HAT Inhibitor Screening Assay Kit

Item No. 10006515

www.caymanchem.com
Customer Service 800.364.9897
Technical Support 888.526.5351
1180 E. Ellsworth Rd · Ann Arbor, MI · USA

TABLE OF CONTENTS

GENERAL INFORMATION

Materials Supplied

Item Number	Item	Quantity
10009330	HAT Assay Buffer (5X)	1 vial
10009331	HAT Acetyl CoA	1 vial
10009332	Histone Acetyltransferase (PCAF)	1 vial
10009333	HAT Peptide	1 vial
10009334	HAT Stop Reagent	1 vial
10009335	HAT Developer	1 vial
400013	96-Well Solid Plate (white)	1 plate
400012	96-Well Cover Sheet	1 cover

If any of the items listed above are damaged or missing, please contact our Customer Service department at (800) 364-9897 or (734) 971-3335. We cannot accept any returns without prior authorization.

WARNING: THIS PRODUCT IS FOR RESEARCH ONLY - NOT FOR HUMAN OR VETERINARY DIAGNOSTIC OR THERAPEUTIC USE.

Safety Data

This material should be considered hazardous until further information becomes available. Do not ingest, inhale, get in eyes, on skin, or on clothing. Wash thoroughly after handling. Before use, the user must review the complete Safety Data Sheet, which has been sent *via* email to your institution.

Precautions

Please read these instructions carefully before beginning this assay.

If You Have Problems

Technical Service Contact Information

Phone: 888-526-5351 (USA and Canada only) or 734-975-3888

Fax: 734-971-3641

Email: techserv@caymanchem.com

Hours: M-F 8:00 AM to 5:30 PM EST

In order for our staff to assist you quickly and efficiently, please be ready to supply the lot number of the kit (found on the outside of the box).

Storage and Stability

This kit will perform as specified if stored at -20°C and used before the expiration date indicated on the outside of the box.

Materials Needed But Not Supplied

1. A fluorometer with the ability to measure fluorescence using an excitation wavelength of 360-390 nm and an emission wavelength of 450-470 nm
2. Adjustable pipettes and a multichannel or repeating pipette
3. A source of UltraPure water (*i.e.*, Milli-Q or HPLC-grade water)

INTRODUCTION

Background

DNA is organized into a nucleoprotein complex termed chromatin, which not only is involved with the compaction of DNA within the nucleus but also serves as an important means to regulate genome function. The basic unit of chromatin is the nucleosome. Each nucleosome core contains two molecules each of the core histones H2A, H2B, H3, and H4. Almost two turns of DNA are wrapped around this octameric core, which represses transcription.[1] The histone amino termini extend from the core, where they can be modified post-translationally by acetylation, phosphorylation, ubiquitination, and methylation, affecting their charge and function. Acetylation of the ε-amino groups of specific histone lysine residues, is catalyzed by histone acetyltransferases (HATs) producing a histone modification that correlates with an open chromatin structure and gene activation. Histone deacetylases (HDACs) catalyze the hydrolytic removal of acetyl groups from histone lysine residues and correlates with chromatin condensation and transcriptional repression.[2,3] Functional defects of either of these enzymes can lead to several diseases, ranging from cancer to neurodenerative dieases. HATs and HDACs thus are potential therapeutic targets.

The p300/CBP-Associated Factor (PCAF) is an important HAT belonging to the GCN5-related N-acetyltransferase (GNAT) family. PCAF acetylates specific lysines on the N-terminal tails of histones H3 and H4. PCAF has also been shown to acetylate the tumor suppressor genes, p53 and PTEN.[4,5] The p53 tumor suppressor gene is the major target for genetic alteration or biochemical inactivation in human cancer(s).[5] Numerous studies have demonstrated that p53 acetylation can greatly enhance its transactivation activity, increase its stability, and induce apoptosis.[5] Acetylation of PTEN by PCAF, results in the inhibition of PTEN regulation of phosphatidylinositol 3-kinase signaling and inhibition of PTEN-regulated cell cycle arrest.[4]

