

**ab156067**

**SIRT3 Activity Assay Kit  
(Fluorometric)**

Instructions for Use

For the quantitative measurement of SIRT3 activity using crude SIRT3 (mitochondrial extracts) or purified SIRT3.

This product is for research use only and is not intended for diagnostic use.

# Table of Contents

---

1. Background	2
2. Overview	4
3. Principle of the Assay	5
4. Protocol Summary	7
5. Materials Supplied	8
6. Storage and Stability	9
7. Materials Required, Not Supplied	10
8. Assay Protocol	11
9. Data Analysis	19
10. Sample Preparation	22
11. Troubleshooting	23

# 1. Background

---

Sir2 is a conserved protein and was recently shown to regulate lifespan extension both in budding yeast and nematode. In 2000, it was reported that the yeast Sir2 protein is a NAD(+)-dependent histone deacetylase that plays a critical role in transcriptional silencing, genome stability and longevity. There are seven mammalian Sir2 homologs, all of which maintain the catalytic core domain of Sir2. NAD-dependent deacetylase activity has been demonstrated for mammalian SIRT1, SIRT2, SIRT3, SIRT5 and SIRT6 proteins.

The presence of NAD-dependent ADP-ribosylase and protein deacetylase activities of sirtuin proteins suggests that they may function as sensors of metabolic or oxidative states of cells and regulate cellular functions accordingly. Mammalian SIRT1, which resides in the nucleus, is the most closely related to yeast Sir2. SIRT1 binds and deacetylates p53, NF-kappa B, forkhead transcription factors, and histones. SIRT1 also suppresses muscle differentiation in response to the redox state. SIRT2 is a cytoplasmic protein, which colocalizes with microtubules and deacetylates alpha-tubulin. SIRT2 abundance increases during mitosis, suggesting that the protein plays a role in cell cycle regulation. Human SIRT3 is a mitochondria protein, with its N-terminal 25 amino acid residues responsible for its mitochondrial localization. Synthesized as an enzymatically inactive protein, Human SIRT3 is activated by mitochondrial matrix processing

peptidase to active 28-kD active enzyme. These observations suggest that the existence of a latent class III deacetylase that becomes catalytically activated upon import into the Human mitochondria.

However, the conventional method for measuring SIRT3 activity is very complicated and laborious. In order to measure SIRT3 enzyme activity, it is necessary to prepare radioactive acetylated histone or p53 as a substrate. First, cells have to be labeled metabolically with radioactivity by adding radioactive acetic acid to the culture medium. Second, radioactive acetylated histone has to be purified from the cells. Following the reaction, it is necessary to extract and separate the radioactive acetyl group, which has been released from acetylated histone, using ethyl acetate to measure the activity of the enzyme based on the radioactivity.

Although a method for measuring the activity of deacetylase without the use of radioactive substances was reported in recent years, owing to the use of fluorescent-labeled acetylated lysine as a substrate, the reaction product must be separated from the intact substrate and the fluorescent intensity measured by reverse phase HPLC. As mentioned above, these measurement systems are difficult to adapt for processing many samples under a variety of conditions, because of their complicated operation. Thus a simple system for biochemical analysis as well as for inhibitor screening without the use of radioactive substances is preferred.

## 2. Overview

---

Abcam's SIRT3 Activity Assay Kit (Fluorometric) (ab156067) is designed for the rapid and sensitive evaluation of SIRT3 inhibitors or activators using crude SIRT3 (mitochondrial) fraction or purified SIRT3.

Applications for this kit include:

- 1) Screening inhibitors or activators of SIRT3.
- 2) Detecting the effects of pharmacological agents on SIRT3.

