NOTE: A portion of the 14 ml should be used to rinse any residual solution from the vial. This solution is now ready to use in the assay. If the entire solution is not used at one time, the solution should be stored at 4°C. Do NOT Freeze! The solution is stable for one month when stored at 4°C; a slight pink discoloration may occur but will have no affect on the assay performance.
Sample Preparation

Plasma
Typically, normal human plasma has triglyceride concentrations in the range of 40-160 mg/dl (male) or 35-135 mg/dl (female).^9

1. Collect blood using an anticoagulant such as heparin, EDTA, or citrate.
2. Centrifuge the blood at 700-1,000 x g for 10 minutes at 4°C. Pipette off the top yellow plasma layer without disturbing the white buffy layer. Store plasma on ice. If not assaying the same day, freeze at -80°C. The plasma sample will be stable for one month when stored at -80°C.
3. Plasma does not need to be diluted before assaying.

Serum
Typically, normal human serum has triglyceride concentrations in the range of 40-160 mg/dl (male) or 35-135 mg/dl (female).^9

1. Collect blood without using an anticoagulant.
2. Allow blood to clot for 30 minutes at 25°C.
3. Centrifuge the blood at 2,000 x g for 15 minutes at 4°C. Pipette off the top yellow serum layer without disturbing the white buffy layer. Store serum on ice. If not assaying the same day, freeze at -80°C. The serum sample will be stable for one month while stored at -80°C.
4. Serum does not need to be diluted before assaying.

Cell Lysates
1. Collect cells (~18 x 10^6 cells) by centrifugation (i.e., 1,000-2,000 x g for 10 minutes at 4°C). For adherent cells, do not harvest using proteolytic enzymes; rather, use a rubber policeman.
2. Resuspend the cell pellet in 1-2 ml of cold diluted Standard Diluent.
3. Sonicate the cell suspension 20X at one second bursts.
4. Centrifuge cell suspension at 10,000 x g for 10 minutes at 4°C.
5. Remove the supernatant and store on ice. If not assaying on the same day, freeze at -80°C until use. The sample will be stable for at least one month when stored at -80°C.
6. Before assaying, further dilute the samples 1:2-1:3 with diluted Standard Diluent.

Tissue Homogenates
1. Weigh tissue and then mince into small pieces.
2. Homogenize 350-400 mg of minced tissue in 2 ml of the diluted NP40 Substitute Assay Reagent containing protease inhibitors of choice (see Interference section).
3. Centrifuge at 10,000 x g for 10 minutes at 4°C.
4. Transfer the entire supernatant to another tube. Store the supernatant on ice. If not assaying the same day, freeze at -80°C. The sample will be stable for one month when stored at -80°C. NOTE: When centrifuged at high speeds some tissue homogenates, such as liver, will leave a layer of insoluble fat at the top of the centrifuge tube. Be sure to include this layer when transferring the supernatant.
5. Typically, tissue samples require dilutions of at least 1:5 or greater. Dilute the samples using the diluted NP40 Substitute Assay Reagent before assaying.
ASSAY PROTOCOL

Plate Set Up

There is no specific pattern for using the wells on the plate. A typical layout of triglyceride standards and samples to be measured in duplicate is given below in Figure 2. We suggest you record the contents of each well on the template sheet provided (see page 22).

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<thead>
<tr>
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<th>1</th>
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<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

A-H = Standards
S = Samples

Figure 2. Sample plate format

Pipetting Hints

- It is recommended that a multichannel pipette be used to deliver reagents to the wells.
- Before pipetting each reagent, equilibrate the pipette tip in that reagent (i.e., slowly fill the tip and gently expel the contents, repeat several times).
- Do not expose the pipette tip to the reagent(s) already in the well.

General Information

- All reagents, except samples, must be equilibrated to room temperature before beginning the assay.
- The final volume of the assay is 160 µl in all wells.
- The incubation temperature is room temperature.
- It is not necessary to use all the wells on the plate at one time.
- It is recommended that the standards and samples be assayed in at least duplicate.
- Measure the absorbance at 530-550 nm using a plate reader.
Standard Preparation

If testing tissue samples it is recommended that the standard curve be prepared in diluted NP40 Substitute Assay Reagent instead of diluted Standard Diluent. For all other sample types it is recommended that the standard curve be prepared in diluted Standard Diluent.