About This Assay

Cayman's HAT Inhibitor Screening Assay Kit provides a fast, fluorescence-based method for evaluating PCAF HAT inhibitors. The procedure requires only three easy steps, all performed in the same microwell plate. In the first step of the protocol, HAT is incubated with acetyl-CoA and the histone H3 peptide. During this time, HAT catalyzes the enzymatic transfer of acetyl groups from acetyl-CoA to the H3 peptide producing an acetylated peptide and CoASH. Following addition of isopropanol to stop the enzymatic reaction (step 2), CPM is added to the wells of the plate (step 3). CPM reacts with the free thiol groups present on CoASH forming a highly fluorescent product that is detected using excitation and emission wavelengths of 360-390 nm and 450-470 nm, respectively. The scheme is shown below in Figure 1.

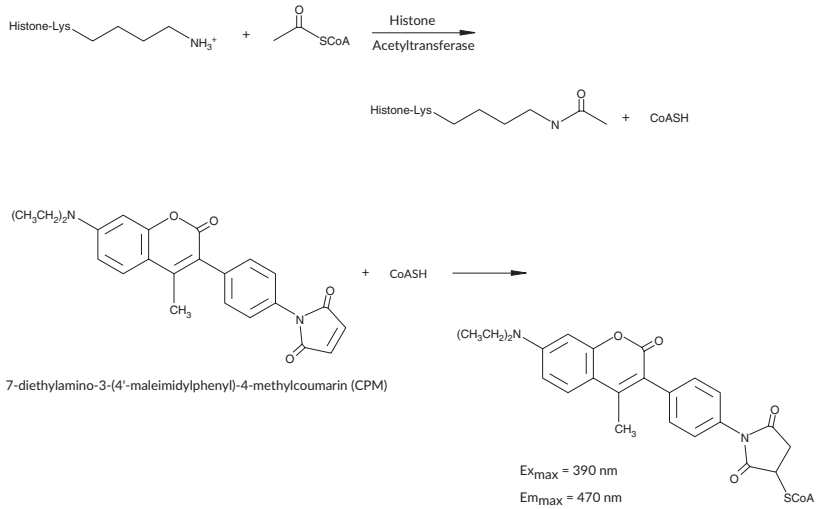


Figure 1. Reaction sequence for the HAT Inhibitor Screening assay

PRE-ASSAY PREPARATION

Reagent Preparation

1. **HAT Assay Buffer (5X) - (Item No. 10009330)**

   Mix 10 ml of Assay Buffer concentrate with 40 ml of UltraPure water. This final Assay Buffer (100 mM HEPES, pH 7.5, containing 0.8% Triton X-100) must be used in the assay, and for diluting HAT Acetyl CoA, HAT, and the HAT Developer. When stored at 4°C, this diluted Assay Buffer is stable for at least three months.

2. **HAT Acetyl CoA - (Item No. 10009331)**

   This vial contains 200 µl of an acetyl CoA solution. Prior to use in the assay, mix 100 µl of Acetyl CoA with 500 µl Assay Buffer. The diluted Acetyl CoA solution is stable for one week at -20°C.

3. **Histone Acetyltransferase (PCAF) - (Item No. 10009332)**

   This vial contains 200 µl of human recombinant PCAF histone acetyltransferase. The enzyme is the catalytic domain of PCAF (p300/CREB-binding protein Associated Factor).[7] Prior to use in the assay, thaw the enzyme on ice and mix 40 µl of PCAF with 960 µl of Assay Buffer. Store the diluted enzyme on ice. The diluted enzyme will be stable for four hours.

