

## Malachite Green Phosphate Assay Kits (POMG-25H) Rapid Colorimetric Phosphate Determination at 620 nm

### DESCRIPTION

The Malachite Green Phosphate Assay Kit is based on quantification of the green complex formed between Malachite Green, molybdate and free orthophosphate. The rapid color formation from the reaction can be conveniently measured on a spectrophotometer (600 - 660 nm) or on a plate reader. The non-radioactive colorimetric assay kits have been optimized to offer superior sensitivity and prolonged shelf life. The assay is simple and fast, involving a single addition step for phosphate determination. Assays can be executed in tubes, cuvettes or multi-well plates. The assays can be conveniently performed in 96- and 384-well plates for high-throughput screening of enzyme inhibitors.

### KEY FEATURES

**Reagent very stable.** Due to our innovative formulation, no precipitation of reagent occurs. Therefore no filtration of reagent is needed prior to assays, as is often required with other commercial kits.

**High sensitivity and wide detection range:** detection of as little of 1.6 pmoles of phosphate and useful range between 0.02  $\mu$ M and 40  $\mu$ M phosphate.

**Fast and convenient:** homogeneous "mix-and-measure" assay allows quantitation of free phosphate within 20 minutes.

**Compatible with routine laboratory and HTS formats:** assays can be performed in tubes, cuvettes or microplates, on spectrophotometers and plate readers.

**Robust and amenable to HTS:** Z' factors of 0.7 to 0.9 are observed in 96-well and 384-well plates. Can be readily automated on HTS liquid handling systems.

### APPLICATIONS

**Phosphatase Assays:** liberation of phosphate from peptide, protein or small molecule substrate.

**Lipase Assays:** liberation of phosphate from phospholipids

**Nucleoside Triphosphatase Assays:** liberation of phosphate from nucleoside triphosphates (ATP, GTP, TTP, CTP etc).

**Quantitation of Phosphate** in phospholipids, proteins and DNAs, etc.

**Drug Discovery:** high-throughput screen for phosphatase inhibitors.

### KIT CONTENTS: 2,500 ASSAYS IN 96-WELL PLATE

**Reagent A:** 50 mL **Reagent B:** 1 mL **Standard:** 1mL 1 mM phosphate

**Storage conditions.** The kit is shipped at ambient temperature. The reagents and standard are stable for one year when stored at 4°C.

**Precautions:** reagents are for research use only. Normal precautions for laboratory reagents should be exercised while using the reagents. Please refer to Material Safety Data Sheet for detailed information.

### PROCEDURE USING 96-WELL PLATE

**Reagent Preparation.** Each assay requires 20  $\mu$ L Working Reagent. Prepare enough Working Reagent by mixing 100 vol of Reagent A and 1 vol of Reagent B (e.g. 5 mL Reagent A and 50  $\mu$ L Reagent B). Working Reagent is stable for at least 1 day at room temperature.

**Important:** The reagent must be brought to room temperature before use. Before each assay, it is important to check that all enzyme preparations and assay buffers do not contain free phosphate. This can be conveniently done by adding 20  $\mu$ L of the Working Reagent to 80  $\mu$ L sample solution. The blank OD values at 620 nm should be lower than 0.2. If the OD readings are higher than 0.2, check water phosphate level. Double distilled water usually have OD readings lower than 0.1. Lab detergents may contain high levels of phosphate. Make sure that lab wares are free from contaminating phosphate after thorough washes.

1. Preparation of phosphate standards. Prepare a Premix solution containing 40  $\mu$ M phosphate by pipetting 40  $\mu$ L 1 mM phosphate standard to 960  $\mu$ L distilled water or enzyme reaction buffer. Number the tubes.

Dilute standards as shown in the following Table. Pipette 80  $\mu$ L standard in duplicate into wells of a clear-bottom 96-well plate. Add blank controls containing water or reaction buffer only.

No	Premix + H <sub>2</sub> O	Final Vol ( $\mu$ L)	Phosphate Conc ( $\mu$ M)	pmoles Phosphate in 50 $\mu$ L
1	200 $\mu$ L + 0 $\mu$ L	200	40	2,000
2	160 $\mu$ L + 40 $\mu$ L	200	32	1,600
3	120 $\mu$ L + 80 $\mu$ L	200	24	1,200
4	80 $\mu$ L + 120 $\mu$ L	200	16	800
5	60 $\mu$ L + 140 $\mu$ L	200	12	600
6	40 $\mu$ L + 160 $\mu$ L	200	8	400
7	20 $\mu$ L + 180 $\mu$ L	200	4	200
8	0 $\mu$ L + 200 $\mu$ L	200	0	0

