

Catalytic Decomposition of H₂O₂ – Elephant’s Toothpaste

Description: The iodide ion (from KI or NaI) is used as a catalyst to decompose H₂O₂, liberating water, oxygen and heat.

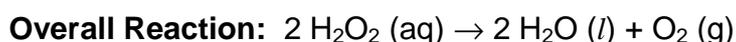
Materials:

30% H ₂ O ₂	1 L Graduated cylinder
KI or NaI	Food coloring
Liquid dish detergent	Large bin

Procedure:

1. Pour 50 mL of 30% H₂O₂ in the 1 L graduated cylinder. Add 3 drops of food coloring. Add a small layer of liquid dish soap to the colored H₂O₂ solution by adding the soap drop wise down the side of the graduated cylinder.
2. To generate toothpaste, add KI (or NaI) from a half-filled spatula to the H₂O₂ solution. Oxygen gas generated from this reaction will create large amounts of colored foam which will rise out of the graduated cylinder. To test for oxygen gas, a glowing wood splint can be reignited by placing it near the emerging foam.
3. A variation of this demonstration for a higher level chemistry class which also demonstrates an enzymatic decomposition of H₂O₂ is detailed in the Lister reference.

Discussion: The decomposition of hydrogen peroxide yields oxygen and water. The reaction is catalyzed by the iodide ion (I¹⁻) from KI (or NaI) as shown in the two-step process below. The oxygen generated creates bubbles in the soap to produce a toothpaste like foam. A glowing splint can be used to test that the gas produced is oxygen. This experiment demonstrates the concept and utility of catalysts.



Safety: Wear proper protective equipment including gloves and safety glasses when preparing and performing this demonstration. Concentrated hydrogen peroxide can cause burns.

Disposal: Remaining solution can be flushed down drain with plenty of water.

Reference:

Shakhashiri, B. Z. In *Chemical Demonstrations: A Handbook for Teachers of Chemistry*; The University of Wisconsin Press: 1983; Vol. 1, p 180-185.

Trujillo, C. A. *J. Chem. Educ.* **2005**, *82*, 855.

Conklin, A. R.; Kessinger, A. *J. Chem. Educ.* **1996**, *73*, 838.

Lister, T. In *Classical Chemical Demonstrations*; The Royal Society of Chemistry: 1996; p 145-146.

Video:

<http://www.youtube.com/watch?v=tnB-uU3w6g8>

<http://www.youtube.com/watch?v=eZsur0L0L1c>