4. **HAT Peptide - (Item No. 10009333)**

   This vial contains 2.5 ml of 250 µM histone H3 peptide. The Peptide comprises residues 5-23 of the human histone H3 N-terminal tail and is centered on Lys-14, the preferred acetylation site for the GCN5/PCAF family of HATs.[8] The solution is ready to use as supplied. *NOTE: The final concentration of Peptide in the assay as described below is 100 µM. This concentration may be reduced with diluted Assay Buffer at the user's discretion.*

5. **HAT Stop Reagent - (Item No. 10009334)**

   This vial contains 10 ml of isopropanol. It is ready to use as supplied.

6. **HAT Developer - (Item No. 10009335)**

   This vial contains 500 µl of 7-diethylamino-3-(4'-maleimidylphenyl)-4-methyl-coumarin (CPM) in dimethylsulfoxide. Prior to use in the assay, mix 100 µl of CPM with 11.9 ml of Assay Buffer. Cover the vial with tin foil. The diluted Developer is stable for six hours.

ASSAY PROTOCOL

Plate Set Up

There is no specific pattern for using the wells on the plate. We suggest that there be at least three wells designated as 100% initial activity and three wells designated as background wells. We suggest that each inhibitor sample be assayed in triplicate and that you record the contents of each well on the template sheet provided on page 19. A typical layout of samples and inhibitors to be measured in triplicate is shown in Figure 2.

	1	2	3	4	5	6	7	8	9	10	11	12
A	BW	BW	BW	7	7	7	15	15	15	23	23	23
B	A	A	A	8	8	8	16	16	16	24	24	24
C	1	1	1	9	9	9	17	17	17	25	25	25
D	2	2	2	10	10	10	18	18	18	26	26	26
E	3	3	3	11	11	11	19	19	19	27	27	27
F	4	4	4	12	12	12	20	20	20	28	28	28
G	5	5	5	13	13	13	21	21	21	29	29	29
H	6	6	6	14	14	14	22	22	22	30	30	30

BW - Background Wells
A - 100% Initial Activity Wells
1-30 - Inhibitor Wells

Figure 2. Sample plate format

Pipetting Hints

- It is recommended that a multichannel pipette be used to deliver reagents to the wells.
- Before pipetting each reagent, equilibrate the pipette tip in that reagent (*i.e.*, slowly fill the tip and gently expel the contents, repeat several times).
- Do not expose the pipette tip to the reagent(s) already in the well.

General Information

- The final volume of the assay is 205 µl in all the wells.
- Use the diluted Assay Buffer in the assay.
- All reagents except HAT (PCAF) must be equilibrated to room temperature before beginning the assay.
- It is not necessary to use all the wells on the plate at one time.
- If the appropriate effective inhibitor concentration is not known, it may be necessary to assay at several dilutions.
- It is recommended that the samples be assayed at least in triplicate, but it is the user's discretion to do so.
- 30 inhibitor samples can be assayed in triplicate or 46 in duplicate.
- The assay temperature is 22-25°C.
- Monitor the fluorescence using an excitation wavelength of 360-390 nm and an emission wavelength of 450-470 nm.

Performing the Assay

1. **100% Initial Activity Wells -** add 15 µl of Assay Buffer, 5 µl of Acetyl CoA, 10 µl of diluted PCAF, and 5 µl of solvent (the same solvent used to dissolve the inhibitor) to three wells.
2. **Background Wells -** add 15 µl of Assay Buffer, 5 µl of Acetyl CoA, 10 µl of diluted PCAF, and 5 µl of solvent (the same solvent used to dissolve the inhibitor) to three wells.
3. **Inhibitor Wells -** add 15 µl of Assay Buffer, 5 µl of Acetyl CoA, 10 µl of diluted PCAF, and 5 µl of inhibitor* to three wells.
4. Incubate for 5 minutes at room temperature.
5. Initiate the reactions by adding 20 µl of HAT Peptide to all the wells being used **except** the background wells.
6. Cover the plate with the plate cover and incubate on a shaker for twenty minutes at room temperature.
7. Remove the plate cover and add 50 µl of HAT Stop Reagent to all the wells being used including the background wells.
8. Add 20 µl of HAT Peptide to the background wells only.
9. Add 100 µl of HAT Developer to all the wells being used including the background wells.
10. Cover the plate with the plate cover and incubate for 20 minutes at room temperature.
11. Remove the plate cover and read the plate using an excitation wavelength of 360-390 nm and an emission wavelength of 450-470 nm. It may be necessary to adjust the gain setting on the instrument to allow for the measurement of all the samples. The fluorescence is stable for 30 minutes.