2. Transfer 80  $\mu$ L test samples into separate wells of the plate.

*Note: in the case of enzyme reactions, the reaction may be terminated by adding a specific inhibitor, or can be stopped directly by the addition of the Working Reagent. Dilution of reaction mixture may be necessary prior to the assay (see General Considerations). For ATPase or GTPase assays, the ATP or GTP concentration should be lower than 0.25 mM. If the reaction mixture contains > 0.25mM ATP or GTP, dilute samples in distilled water. For example, if the ATPase reaction contained 1 mM ATP, at the end of reaction dilute reaction mixture 4-fold in water prior to the assay.*

3. Add 20  $\mu$ L of Working Reagent to each well. Mix gently by tapping the plate.

4. Incubate for 30 min at room temperature for color development.

5. Measure absorbance at 600 nm - 660nm (620 nm) on a plate reader.

For assays in 384-well plates, the procedures are the same, except that the volume of the standard and sample solution should be 40  $\mu$ L and that of the Working Reagent should be 10  $\mu$ L.

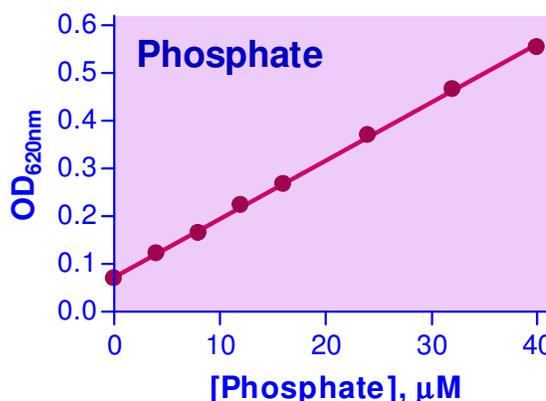


Figure. Phosphate standard curve in 96-well plate. After 30 minute incubation, the OD at 620 nm was read. Data are presented as mean  $\pm$  SD (n = 2). Useful detection range was 0.02 to 40 $\mu$ M phosphate.

### GENERAL CONSIDERATIONS

**Incubation time.** The chromogenic reaction is completed within 30 min at room temperature. Read OD values at 30 min.

**Precipitation** may occur at high concentrations of phosphate (>100  $\mu$ M), or in the presence of high concentrations of e.g. proteins and metals.

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If precipitation occurs, perform a series dilution of sample in H<sub>2</sub>O, run the assay and determine the dilution factor from wells with no precipitation. Repeat assays using diluted samples.

**Enzyme reaction buffer.** Because any exogenous free phosphate would interfere with the assay, it is important to ensure that the protein preparation, the reaction buffer and lab wares employed in the assay should not contain free phosphate. This can be conveniently checked by adding the Working Reagent to the buffer and measuring the color formation.

**Liquid disposal.** The assay mixture contains 0.4 M sulfuric acid. It is recommended that the waste liquid be neutralized with equal volume of 1 N NaOH prior to disposal.

### DATA ANALYSIS

Plot OD<sub>620nm</sub> versus phosphate standard concentrations. Determine sample phosphate concentrations from the standard curve.

### PUBLICATIONS

1. Guérette, D. et al (2007). Molecular evolution of type VI intermediate filament proteins. *BMC Evolutionary Biology* 2007, 7:164.
2. Green, M.L. et al (2005). Ethylene glycol induces hyperoxaluria without metabolic acidosis in rats. *Am J Physiol Renal Physiol* 289: F536–F543.
3. Saran, D. et al (2006). Multiple-turnover thio-ATP hydrolase and phospho-enzyme intermediate formation activities catalyzed by an RNA enzyme. *Nucleic Acids Research*, 34(11): 3201–3208.
4. Adkins, M.W. et al (2007). Chromatin disassembly from the *PHO5* promoter is essential for the recruitment of the general transcription machinery and coactivators. *Mol. Cell. Biol.* 27: 6372–6382.

### TECHNICAL NOTES

The Malachite Green Phosphate Assay kits have been optimized and formulated to provide a sensitive, convenient and robust quantitation of free phosphate liberated from enzyme reactions and natural sources. Key features of the kits are as follows:

*Reagent very stable.* Due to our innovative formulation, no precipitation of reagent occurs. Therefore no filtration of reagent is needed prior to assays, as is often required with other commercial kits.

*Safe.* Non-radioactive assay.

High sensitivity and wide detection range: detection of as little of 1.6 pmoles of phosphate and 0.02 μM to 40 μM phosphate.

*Fast and convenient:* homogeneous “mix-and-measure” assay allows quantitation of free phosphate within 20 minutes.

*Compatible with routine laboratory and HTS formats:* assays can be performed in tubes or microplates, on spectrophotometers and plate readers.

*Robust and amenable to HTS:* Z' factors of 0.7 to 0.9 are observed in 96-well and 384-well plates. Can be readily automated on HTS liquid handling systems.