### 3. Principle of the Assay

---

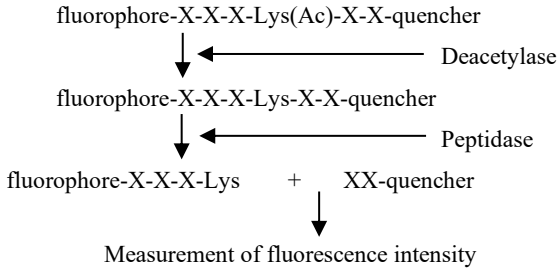
Abcam's SIRT3 Activity Assay Kit (Fluorometric) measures the activity of SIRT3 by the basic principle of changing a SIRT3 reaction into the activity of the peptidase. In order to measure the enzyme activity of SIRT3, which is the NAD dependent Histone deacetylase, and its homolog, this kit is designed so that the activity of NAD dependent Histone deacetylase can be measured under existence of Trichostatin A, which is the powerful inhibitor of HDACs.

In this kit, fluorophore and quencher are coupled to amino terminal and carboxyl terminal of substrate peptide, respectively, and before reaction of deacetylase, the fluorescence cannot be emitted. However, if SIRT3 performs deacetylation, substrate peptide will become cut by the action of peptidase added simultaneously, quencher will separate from fluorophore, and fluorescence will be emitted. Deacetylase enzyme activity is measured by measuring this fluorescence intensity.

Since it is very simple to measure and it can be performed at a low price, the measurement of SIRT3 activity in most laboratories is possible if they are equipped with a fluorescent reader for microtiter plates. Considering that the use of fully automatic apparatus to measure fluorescence intensity has become widespread, SIRT3 activity measurement, which could not be made by the conventional method, is now possible with the SIRT3 Activity Assay Kit

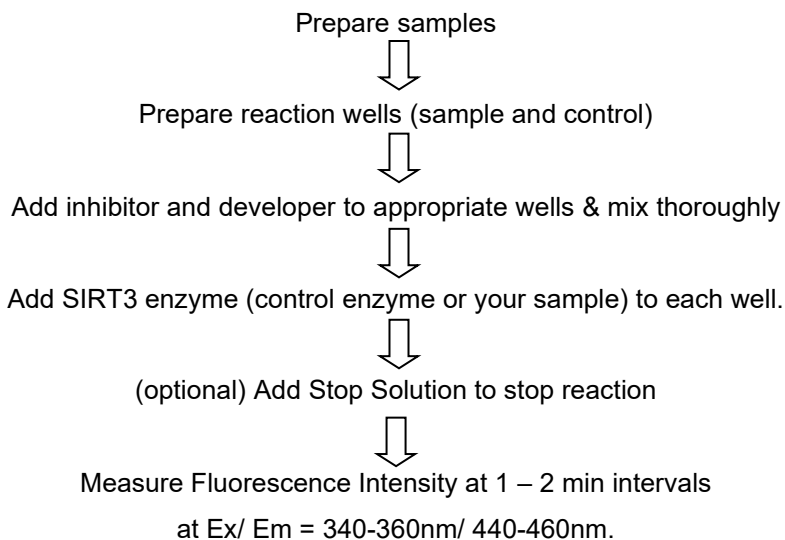
(Fluorometric) using the same equipment. This new method of measurement should dramatically raise the efficiency of inhibitor screening and biochemical analysis of these enzymes.

**Assay Principle:**



## 4. Protocol Summary

---



## 5. Materials Supplied

---

Item	Identifier	Quantity	Storage
SIRT3 Assay Buffer	#1	2 x 1 mL	-20°C
Fluoro-Substrate Peptide (0.2 mM)	#2	1 x 500 $\mu$ L	-20°C
Fluoro-Deacetylated Peptide (0.2 mM)	#3	1 x 100 $\mu$ L	-20°C
NAD (2 mM)	#4	1 x 500 $\mu$ L	-20°C
Developer	#5	1 x 500 $\mu$ L	-80°C
Recombinant SIRT3	#6	1 x 500 $\mu$ L	-80°C
Stop Solution	#7	2 x 1 mL	-20°C

## 6. Storage and Stability

---

All reagents included in this kit have been tested for stability. Reagents should not be used beyond the stated expiration date. Upon receipt, store the Developer and Recombinant SIRT3 at  $-80^{\circ}\text{C}$ , all other kit reagents should be stored below  $-20^{\circ}\text{C}$ .