*Inhibitors can be dissolved in Assay Buffer, ethanol, methanol, or dimethylsulfoxide and should be added to the assay in a final volume of 5 µl. In the event that the appropriate concentration of inhibitor needed for HAT inhibition is completely unknown, we recommend that several concentrations of the inhibitor be assayed.

Steps	Reagent	100% Initial Activity	Background Wells	Inhibitor Wells*
1. Pipette reagents	HAT Assay Buffer	15 µl	15 µl	15 µl
	HAT Acetyl CoA	5 µl	5 µl	5 µl
	PCAF	10 µl	10 µl	10 µl
	Solvent	5 µl	5 µl	---
	Inhibitor	---	---	5 µl
2. Incubate	5 minutes at room temperature			
3. Initiate Reaction	HAT Peptide	20 µl	---	20 µl
4. Incubate	20 minutes at room temperature			
5. Stop Reaction	HAT Stop Reagent	50 µl	50 µl	50 µl
	HAT Peptide	---	20 µl	---
6. Develop	HAT Developer	100 µl	100 µl	100 µl
7. Incubate	20 minutes at room temperature			
8. Read	Excitation 360-390 nm; Emission 450-470 nm			

Table 1. Assay protocol

ANALYSIS

Many plate readers come with data reduction software that plot data automatically. Alternatively a spreadsheet program can be used.

Calculations

1. Calculate the average fluorescence of each sample.
2. Subtract the fluorescence of the background wells from the fluorescence of the 100% initial activity and the inhibitor wells.
3. Determine the percent inhibition for each sample.

$$\text{\% Inhibition} = \left[\frac{\text{100\% Initial Activity - Inhibitor Sample Activity}}{\text{100\% Initial Activity}}\right] \times 100$$

4. Graph the Percent Inhibition (or Percent Initial Activity) as a function of the inhibitor concentration to determine the IC_{50} value (concentration at which there is 50% inhibition).

Performance Characteristics

Precision:

When a series of 16 HAT samples were performed on the same day, the intra-assay coefficient of variation was 3.2%. When a series of 16 HAT samples were performed on six different days under the same experimental conditions, the inter-assay coefficient of variation was 4.4%.

Interferences

There is a possibility that potential HAT inhibitors may interfere with the assay. If you are experiencing erratic fluorescence values in the inhibitor wells, test the inhibitor for interference using the protocol outlined below.

Interference Protocol:

1. **100% Initial Activity Wells -** add 15 µl of Assay Buffer, 5 µl of Acetyl CoA, 10 µl of diluted PCAF, and 5 µl of solvent (the same solvent used to dissolve the inhibitor) to three wells.
2. **Background Wells -** add 15 µl of Assay Buffer, 5 µl of Acetyl CoA, 10 µl of diluted PCAF, and 5 µl of solvent (the same solvent used to dissolve the inhibitor) to three wells.
3. **Inhibitor Wells -** add 15 µl of Assay Buffer, 5 µl of Acetyl CoA, 10 µl of diluted PCAF, and 5 µl of inhibitor to three wells.
4. **Interference Wells -** add 15 µl of Assay Buffer, 5 µl of Acetyl CoA, 10 µl of diluted PCAF, and 5 µl of inhibitor to three wells.
5. Incubate for five minutes at room temperature.
6. Initiate the reactions by adding 20 µl of HAT Peptide to all the wells being used **except** the background and interference wells.
7. Cover the plate with the plate cover and incubate on a shaker for 20 minutes at room temperature.
8. Remove the plate cover and add 50 µl of HAT Stop Reagent to all the wells being used including the background and interference wells.
9. Add 20 µl of HAT Peptide to the background and interference wells only.
10. Add 100 µl of HAT Developer to all the wells being used including the background and interference wells.
11. Cover the plate with the plate cover and incubate for 20 minutes at room temperature.
12. Remove the plate cover and read the plate using an excitation wavelength of 360-390 nm and an emission wavelength of 450-470 nm. It may be necessary to adjust the gain setting on the instrument to allow for the measurement of all the samples. The fluorescence is stable for 30 minutes.

