



AnaTag™ AMCA-X Protein Labeling Kit

Revision Number: 1.1	<i>Last updated: October 2014</i>
Catalog #	AS-72055
Kit Size	3 Conjugation Reactions

- This kit is optimized to conjugate AMCA-X to proteins (e.g., IgG).
- It provides ample materials to perform three protein conjugations and purifications.
- One conjugation reaction can label up to 5 mg protein.
- The entire process only takes about half an hour.

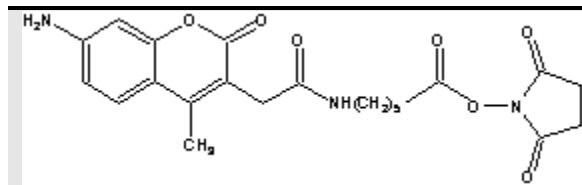
Kit Components, Storage and Handling

Component	Function	Quantity
A. AMCA-X SE	Amino-reactive dye	3 vials
B. Reaction buffer	For pH adjustment of the conjugate reaction	0.5 mL
C. Desalting column	Purify dye-protein conjugate	3 Pre-packed columns
D. DMSO	Solvent for preparing dye solution	1 mL
E. 10X Elution buffer	Solution for eluting dye-protein conjugates	30 mL

Storage and Handling

- Store all kit components at 4°C.
- Keep component A away from light and protect from moisture.
- Component A may be frozen

Introduction



Physical and Spectral Properties of AMCA-X SE:

- **Fluorescence:** Blue
- **Molecular weight:** 443.46
- **Maximal absorption:** 347 nm
- **Maximal emission:** 447 nm
- **Reactive form:** Succinimidyl esters (amine-reactive)

AMCA-X SE (6-((7-Amino-4-methylcoumarin-3-acetyl)amino)hexanoic acid, succinimidyl ester) is one of the most popular blue fluorophores used to label proteins. AMCA-X succinimidyl ester contains a seven-atom aminohexanoyl spacer, the so-called 'X' spacer, between the fluorophore and the reactive group. It is well known that the spacer between the fluorophore and the reactive group potentially reduces the quenching that typically occurs upon conjugation. In some cases, the 'X' spacer allows the dye to be more available for recognition by secondary detection reagents.

The AnaTag™ AMCA-X Protein Labeling Kit provides a convenient way to label proteins by using the succinimidyl ester (SE) reactive form of AMCA-X. Succinimidyl ester shows good reactivity and selectivity with aliphatic amines of the protein and forms a carboxamide bond, which is identical to, and is as stable as the natural peptide bond (Figure 1). AMCA-X-protein conjugates are very stable and are suitable for immunofluorescent staining, fluorescence *in situ* hybridization, flow cytometry and other biological applications.

The kit has all the essential components for performing the conjugation reaction and for purifying the AMCA-X-protein conjugates.

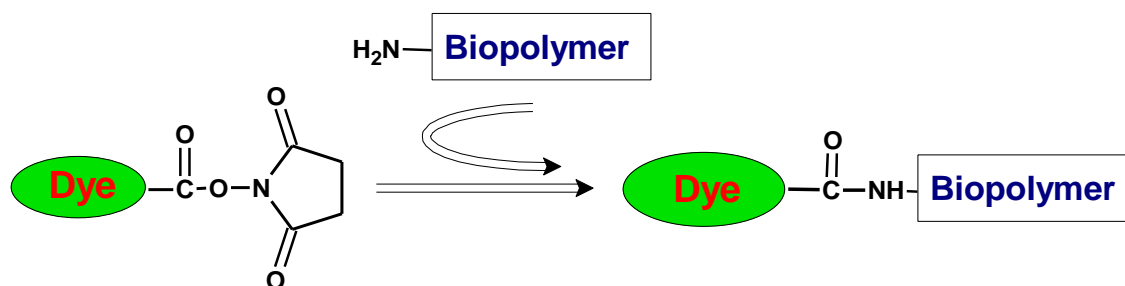


Figure 1. The succinimidyl ester group of fluorophore reacts with amine groups on the protein to form a stable carboxamide bond.

Protocol

1. Preparing the protein solution

Add reaction buffer (component B) at 1/10 (v/v) ratio to your target protein (e.g. antibody) solution (2-10 mg/mL is the recommended concentration range of protein).

Note 1: The protein can be dissolved in phosphate, carbonate, borate, triethanolamine or MOPS buffer, pH 7.2-7.5, without reducing reagents (e.g. DTT), protein stabilizers (e.g. BSA) or sodium azide. If the protein is dissolved in Tris or glycine buffer, it should be dialyzed against 0.01 M phosphate buffer saline, pH 7.2-7.4 to get rid of free amines. Ammonium salts (such as ammonium sulfate and ammonium acetate) that are widely used for protein precipitation must also be removed before performing the dye conjugations.

Note 2: The conjugation efficiency is poor when the concentration of protein is less than 2 mg/mL. Meanwhile, the purification column included in this kit can maximally purify 3 mL conjugate solution. You may concentrate the protein solution using a speed vacuum or a centrifugal filter (Millipore, Cat# 42407).

2. Preparing the dye solution

Add 20 μ L of DMSO (component D) to one vial of AMCA-X SE (component A). This gives a 10 mg/mL of dye solution (22.5 mM). Completely dissolve all the dye contents by vortexing.

Note: Dye solution should be prepared fresh for each conjugation reaction. Extended storage of the dye solution may reduce dye activity. Any solutions containing the dye must be kept from light.