- Thaw Fluoro-Substrate Peptide and Fluoro-Deacetylated Peptide at room temperature before use. Then, thaw the other reagents in ice and use after they are completely thawed.
- Avoid repeated freezing and thawing of Recombinant SIRT3. There is a possibility that the enzyme activity may be inactivated. Aliquot to 10-20  $\mu\text{L}$  and store at  $-80^{\circ}\text{C}$ .
- Avoid mixing of protease/peptidase inhibitors such as PMSF, or alkyl amine in samples that will be measured SIRT3 activity.

## 7. Materials Required, Not Supplied

---

- 96 well plate – black wells
- MilliQ water or other type of double distilled water (ddH<sub>2</sub>O)
- Microcentrifuge
- Pipettes and pipette tips
- Microplate reader capable of measuring fluorescence at Ex/Em = 340-360/440-460 nm
- Orbital shaker

## 8. Assay Protocol

---

Abcam's SIRT3 Activity Assay Kit (Fluorometric) can measure the enzyme activity of SIRT3 with a homogeneous method. In this method, the reaction is initiated and the fluorescence intensity is measured by mixing simultaneously fluorescence-labeled acetylated peptide, which is a substrate, SIRT3, NAD and the developer. Since the reaction is not stopped, it is necessary to measure fluorescence intensity at regular intervals after the reaction is initiated, and to determine reaction velocity. Alternatively, within a time in which the reaction velocity is kept constant, it is also possible to stop the reaction by adding stop solution and to measure fluorescence intensity.

## 1. Assay for Quantification of SIRT3 Activity

- Following the table below and **in duplicate**, add ddH<sub>2</sub>O, #1. SIRT3 Assay Buffer, #2. Fluoro-Substrate Peptide and #4. NAD to microtiter plate wells.
- Add #5. Developer to each well of the microtiter plate and mix well.

Assay reagents	Test sample	No enzyme control	No Test Sample control	No NAD control
ddH <sub>2</sub> O	25 µL	25 µL	25 µL	30 µL
#1. SIRT3 Assay Buffer	5 µL	5 µL	5 µL	5 µL
#2. Fluoro-Substrate Peptide	5 µL	5 µL	5 µL	5 µL
#4. NAD	5 µL	5 µL	5 µL	-
#5. Developer	5 µL	5 µL	5 µL	5 µL
Enzyme Sample	5 µL	-	-	5 µL
Buffer of Enzyme Sample <sup>(1)</sup>	-	5 µL	-	-
#6. Recombinant SIRT3	-	-	5 µL	-
<b>Total volume</b>	50 µL	50 µL	50 µL	50 µL

### (1)More information on Sample preparation in section 10

- Initiate reactions by adding 5 µL of your Enzyme Sample or Buffer of Enzyme Sample or #6. Recombinant SIRT3 to each well and mixing thoroughly at room temperature.

NOTE: Although the volume of addition of Enzyme Sample or Buffer of Enzyme Sample or #6. Recombinant SIRT3 is set to 5  $\mu\text{L}$  in the previous table; it may be changed to a volume up to 20  $\mu\text{L}$  at your discretion. In that case, please reduce the volume of Distilled water to set the final reaction volume of 50  $\mu\text{L}$ .

4. Read fluorescence intensity for 30 to 60 minutes at 1 to 2 minute intervals using microtiter plate fluorometer with excitation at 340-360 nm and emission at 440-460 nm. Measure and calculate the rate of reaction while the reaction velocity remains constant.

*Alternative procedure*

1. Follow procedure described above till step 4.
2. While the reaction rate is kept constant, add 20  $\mu\text{L}$  of #7. Stop Solution to each well at appropriate time to stop the reaction, and measure fluorescence intensity in a microplate fluorescence reader capable of excitation at a wavelength in the range 340-360 nm and detection of emitted light in the range 440-460 nm.