Determining Interference:

1. Determine the average fluorescence of each sample.
2. Subtract the fluorescence of the background wells from the fluorescence of the 100% initial activity wells.
3. Subtract the fluorescence of the interference test wells from the fluorescence of the inhibitor wells.
4. If the fluorescence seen in the inhibitor wells is greater than the 100% Initial Activity wells, then the compound is interfering in the assay and should not be used.
5. An example of a known PCAF HAT inhibitor, garcinol, interfering with the assay is shown in Figure 3.[9]

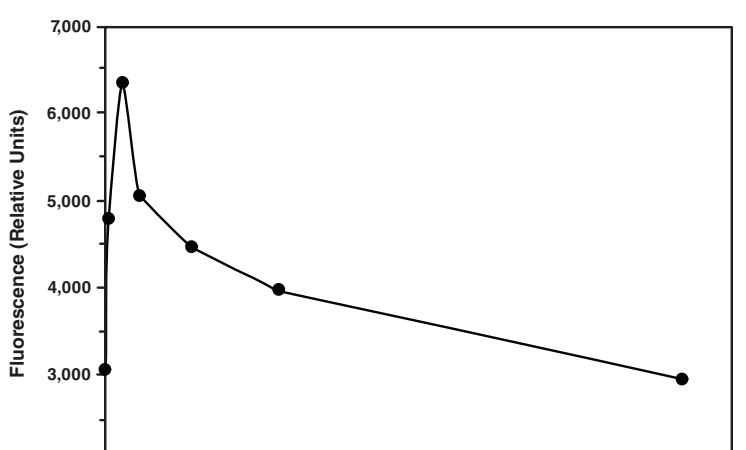


Figure 3. Interference of garcinol in the assay

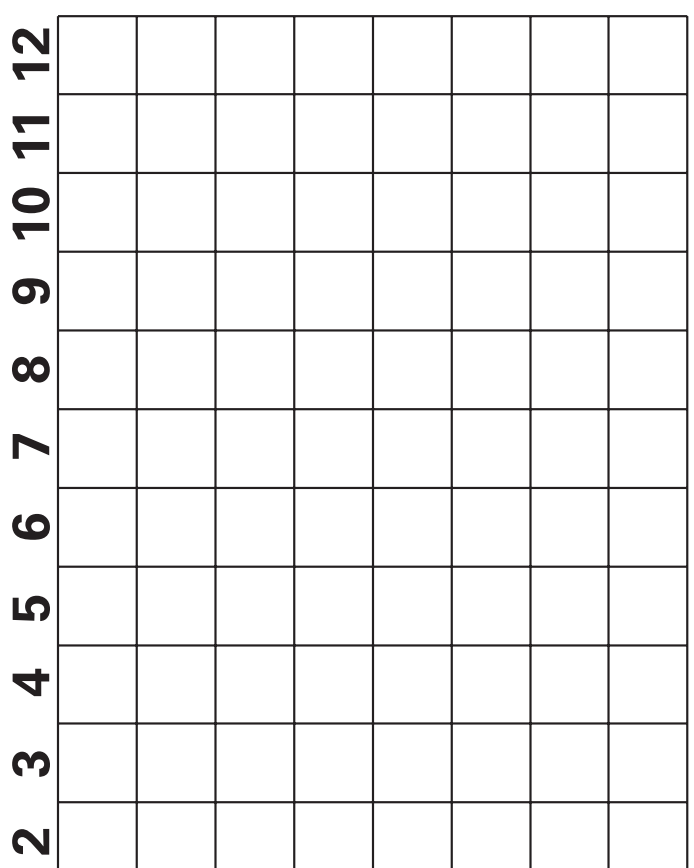
RESOURCES

Troubleshooting

Problem	Possible Causes	Recommended Solutions
Erratic values; dispersion of duplicates/triplicates	A. Poor pipetting/ technique B. Bubble in the well(s)	A. Be careful not to splash the contents of the wells B. Carefully tap the side of the plate with your finger to remove bubbles
No fluorescence above background is seen in the Inhibitor wells	A. Enzyme, acetyl CoA, or HAT peptide was not added to the well(s) B. Inhibitor concentration is too high and inhibited all of the enzyme activity	A. Make sure to add all the components to the wells B. Reduce the concentration of the inhibitor and re-assay
Fluorescence value was at the maximal level in the wells	A. The enzyme is too concentrated B. The *gain* setting is set too high	A. Set the *gain* to a lower setting and measure the fluorescence B. Make sure that you diluted the enzyme before assaying
The inhibitor did not inhibit the enzyme	Either the inhibitor concentration is not high enough or the compound is not an inhibitor	Increase the inhibitor concentration and re-assay
The fluorescence of the inhibitor wells is higher than the 100% Initial activity wells	The inhibitor may be interfering with the assay	See Interference section for guidance (see page 14)