3. Performing the conjugation reaction

Note: The procedure given here is optimized for IgG (MW ~ 150,000) labeling with AMCA-X SE. The dye: protein molar ratio is 10:1. For proteins other than IgG, the optimal dye/protein molar ratio may need to be determined. It will normally be between 2:1 and 20:1.

- 3.1 Calculate the needed volume of AMCA-X solution for conjugation reaction. For labeling IgG the recommended dye:protein molar ratio is 10:1. Table 1 gives a quick reference for labeling IgG. Add the needed amount of dye solution to a clean tube.

Note: The molecular weight of IgG is 150 kDa.

Table 1. The volume of dye solution needed for different amount of IgG.

Ig G	Dye solution
0.5 mg	1.5 μ L
1 mg	3.0 μ L
1.5 mg	4.4 μ L
2 mg	5.9 μ L
2.5 mg	7.4 μ L
3 mg	8.8 μ L
3.5 mg	10.4 μ L
4 mg	11.8 μ L
4.5 mg	13.3 μ L
5 mg	14.8 μ L

- 3.2 Add DMSO (component D) at 10% of your protein solution volume to the above tube containing dye solution.

- 3.3 Add the diluted dye into your protein solution.

Note: Since AMCA-X has poor water solubility, 10% DMSO is necessary to present in the conjugation reaction mixture.

- 3.4 Keep the reaction mixture away from light and shake for 15 minutes - 1 hour at room temperature on a rotator or a shaker.

4. Purify dye-protein conjugates

Note: The desalting column (component C) is best suited for purifying proteins of MW>6,000. For smaller proteins, we recommend using Sephadex LH-20 or dialysis. HPLC may also be used to purify the smaller protein or peptide conjugates.

- 4.1 Dilute 10X elution buffer (component E) to 1X in deionized water.
- 4.2 Hold the desalting column (component C) upright. Remove the top cap of the column, and then cut its bottom tip. Pour off the excess buffer above the top frit.
- 4.3 Add 25 mL 1X elution buffer to pre-equilibrate the column.
- 4.4 Allow the buffer to drain to the top frit. The column will not run dry. Flow will stop when the buffer level reaches the top frit. Load the column with the reaction mixture (directly from step 3.2.).
- 4.5 Allow entire sample to enter the column, add 10 mL 1X elution buffer into the column.
- 4.6 As the reaction mixture runs down the column, you should see the colored material separated into two bands. The faster-running band (lower band) contains the desired dye-labeled protein, while the slower-running band (upper band) contains the free dye.
- 4.7 Collect the faster-running band only. Avoid the slower-running band, which will contaminate your conjugate.
- 4.8 The degree of substitution (DOS) of the conjugate can be determined according to the Appendix.

Appendix. Characterizing the Dye-Protein Conjugate

The degree of substitution (DOS) is important for characterizing dye-labeled proteins. Proteins of lower DOS usually have weaker fluorescence intensity, but proteins of higher DOS (e.g. DOS>6) tend to have reduced fluorescence due to fluorescence quenching. The optimal DOS recommended for most antibodies is between 2 and 6. To determine the DOS of AMCA-X SE labeled proteins:

1. Read absorbance at 280 nm (A_{280}) and 347 (A_{\max})

For most spectrophotometers, dilute a small portion of conjugate solution in phosphate buffered saline so that the absorbance readings are in the 0.1 to 0.9 ranges. The maximal absorption of protein is at 280 nm (A_{280}). The maximal absorption of AMCA-X (A_{\max}) is approximately at 347 nm.

2. Calculating the DOS using the following equations for IgG labeling

Molar concentration of dye:

$$[\text{Dye}] = (A_{\max}/0.692 \times \text{dilution factor}) / \epsilon_{\text{AMCA-X}} \quad \epsilon_{\text{AMCA-X}} = 19,000 \text{ cm}^{-1}\text{M}^{-1}$$

ϵ is the extinction coefficient.

Note: The absorption of AMCA is environmentally sensitive. The constant, 0.692, is used to convert the absorption of AMCA in phosphate buffered saline to methanol.

Molar concentration of protein:

$$[\text{Protein}] = ((A_{280} - 0.368 \times A_{\max}) \times \text{dilution factor}) / \epsilon_{\text{protein}} \quad \epsilon_{\text{IgG}} = 203,000 \text{ cm}^{-1}\text{M}^{-1}$$

$$\text{DOS} = [\text{Dye}]/[\text{Protein}]$$

Protein concentration (mg/mL):

$$\text{Ig G (mg/mL)} = [\text{Ig G}] \times 150,000 \quad \text{MW}_{\text{Ig G}} = 150,000$$

For effective labeling, the degree of substitution should fall within 2-6 moles of AMCA-X per one mole of protein.

Storage of Dye - Protein Conjugates

The dye-labeled protein should be stored at > 0.5 mg/mL or in the presence of a carrier protein (e.g., 0.1% Bovine Serum Albumin). We recommend adding preservative (e.g. 0.01% sodium azide). The dye-labeled protein can be stored at 4°C for two months without significant changes if kept from light. For extended storage, it can be aliquoted or lyophilized and stored at -20°C in the dark.

References

1. Hermanson GT (1996). *Bioconjugate Techniques*, Academic Press, New York.
2. Haugland RP (1995). Coupling of monoclonal antibodies with fluorophores. *Methods Mol Biol* **45**, 205-21.
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4. Banks PR, Paquette DM (1995). Comparison of three common amine reactive fluorescent probes used for conjugation to biomolecules by capillary zone electrophoresis. *Bioconjug Chem.* **6**, 447-58.