NOTE:

- During the time in which SIRT3 reaction rate is maintained, the difference in fluorescence intensity between Enzyme Sample Assay and No Enzyme Control Assay indicates the SIRT3 activity of your Enzyme Sample.
- If enzyme samples contain some protease/peptidase able to break down #2. Fluoro-Substrate Peptide, resulting in an increase of fluorescence intensity in No NAD Control Assay, the SIRT3 activity in the samples cannot be evaluated correctly.
- If enzyme samples contain inhibitors for protease/peptidase, precise SIRT3 enzyme activity cannot be measured. Since protease/peptidase inhibitors used in the usual protein purification process strongly inhibit the peptidase activity in the development reaction, please avoid using any protease/peptidase inhibitors during the process of protein purification.
- If enzyme samples have an inhibitory effect on the peptidase in the development reaction, the final fluorescence intensity will not increase. Please use #3. Fluoro-Deacetylated Peptide instead of #2. Fluoro-Substrate Peptide, and conduct a control experiment.

## 2. Assay for SIRT3 Inhibitor/Activator Screening

1. Following the table on the next page and **in duplicate**, add ddH<sub>2</sub>O, #1. SIRT3 Assay Buffer, #2. Fluoro-Substrate Peptide or #3. Fluoro-Deacetylated Peptide and #4. NAD to microtiter plate wells.
2. Add Test Compound (inhibitor compound to test) or just the Solvent in which compound is dissolved (control) or Control Compound (not provided) to each well of the microtiter plate and mix.
3. Add #5. Developer to each well of the microtiter plate and mix well.
4. Initiate reactions by adding 5  $\mu$ L of your of #6. Recombinant SIRT3 or your Enzyme Sample to each well and mix thoroughly at RT.

NOTE: Although the volume of addition of Recombinant SIRT3 or your Enzyme Sample is set to 5  $\mu$ L in above tables, it may be changed to a volume up to 20  $\mu$ L at your discretion. In that case, please reduce the volume of ddH<sub>2</sub>O to set the final reaction volume of 50  $\mu$ L.

5. Read fluorescence intensity for 30 to 60 minutes at 1 to 2 minute intervals using microtiter plate fluorometer with excitation at 340-360 nm and emission at 440-460 nm. Measure and calculate the rate of reaction while the reaction velocity remains constant.

<b>Assay reagents</b>	<b>Test Compound Assay</b>	<b>Solvent Control Assay</b>	<b>Control Compound Assay</b>	<b>No Enzyme Control Assay</b>	<b>Development Control Assay</b>
<b>ddH<sub>2</sub>O</b>	20 µL	20 µL	20 µL	25 µL	30 µL
<b>#1. SIRT3 Assay Buffer</b>	5 µL	5 µL	5 µL	5 µL	5 µL
<b>#2. Fluoro-Substrate Peptide</b>	5 µL	5 µL	5 µL	5 µL	-
<b>#3. Fluoro-Deacetylated Peptide</b>	-	-	-	-	5 µL
<b>#4. NAD</b>	5 µL	5 µL	5 µL	5 µL	-
<b>Test Compound</b>	5 µL	-	-	-	5 µL
<b>Solvent of Test Compound</b>	-	5 µL	-	5 µL	-
<b>Control Compound (not provided)</b>	-	-	5 µL	-	-
<b>#5. Developer</b>	5 µL	5 µL	5 µL	5 µL	5 µL
<b>#6. Recombinant SIRT3 (or Enzyme Sample)</b>	5 µL	5 µL	5 µL	-	-
<b>Total volume</b>	50 µL	50 µL	50 µL	50 µL	50 µL

(1)More information on Sample preparation in section 10

### *Alternative procedure*

1. Follow procedure described above till step 4.
2. While the reaction rate is kept constant, add 20  $\mu\text{L}$  of #7. Stop Solution to each well at appropriate time to stop the reaction, and measure fluorescence intensity in a microplate fluorescence reader capable of excitation at a wavelength in the range 340-360 nm and detection of emitted light in the range 440-460 nm.