Label eight clean test tubes A-H. Add 200 µl of the diluted Standard Diluent (Item No. 700732) or diluted NP40 Substitute Assay Reagent (Item No. 700024) to tubes B-H. Add 400 µl of diluted Standard Diluent (or diluted NP40 Substitute Assay Reagent) to tube A. Add 100 µl of Triglyceride Standard (Item No. 10010509) to tube A and mix thoroughly. The concentration of tube A is 200 mg/dl (2.26 mmol/L). Serially dilute the standard by removing 200 µl from tube A and adding it to tube B; mix thoroughly. Next, remove 200 µl from tube B and place it into tube C; mix thoroughly. Repeat this process for tubes D-G. Tube H only has diluted Standard Diluent or diluted NP40 Substitute Assay Reagent and is used as the blank. We recommend that you store these diluted standards for no more than one to two hours. See Table 1 below for the triglyceride concentrations of the serial dilutions.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Triglyceride Concentration (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>200</td>
</tr>
<tr>
<td>B</td>
<td>100</td>
</tr>
<tr>
<td>C</td>
<td>50</td>
</tr>
<tr>
<td>D</td>
<td>25</td>
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<td>E</td>
<td>12.5</td>
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<tr>
<td>F</td>
<td>6.25</td>
</tr>
<tr>
<td>G</td>
<td>3.125</td>
</tr>
<tr>
<td>H</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1. Preparation of Triglyceride Standards

Performing the Assay

1. **Triglyceride Standard Wells** - Add 10 µl of standard (tubes A-H) to the designated wells on the plate (see Sample Plate Format, Figure 2, page 12).
2. **Sample Wells** - Add 10 µl of sample to two or three wells. **NOTE:** The amount of sample added to the well should always be 10 µl.
3. Initiate the reaction by adding 150 µl of diluted Enzyme Mixture solution to each well.
4. Cover with the plate cover. Carefully shake the plate for a few seconds to mix.
5. Incubate the plate for 15 minutes at room temperature.
6. Measure the absorbance at 530-550 nm using a plate reader.
Calculations
1. Calculate the average absorbance of each standard and sample.
2. Subtract the absorbance value of standard H (0 mg/dl) from itself and all other values (both standards and samples). This is the corrected absorbance.
3. Graph the corrected absorbance values (from step 2 above) of each standard as a function of the final triglyceride concentration (mg/dl) (see Table 1, page 14). A typical triglyceride standard curve is shown in Figure 3 on page 18.
4. Calculate the values of triglyceride samples using the equation obtained from the linear regression of the standard curve by substituting the corrected absorbance values for each sample into the equation.

\[
Triglycerides \text{ (mg/dl)} = \frac{(\text{Corrected absorbance}) - \text{(y-intercept)}}{\text{Slope}}
\]

Performance Characteristics

Precision:
When a series of sixteen human serum samples were assayed on the same day, the intra-assay coefficient of variation was 1.34%. When a series of sixteen human serum samples were assayed on six different days under the same experimental conditions, the inter-assay coefficient of variation was 3.17%.

Sensitivity:
The lower limit of detection (LLOD) for this assay is approximately 0.5 mg/dl using the Standard Diluent Assay Reagent and 1.6 mg/dl when using the NP40 Substitute Assay Reagent.
Representative Triglyceride Standard Curve

The standard curve, presented below, is an example of the data typically provided with this kit; however, your results will not be identical to these. You must run a new standard curve. Do not use this data to determine the values of your samples.

\[
y = 0.004x - 0.005 \\
r^2 = 0.9992
\]

\[
y = 0.003x + 0.0005 \\
r^2 = 0.9968
\]

Figure 3. Triglyceride standard curve

Interferences

The following reagents were tested in the assay for interference:

<table>
<thead>
<tr>
<th>Reagent</th>
<th>Will Interfere (Yes or No)</th>
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<tbody>
<tr>
<td>Buffers</td>
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</tr>
<tr>
<td>Tris</td>
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</tr>
<tr>
<td>Borate</td>
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<tr>
<td>HEPES</td>
<td>No</td>
</tr>
<tr>
<td>Phosphate</td>
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<td>Triton X-100 (1%)</td>
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<td>Protease Inhibitors/</td>
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<td>Leupeptin (10 µg/ml)</td>
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## Troubleshooting

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<thead>
<tr>
<th>Problem</th>
<th>Possible Causes</th>
<th>Recommended Solutions</th>
</tr>
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</table>
| Erratic values; dispersion of duplicates/triplicates | A. Poor pipetting/technique  
B. Bubble in the well(s) | A. Be careful not to splash the contents of the wells  
B. Carefully tap the side of the plate with your finger to remove bubbles |
| No triglyceride was detected in the sample        | Triglyceride concentration was too low or the sample was too dilute | Do not dilute samples and re-assay                                                     |
| Sample absorbance values are above highest point in standard curve | Triglyceride concentration was too high in the sample or the sample was too concentrated | Dilute samples with assay buffer and re-assay; NOTE: Remember to account for the dilution factor when calculating the triglyceride concentration |

### References

Warranty and Limitation of Remedy

Buyer agrees to purchase the material subject to Cayman’s Terms and Conditions. Complete Terms and Conditions including Warranty and Limitation of Liability information can be found on our website.

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