

# Glycogen Synthetase (GCS) Assay Kit

**Note:** It is necessary to predict 2-3 large difference samples before the formal determination.

**Operation Equipment:** Spectrophotometer

**Cat No:** NA0633

**Size:** 50T/48S

## Components:

Extract solution: Liquid 60 mL×1, store at 4°C;

Reagent I: Liquid 40 mL×1, store at 4°C;

Reagent II: Liquid 15 mL×1, store at 4°C;

Reagent III: Liquid 36  $\mu$ L×1, store at 4°C;

Reagent IV: Powder×1, store at -20°C;

Reagent V: Powder×1, store at -20°C;

Reagent VI: Liquid 115  $\mu$ L×1, store at 4°C;

Reagent VII: Powder×1, store at -20°C;

Reagent VIII: Powder×1, store at 4°C and protect from light;

Working solution: Transfer reagent III, IV and V to reagent I for mixing and dissolving before use; The rest of reagent can store at -20°C for one week; Avoid repeated freezing and thawing;

Preparation of reagent VIII: Add 12 mL of reagent II into reagent VIII and dissolve it before use. Then transfer reagent VI and VII to reagent VIII to mix and dissolve them for use; The rest of reagent can store at -20°C for one week; Avoid repeated freezing and thawing;

## Product Description:

Glycogen synthetase (GCS) can add the glycogen of UDPG to the original glycogen or the non-reducing end of glycogen protein, and be connected by  $\alpha$  - 1,4 glycoside bond. GCS is the rate limiting enzyme of glycogen synthesis in animal body. It is also the main target enzyme of insulin. It plays an important role in the process of glucose metabolism and maintaining the relative stability of blood glucose.

GCS catalyzes the production of glycogen and UDP from UDPG and glucose residues. Pyruvate kinase and lactate dehydrogenase further catalyze NADH to generate NAD<sup>+</sup>. The decrease rate of NADH at 340 nm can reflect the activity of GCS.

## Required but Not Provided:

Ultraviolet spectrophotometer, balance, low temperature desk centrifuge, water-bath, transferpettor, 1 mL quartz cuvette, mortar/homogenizer, ice and distilled water.

## Protocol

### I. Preparation:

1. Tissue: according to the ratio of mass (g): extraction volume (mL): 1:5-10 to add the extract solution. It

is suggested that add 1 mL of extract to 0.1 g of tissue. Homogenate on ice. Centrifuge at 8000 g 4°C for 10 min. Take the supernatant on ice for test.

2. Bacteria and cells: according to the ratio of  $10^4$  cells: extract volume (mL) 500-1000:1. It is suggested to take about 500 million bacteria/cell and add 1 mL extraction reagent. Bacteria/cell is split by ultrasonication (power 200w, ultrasonic 3s, interval 7s, total time 3 min). Centrifuge at 8000 g 4°C for 10 min. Take the supernatant on ice for test.

3. Serum and other liquids: detect directly.

## II. Determination procedure:

1. Preheat ultraviolet spectrophotometer for 30 min, adjust wavelength to 340 nm, set the counter to zero with distilled water.

2. Operation table: (add the following reagents in 1 mL quartz cuvette in turn)

Reagent ( $\mu\text{L}$ )	Test tube ( $A_T$ )	Blank tube ( $A_B$ )
Sample	50	
Distilled water		50
Working solution	750	750
Reagent VIII	200	200

Add samples and start timing. Mix thoroughly. The absorbance value  $A_1$  for 10s and  $A_2$  for 1 min10s be measured at 340 nm. Calculate  $\Delta A_T = A_{1T} - A_{2T}$ ,  $\Delta A_B = A_{1B} - A_{2B}$ ,  $\Delta A = \Delta A_T - \Delta A_B$ . Blank tube only needs to be test once or twice.

## III. GCS Calculation:

1) Protein concentration:

Unit definition: One unit of enzyme is defined as the amount of enzyme that catalyzes the consumption of 1 nmol NADH per minute every mg tissue protein in the reaction system.

$$\text{GCS (U/mg prot)} = \Delta A \div (\epsilon \times d) \times V_T \times 10^9 \div (\text{Cpr} \times V_{SA}) \div T = 3215.4 \times \Delta A \div \text{Cpr}$$

2) Sample weight:

Unit definition: One unit of enzyme is defined as the amount of enzyme that catalyzes the consumption of 1 nmol NADH per minute every gram tissue weight in the reaction system.

$$\text{GCS (U/g weight)} = \Delta A \div (\epsilon \times d) \times V_T \times 10^9 \div (W \times V_{SA} \div V_E) \div T = 3215.4 \times \Delta A \div W$$

3) Cells

Unit definition: One unit of enzyme is defined as the amount of enzyme that catalyzes the consumption of 1 nmol NADH per minute every  $10^4$  cells in the reaction system.

$$\text{GCS (U/10}^4 \text{ cell)} = \Delta A \div (\epsilon \times d) \times V_T \times 10^9 \div (\text{cells (10}^4\text{)} \times V_{SA} \div V_E) \div T = 3215.4 \times \Delta A \div \text{cells (10}^4\text{)}$$

4) Liquid volume

Unit definition: One unit of enzyme is defined as the amount of enzyme that consume of 1 nmol NADH per minute every mL serum in the reaction system.

$$\text{GCS (U/mL)} = \Delta A \div (\epsilon \times d) \times V_T \times 10^9 \div V_{SA} \div T = 3215.4 \times \Delta A$$

$\epsilon$ : NADH molar extinction coefficient,  $6.22 \times 10^3$  L/mol/cm;

$d$ : Light path of cuvette, 1 cm;

$10^9$ : Unit conversion coefficient, 1 mol =  $10^9$  nmol;

$V_T$ : Total volume of reaction system,  $1 \times 10^{-3}$  L;

$V_{SA}$ : Sample volume, 0.05 mL;

Cpr: Protein concentration, mg/mL;

W: Sample weight, g;

$V_E$ : Extract solution volume of cells, 1 mL;

T: Reaction time, 1 min;

**Note:**

1. The supernatant of sample extraction should be placed on ice for testing. It is recommended to finish the test on the same day.
2. If the  $\Delta A$  is greater than 0.2, it is recommended to dilute the sample with the extract for determination. To improve the detection sensitivity. Multiply the corresponding dilution ratio in the calculation formula.

**Experimental examples:**

1. Take 0.1 g of mouse heart tissue and add 1 mL of Extract solution for sample processing. After centrifugation to take the supernatant, proceed according to the determination procedure. Calculate  $\Delta A_T = A_{1T} - A_{2T} = 1.177 - 1.119 = 0.058$ ,  $\Delta A_B = A_{1B} - A_{2B} = 0.944 - 0.939 = 0.005$ ,  $\Delta A = \Delta A_T - \Delta A_B = 0.058 - 0.005 = 0.053$ . The enzyme activity is calculated according to the sample mass.

$$\text{GCS (U/g weight)} = 3215.4 \times \Delta A \div W = 1704.162 \text{ U/g weight.}$$

**Related products:**

NA0838/NA0596  $\beta$ -1,3-glucanase( $\beta$ -1,3-GA) Activity Assay Kit

NA0682/NA0441 Acidic Xylanase Activity Assay Kit

NA0312/NA0311 N-Acetyl- $\beta$ -D-Glucosidase(NAG) Activity Assay Kit