#### NOTE:

- Although the above tables indicate the volume of addition of Test Compound or Solvent of Test Compound or Control Compound (not provided) as 5  $\mu\text{L}$ , the concentration and the volume of the reagents to add can be changed so that the concentration of test compounds becomes the setting concentration. For example, since the final volume of reaction is 50  $\mu\text{L}$  here, it is also possible to add 10  $\mu\text{L}$  of Test Compound or Solvent of Test Compound or Control Compound (not provided). In this case, please reduce the volume of Distilled water to set the final reaction volume of 50  $\mu\text{L}$ .
- During the time in which SIRT3 reaction rate is maintained, the difference in fluorescence intensity between Solvent Control Assay and No Enzyme Control Assay indicates the SIRT3 activity.

- In order to estimate the active or inhibitory effect on SIRT3 activity by the test compounds correctly, it is necessary to conduct the control experiment of Solvent Control Assay at least once for every experiment and Control Compound Assay at least once for the first experiment, in addition to Test Compound Assay as indicated in the Table.2. When test compounds cause an active or inhibitory effect on SIRT3 activity, the level of increase of fluorescence intensity is strengthened or weakened as compared with Solvent Control Assay.
- The efficacy of the test compounds on the SIRT3 activity is the difference in fluorescence intensity between Test Compound Assay minus No Enzyme Control Assay and Solvent Control Assay minus No Enzyme Control Assay.
- If test compounds have an inhibitory effect on protease/peptidase, resulting that the increase in fluorescence intensity is not or a little observed in Development Control Assay, the effect on SIRT3 activity cannot be evaluated correctly.

