

# BG-Maleimide



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S9153S 007150118011

## S9153S

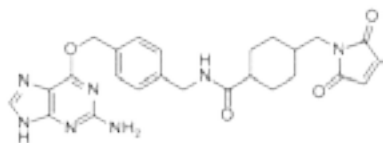
**2 mg** **Lot: 0071501**  
**Store at: -20°C** **Exp: 1/18**

### Introduction

BG-Maleimide is a thiol-reactive building block for the one-step synthesis of SNAP-tag® substrates from thiol-containing precursors such as cysteine-containing peptides and proteins, or thiol-modified oligonucleotides. This building block allows you to make custom SNAP-tag substrates for labeling SNAP-tag fusion proteins for a wide range of applications such as the coupling of proteins and solid surfaces such as DNA chips.

The SNAP-tag protein labeling system enables the specific, covalent attachment of virtually any molecule to a protein of interest. The SNAP-tag is a protein based on human O<sup>6</sup>-alkylguanine-DNA-alkyltransferase (hAGT). SNAP-tag substrates are fluorophores, biotin or beads conjugated to guanine or chloropyrimidine leaving groups via a benzyl linker. In the labeling reaction, the substituted benzyl group of the substrate is covalently attached to the SNAP-tag.

There are two steps to using this system: sub-cloning and expression of the protein of interest as a SNAP-tag fusion, and labeling of the fusion with the SNAP-tag substrate of choice. Expression of SNAP-tag fusion proteins is described in the documentation supplied with SNAP-tag plasmids. The labeling of the fusion proteins with the SNAP-tag substrate is described in this document.



**Figure 1.** Structure of BG-Maleimide (MW 489.5 g/mol)

### Storage

Dry BG-Maleimide should be stored at -20°C.

The BG-Maleimide building block should be dissolved in anhydrous DMF. Choose a solvent volume that will be compatible with the final use. Unused building block dissolved in DMF should be stored at -20°C.

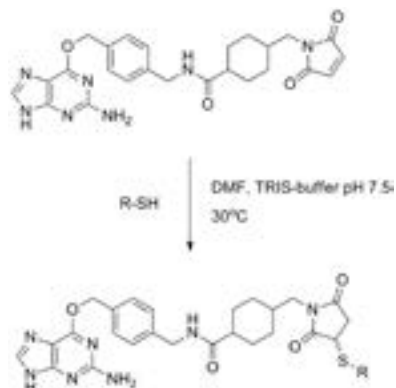
### Quality Control

**Purity and Characterization:** Purity of BG-Maleimide was determined to be 98% by HPLC analysis. Molecular weight [M+H]<sup>+</sup> was determined by MS to be 490.2 (490.2 expected)

### Reaction Conditions for Chemical Coupling

Coupling reactions are typically performed at room temperature overnight by using N, N-dimethylformamide (DMF) and Tris-HCl or PBS Buffer (pH 7.0–7.5) as solvent. It may be advisable to carry out the reduction of disulfide bonds by adding a 10-fold molar excess of a reducing agent such as DTT or TCEP. If DTT is used, then dialysis is required to remove the excess of DTT prior to the addition of the reactive maleimide.

### Example Reaction: Coupling of BG-Maleimide to a 5' thiol modified Oligonucleotide:



**Figure 2.** Reaction of BG-Maleimide with thiol groups. The 5'-thiol modified oligonucleotide (43 nmol) was reduced by incubation for 1 hour at room temperature with 10 mM DTT in 200 µl 20 mM Tris-HCl pH 8.5. The DTT was removed by gel filtration and the oligonucleotide eluted in PBS buffer (pH 7.4). The most concentrated fractions were combined giving a total of 800 µl. Three hundred microliters of BG-maleimide solution (2.5 mM in DMF) was added and the reaction mixture incubated at room temperature for 1 hour. The reaction mixture was diluted with water to a total volume of 2 ml and excess maleimide removed by gel filtration. The BG-maleimide-oligonucleotide conjugate was then purified by HPLC (solvent A: 0.1 M tetraethylammonium acetate pH 6.9 in water; solvent B: acetonitrile).

### Protocol for Labeling SNAP-tag Fusion Proteins with BG-substrates

Once the thiol-containing precursor has been converted into a BG-substrate it can be used to label SNAP-tag fusion proteins. These can be labeled in cell lysates or as purified protein. For expression of fusion proteins with the SNAP-tag, refer to instructions supplied with the SNAP-tag plasmids.

We recommend using a 1.5 fold excess of substrate over SNAP-tag fusion protein and incubating for 1 hour at room temperature. Typical concentrations are 30 µM substrate and 20 µM SNAP-tag fusion protein. The labeling incubation is followed by a separation step such as dialysis or spin column separation to remove unreacted substrate.

### Notes

Unlabeled protein samples should be stored at -20°C, or at -80°C for long-term storage. Many proteins benefit from the addition of glycerol for frozen storage, typically 20% v/v. Handling at temperatures above 0°C should be minimized by thawing the unlabeled protein samples shortly before use, and keeping them on ice until just before the labeling reaction.

