

Protocol for washing and modifying QCM-D sensors

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Abstract

This protocol describes how to wash QCM-D sensors before usage and how to modify their surface using a composition of symmetric (oligo)ethylene glycol (OEG) disulfides consisting of 99% dS-OEG and 1% dS-OEG-biotin.

Citation: Victoria Linderberg Protocol for washing and modifying QCM-D sensors. **protocols.io**

dx.doi.org/10.17504/protocols.io.efybbpw

Published: 25 Jan 2016

Before start

Safety assessment of harmful chemicals used:

- Ammonia: "Flammable gas", "Contains gas under pressure; may explode if heated", "Causes severe skin burns and eye damage", "Toxic if inhaled" and "Very toxic to aquatic life with long lasting effects".
 - Hydrogen peroxide: "Harmful if swallowed" and "Causes serious eye damage".
 - Ethanol: "Highly Flammable liquid and vapour" and "Causes serious eye irritation".
 - Liquid nitrogen: "Extremely cold liquid and gas under pressure", "Can cause rapid suffocation" and "Can cause severe frostbite". <https://www.nwmissouri.edu/naturalsciences/sds/n/Nitrogen%20liquid.pdf>
- Precautions: Use lab coat, gloves (special ones for the liquid nitrogen!), safety glasses and a fume hood.

Materials

- ✓ Distilled Water by Contributed by users
Ethanol, pure [4455](#) by [Omnipure Filter Company](#)
- ✓ Ammonia by Contributed by users
- ✓ Hydrogen peroxide by Contributed by users
- ✓ Liquid nitrogen by Contributed by users

- ✓ dS-OEG by Contributed by users
- ✓ dS-OEG-biotin by Contributed by users

Protocol

Step 1.

Prepare a washing solution consisting of 5:1:1 (volume parts) of water, 25% ammonia and 30% hydrogen peroxide. (To make 14 ml washing solution, mix 10 ml water, 2 ml 25% ammonia and 2 ml 30% hydrogen peroxide)

Step 2.

Clean the gold-coated QCM-D sensors by putting them in a glass petri dish and cover them with washing solution. Heat for 10 min at 80°C.

 DURATION

00:10:00

Step 3.

Rinse the sensor surfaces repeatedly with water and then dry them under a flow of nitrogen.

Step 4.

Make an ethanolic solution with total concentration 0.5 mM of OEG disulfides. The OEG disulfides should consist of dS-OEG and dS-OEG-biotin in a molar ratio of 99:1.

($M_{W, \text{dS-OEG}} = 386.5 \text{ Da}$ and $M_{W, \text{dS-OEG-biotin}} = 788.0 \text{ Da}$)

Step 5.

Incubate the QCM-D sensors in the ethanolic dS-OEG/dS-OEG-biotin solution for at least 12 hours in room temperature.

Step 6.

Rinse the sensors in ethanol and ultra-sonicate them for 3-5 min in ethanol.

Step 7.

The modified sensors may now be used or stored.

Warnings

When making and using the washing solution, be in a fume hood since both ammonia and hydrogen peroxide are used!

If storing the modified sensors, be sure to keep them cold and in darkness!