Spectrum For Diagnostic Industries

# Glucose-6-Phosphate dehydrogenase (G-6-PD)

IVD

| REF. | Pack size |
|---|---|
| 184 10 001 | ( 10 x 1 ml) 10 tests |

## Intended Use

G-6-PDH reagent is intended for the in-vitro quantitative UV diagnostic estimation of G-6-PDH in Whole blood.

## Background

Glucose-6-Phosphate-Dehydrogenase (G6PDH) deficiency is one of the most common human enzyme deficiencies in the world. During G6PD deficiency, the red cells are unable to regenerate reduced Nicotineamide adenine dinucleotide phosphate (NADPH), a reaction that is normally catalyzed by the G6PD enzyme. Since the X chromosome carries the gene for G6PD enzyme, this deficiency mostly affects the males. The two major conditions associated with G6PD deficiency are hemolytic anaemias and neonatal jaundice, which may result in neurological complications and death. Screening and detection of G6PD deficiency helps in reducing such episodes, through appropriate selection of treatment, patient counseling and abstinence from disease precipitating drugs such as anti malarials and other agents.

## Method

UV-Kinetic Method.

## Assay Principle

G6PDH in the RBC's is released by a lysing agent present in the reagent. The G6PDH released catalyzes the oxidation of Glucose 6 phosphate with the reduction of NADP to NADPH. The rate of reduction of NADP to NADPH is measured as an increase in absorbance which is proportional to the G6PDH activity in the sample.

G-6-P +NADP ⟶ Gluconate -6-P+ NADPH+H

## Reagents

Reagent 1a **(R1a):** G6PDH Assay vials
Reagent 1b **(R1b):** Assay Diluent
Reagent 2 **(R2) :** Substrate Solution

## Precautions and Warnings

Do not ingest or inhalate. In case of contact with eyes or skin; rinse immediately with plenty of soap and water. In case of severe injuries; seek medical advice immediately.

## Reagent Storage and Stability

Reagents and standard are ready-to-use. When stored at 2 – 8 $^{O}$C; they are stable up to the expiry date stated on the label. Recontituted G6PDH Assay solution is stable for 8hrs at room temp. (15 - 25 °C) or 5 days refrigerated (2 - 8 °C).

## Sample collection and preparation

Whole blood collected in EDTA, Heparin or ACD is satisfactory. Red cell G-6-PDH is stable in whole blood for one week refrigerated (2-8°C), but is unstable in red cell hemolysates. Freezing of blood is not recommended. Since activity is reported in terms of number of red cells or grams of hemoglobin. The red cell count or hemoglobin concentration should be determined prior to performing the G-6-PDH assay.

The integrity of erythrocytes collected in ACD is preserved even after prolonged storage so that obtaining accurate red cell counts usually poses no problem. However, red cell counts on specimens collected in heparin become unreliable after about 2 days. Thus, for heparinized samples, results are best reported in terms of hemoglobin concentration. Both copper, which completely inhibits the enzyme at a concentration of 100ìmol/L, and sulfate ions (0.005 mol/L) will decrease observed values of G-6-PDH activity, certain drugs and other substances are known to influence circulating levels of G-6-PDH. Reticulocytes have higher G-6-PDH levels than mature red cells. Therefore it is not recommended that assays be performed after a severe hemolytic crisis, since G-6-PDH levels appear falsely elevated. Under those conditions, detection of deficiency may require family studies. Testing may be more helpful after the level of mature red cells has returned to normal. Under normal circumstances, activity contributed by leucocytes, platelets and serum is relatively small. However, in cases of extreme anemia, grossly elevated white counts or very low levels of red cell G-6-PDH activity, the contribution to the total made under these conditions may be significant. See “Use of Buffy-Coat-Free Samples” section.

## Reagent preparation

**G-6-PDH ASSAY SOLUTION Preparation**
Is prepared by reconstituting G-6-PDH assay vials with the volume of Assay diluent as stated on the vial. Swirl gently and invert several times to dissolve the contents. Wait 2-3 minutes and mix again.

**G-6-PDH SUBSTRATE SOLUTION**
Is supplied ready to use.

## System Parameters

| | |
|---|---|
| Wavelength | 340 nm |
| Optical path | 1 cm |
| Assay type | UV-Kinetic |
| Direction | Increase |
| Sample: Reagent Ratio | 1:100 |
| Temperature | 30 $^{O}$C |
| Measurement | Against distilled water |
| Delay/Lag/Time | 300 sec |
| Interval Time | 60 sec |
| NO. OF READINGS | 05 |
| Blank Absobance Limit | < 0.8 |
| Factor | 4839 |
| Low Normal at 30°C | 4.6 µ/g Hb |
| High Normal at 30°C | 13.5 µ/g Hb |
| Linearity at 30°C | 19.5 µ/g Hb |

## Procedure

The temperature of the reaction mixture should be maintained at 30°C or some other constant temperature (see “Temperature Correction” section).