# 9. Data Analysis

## 1. Typical Results

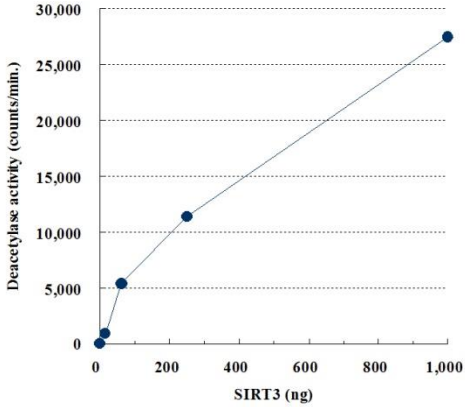


Figure 1: Dose dependency curve of recombinant SIRT3 activity

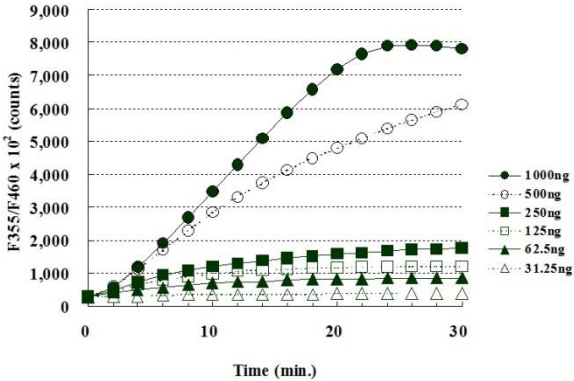


Figure 2: Time course of SIRT3-substrate deacetylation by recombinant SIRT3

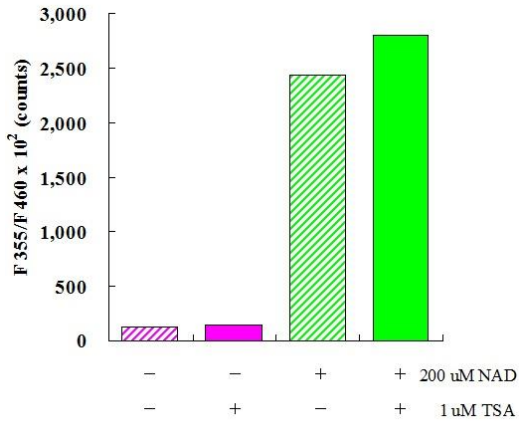


Figure 3: Effect of Trichostatin A and NAD on recombinant SIRT3 activity

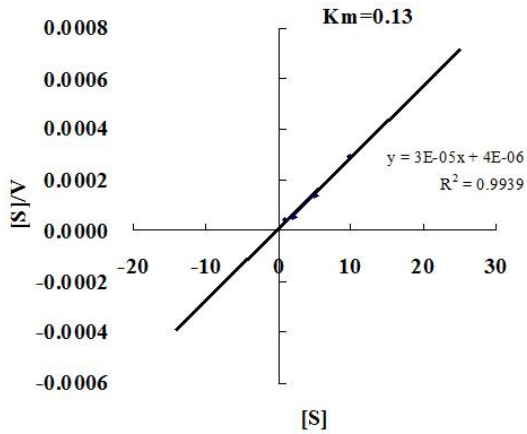


Figure 4: K<sub>m</sub> value of recombinant SIRT3 for Fluoro-Substrate Peptide

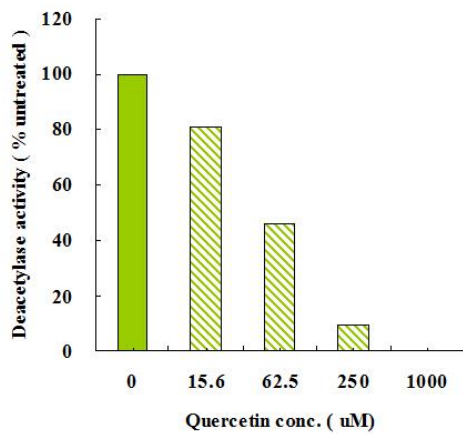
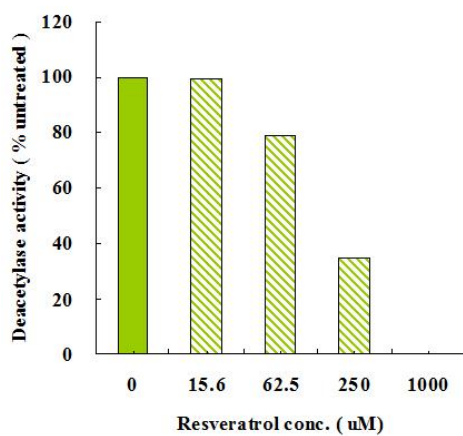


Figure 5: Effect of polyphenol on recombinant SIRT3 activity

## **10. Sample Preparation**

---

Numerous extraction and purification methods can be used to isolate SIRT3. Abcam has a range of products to help with Mitochondria extraction please visit the Abcam website for details.

## 11. Troubleshooting

---

- When chemicals that have an inhibitory effect on the peptidase are mixed in a crude SIRT3 fraction purified from various cells or the immunoprecipitate using a specific antibody against SIRT3 or other proteins, precise SIRT3 enzyme activity cannot be measured. Since the protease/peptidase inhibitors used in the usual protein purification process inhibit the peptidase activity strongly, please avoid the use of any protease/peptidase inhibitors during the protein purification process.
- Final fluorescence intensity will not increase, both when test chemicals have an inhibitory effect on SIRT3, and also when there is an inhibitory effect on the peptidase.
- If the test reagents themselves emit fluorescence at excitation wavelength: 340-360 nm and fluorescence wavelength: 440-460 nm, the inhibitory effect of the test assay cannot be evaluated correctly.
- The recombinant SIRT3 should be run in duplicate, using the protocol described in the Assay Protocol. Incubation times or temperatures significantly different from those specified may give erroneous results.

- The reaction curve is nearly a straight line if the kinetics of the assay is of the first order. Variations in the protocol can lead to non-linearity of the curve, as can assay kinetics that are other than first order. For a non-linear curve, point to point or quadratic curve fit methods should be used.
- Poor duplicates indicate inaccurate dispensing. If all instructions in the Assay Protocol were followed accurately, such results indicate a need for multi-channel pipettor maintenance.

**Technical Support**

For technical support contact information, visit:

<https://www.abcam.com/en-us/contact-us>

<https://www.abcam.cn/contact-us> (China)

<https://www.abcam.co.jp/contact-us> (Japan)