References

1. Grunstein, M. Histone acetylation in chromatin structure and transcription. *Nature* **389**, 349-352 (1997).
2. Strahl, B.D. and Allis, D. The language of covalent histone modifications. *Nature* **403**, 41-45 (2000).
3. Cheung, W.L., Briggs, D.B., and Allis, C.D. Acetylation and chromosomal functions. *Curr. Opin. Cell Biol.* **12**, 326-333 (2000).
4. Okumura, K., Mendoza, M., Bachoo, R.M., *et al.* PCAF modulates PTEN activity. *J. Biol. Chem.* **281**, 26562-26568 (2006).
5. El-Deiry, W.S. The p53 pathway and cancer therapy. *Cancer Journal* **11**, 229-236 (1998).
6. Trievel, R.C., Li, F.-Y., and Marmorstein, R. Application of a fluorescent histone acetyltransferase assay to probe the substrate specificity of the human p300/CBP-associated factor. *Anal. Biochem.* **287**, 319-328 (2000).
7. Clements, A., Rojas, J.R., Trievel, R.C., *et al.* Crystal structure of the histone acetyltransferase domain of the human PCAF transcriptional regulator bound to coenzyme A. *EMBO J.* **18(13)**, 3521-3532 (1999).
8. Lau, O.D., Courtney, A.D., Vassilev, A., *et al.* p300/CBP-associated factor histone acetyltransferase processing of a peptide substrate. Kinetic analysis of the catalytic mechanism. *J. Biol. Chem.* **275(29)**, 21953-21959 (2000).
9. Balasubramanyam, K., Altaf, M., Varier, R.A., *et al.* Polyisoprenylated benzophenone, garcinol, a natural histone acetyltransferase inhibitor, represses chromatin transcription and alters global gene expression. *J. Biol. Chem.* **279(6)**, 33716-33726 (2004).



NOTES

Warranty and Limitation of Remedy

Buyer agrees to purchase the material subject to Cayman's Terms and Conditions. Complete Terms and Conditions including Warranty and Limitation of Liability information can be found on our website.