We recommend the routine addition of 1 mM DTT to all buffers used for handling, labeling and storage of SNAP-tag fusion proteins. The stability of the SNAP-tag is improved in the presence of reducing agents; however it can also be labeled in their absence.

If a particular fusion protein requires buffers without reducing agents, pay particular attention to minimize all handling steps of the protein above 4°C prior to the labeling reaction.

The SNAP-tag labeling reaction works well between pH 5.0 and pH 10.0. The salt concentration may need to be optimized for your particular fusion protein, although the SNAP-tag labeling reaction has been shown to work at a broad range of ionic strengths (NaCl concentrations between 15 mM and 1 M). If the buffer conditions used for labeling lead to insolubility of your protein, we recommend testing a range of pH and ionic strengths. For a range of fusion proteins we have found ionic strengths for monovalent salts (e.g. sodium chloride) from 50 mM to 250 mM helpful.

Where stickiness of the fusion protein is a problem we recommend adding Tween 20 at a final concentration of 0.05% to 0.1%. At this concentration Tween 20 does not affect the performance of the SNAP-tag. Ionic detergents (e.g. SDS) should be avoided.

The maximum degree of labeling possible with the SNAP-tag is one molecule of label per molecule of fusion protein.

### Storage and Handling of Labeled SNAP-tag Fusion Proteins

Labeled SNAP-tag fusion proteins should be stored at concentrations of 1 mg/ml or less at 4°C protected from light. Sodium azide may be added to 2 mM final concentration. Under these conditions the labeled protein should be stable at 2–6°C for several months. If freezing is required, it may be best to shock freeze by rapidly cooling the sample to a temperature significantly below 0°C in the presence of 20% (v/v) glycerol.

Labeled protein is linked to the SNAP-tag label by a covalent bond. Therefore the conjugates are highly stable. DTT or other reducing agent is not required in the storage buffers. As the fusion protein is covalently labeled, labeled protein may be detected after harsh or even denaturing treatments, such as chromatographic or electrophoretic separation including SDS-PAGE.

Note: Avoid repeated freezing and thawing. Protect from light if the protein is labeled with a fluorophore.

### Troubleshooting

#### Labeling reaction

If exhaustive labeling of a protein sample is not achieved using the recommended conditions, try the following protocol modifications: Increase the incubation time to two hours total at 25°C or to 24 hours at 4°C; or double the ratio of label to protein in the labeling reaction. Both approaches may be combined. If you still have poor labeling results, we recommend checking the activity of the SNAP-tag.

If your fusion protein is particularly sensitive to degradation or to loss of activity, you can try reducing the labeling time or decreasing the labeling temperature. If you label at 4°C we recommend overnight incubation.

#### Inefficient Labeling

If the degree of labeling is extremely low, the labeling reaction was probably inefficient. A number of reasons can lead to such inefficient labeling:

If you added the substrate dissolved in DMSO at greater than 1% of the volume of protein solution, the higher DMSO concentration may slow down the reaction rate. At lower substrate concentrations the labeling time should be increased to 2 hours.

(see other side)

CERTIFICATE OF ANALYSIS

The activity of the SNAP-tag may have been partially or completely lost. This may be due to extended storage of non-reacted SNAP-tag fusion proteins at 4°C or greater. The sensitivity of the SNAP-tag to inactivation is also significantly increased if no reducing agent is added (such as DTT at 1 mM).

If you believe that the activity of the SNAP-tag is affected, we recommend analyzing a small fraction of it on an SDS-PAGE gel using SNAP-Vista Green (NEB #S9147) to confirm that the SNAP-tag is active.

If you encounter problems with the activity we recommend thawing another sample of your protein or reexpressing and repurifying the SNAP-tag fusion protein following the advice given in the pSNAP<sub>1</sub> Vector (NEB #N9183) instructions.

## Reference

1. Jongsma, M.A. and Litjens, R.H. (2006) *Proteomics*, 6, 2650–2655.



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The products and/or their use may be covered by one or more of the following patents and patent applications: U.S. Patent No. 7,939,284 (Methods for Using O6-Alkylguanine-DNA-Alkyltransferases); U.S. Patent No. 7,888,090 (Mutants of O6-Alkylguanine-DNA-Alkyltransferases); U.S. Patent No. 8,163,479 (Specific Substrates for O6-Alkylguanine-DNA-Alkyltransferases); U.S. Patent No. 8,178,314 (Pyrimidines reacting with O6-Alkylguanine-DNA-Alkyltransferases); PCT/EP2007/057597 (Labeling of Fusion Proteins with Synthetic Probes); EP07117800 (Drug Delivery); EP07117802 (Drug Delivery); EP07120288 (GTPase-Transient Protein Protein Interactions) These patents and patent applications are owned by Covaly, or owned by the Ecole Polytechnique Fédérale de Lausanne (EPFL) and exclusively licensed to Covaly and NEB.