**1.Prepare reaction mixture :**

a)Add 0.01ml blood to 1.0 ml of G-6-PDH Assay solution and mix thoroughly to completely suspend erythrocytes. Let stand at room temperature (18-26°C) for 5-10 minutes.

b)Add 2.0ml G-6-PDH Substrate solution directly to vial and mix gently by inverting several times.

c)Transfer contents of vial to cuvette labeled Test & proceed with Step2.

**2.**Place cuvette in constant temperature cuvette compartment or water bath and incubate for approximately 5 minutes to obtain thermal equilibrium.

**3.**Read and record absorbance (A) of Test at 340nm vs water or Potasium Dichromate solution. This is INITIAL A. (if using the water bath or incubator, return the cuvet to it)

**4.**Exactly 5 minutes later, again read and record absorbance. This is FINAL A.

**5.**To determine G-6-PDH activity, refer to "calculations" section.

## CALCULATION

$$\text{A per min} = \frac{\text{FINAL A - INITIAL A}}{5}$$

G-6-PDH activity is expressed as U/$10^{12}$ erythrocytes (RBC) or U/g hemoglobin (Hb).

$$\text{G-6-PDH (U/}10^{12}\text{ RBC)} = \text{A per min} \times \frac{48{,}390}{N} \times \text{TCF}$$

Where :

N = Red cell count divided by 10
TCF = Temperature correction factor (1 at 30°C)

$$\text{G-6-PDH(U/g Hb)} = \text{A per min} \times \frac{4839 \times \text{TCF}}{\text{Hb(g/dL)}}$$

**EXAMPLE :**
Assay of a specimen which had a red cell count of 4.6 x$10^{6}$ / $mm^{3}$ and a hemoglobin concentration 15.2 g/dL resulted in an Absorbance per min of 0.026 at 30°C .

$$\text{G-6-PDH (U/}10^{12}\text{ RBC)} = 0.026 \times \frac{48{,}390}{4.6} = 273.5$$

$$\text{G-6-PDH(U/g Hb)} = 0.026 \times \frac{4839}{15.2} = 8.27$$

**Note:** If A per min is greater than 0.060, repeat determination (3) using 5 µL blood and multiply results by 2 .

## Calibration

The procedure is standardized on the basis of the milimolar absorptivity of NADPH, which is 6.22 at 340nm. The oxidative conversion of G-6-P by G-6-PDH leads to reduction of NADP to NADPH on a molar equivalent basis. Measurement of the rate of increase in absorbance ( A) at 340nm serves to quantitate enzymatic activity. The maximum G-6-PDH activity which may be measured by this procedure is approximately 650 U/1012 RBC or 19.5 U/g Hb.

## Use of Buffy-Coat-Free Sample

Under normal circumstances G-6-PDH activity contributed by leucocytes, platelets and serum is relatively small. However, as reported by Echler and others, more accurate measurement of G-6-PDH activity, specially in the presence of anaemia and /or leucocytosis, can be achieved by using buffy coat-free blood samples for assay. Thus in case of a boderline value obtained with whole blood, it may be warranted to repeat the assay on a buffy coat-free sample.

## Temperature Correction

When temperature of 30°C, no temperature correction factor (TCF) is required in the calculations. If assay is performed at a room temperature other than 30°C, a TCF must be used. When the temperature is 37° C, the TCF is 0.66.

## Linearity

The assay is linear up to 19.5 µg Hb

## Expected Values

| | |
|---|---|
| G6PDH Activity (U/g Hb.) : | 4.6 - 13.5 at 30°C |
| | 6.4 - 18.7 at 37°C |
| (U/$10^{12}$ RBC's) : | 146 - 376 at 30°C |
| | 202 - 522 at 37°C |

**Note:**
It is recommended for each laboratory to establish and maintain its own reference values. The given data are only an indication.

## Waste Disposal

This product is made to be used in professional laboratories.
Please consult local regulations for a correct waste disposal.
**S56:** dispose of this material and its container at hazardous or special waste collection point.
**S57:** use appropriate container to avoid environmental contamination.
**S61:** avoid release in environment. refer to special instructions/safety data sheets.

## References

S.K. Sood et al., The Indian journal of path and micro,, 24 (1981), 89. Lubin, B.H. and Oski, F.A., J. Pediatr. 70 (1967), 788.

## SYMBOLS IN PRODUCT LABELLING

| | |
|---|---|
| IVD | For in-vitro diagnostic use |
| LOT | Batch Code/Lot number |
| REF | Catalogue Number |
| | Consult instructions for use |
| | Temperature Limitation |
| | Use by/Expiration Date |
| | CAUTION. Consult instructions for use |
| | Manufactured by |

Spectrum For Diagnostics Industries - Free Zone
Ismailia Free Zone , Block 5 .
Cairo- Port said Avenue.
Ismailia,Egypt
Tel: +2 064 3488 013 - +2 064 3488 014 Fax: +2 064 3488 015
www.sdi-fz.com

EC REP **MDSS GmbH**
Schiffgraben 41
30175 Hannover, Germany