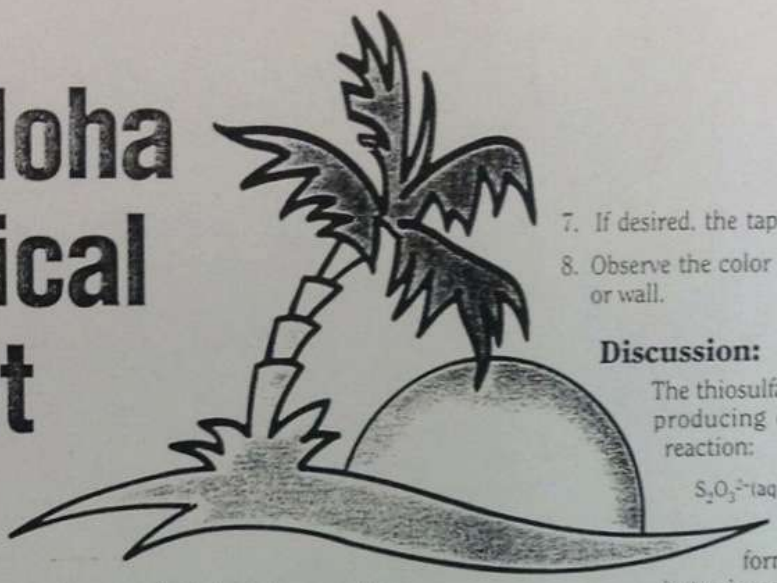
The Aloha Chemical Sunset



A simple chemical reaction produces a colloidal solution, resulting in a colorful chemical "sunset".

Chemical Concepts:

- Colloids and precipitates
- Tyndall effect and light scattering

Materials Needed:

Sodium thiosulfate solution, 0.2 M, $Na_2S_2O_3$, 14 mL
Hydrochloric acid solution, 1 M, HCl, 8 mL
Petri dish or glass culture dish, 100 × 15 mm
Chemical sunset cutouts (printed palm tree and circular cutout to fit Petri dish)
Overhead projector
Hawaiian music (optional)

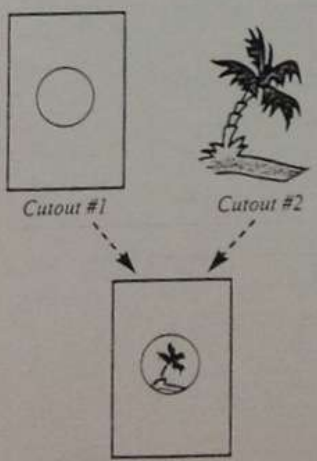
Pre-Lab:

Prepare the 0.2 M sodium thiosulfate solution by dissolving 4.96 grams of sodium thiosulfate, $Na_2S_2O_3 \cdot 5H_2O$, in enough distilled or deionized water to make 100 mL of solution. Prepare the 1 M hydrochloric acid solution by diluting 8.33 mL of concentrated (12 M) HCl to 100 mL with distilled or deionized water, or purchase it ready-made. Remember to always add acid to water when diluting concentrated acids.

The Chemical Sunset cutouts can be made by cutting the designated shapes out of paper or cardboard. Cutout #1 is simply a piece of cardboard or paper with a circular hole the size of a Petri dish. Cutout #2 is in the shape of a palm tree.

Procedure:

1. Place Cutout #1 on the overhead.
2. Place Cutout #2 inside the hole in Cutout #1.
3. Place the Petri dish over the hole in Cutout #1, on top of Cutout #2.
4. Turn on the overhead projector. Focus the image on a projector screen or wall.
5. Measure out 14 mL of 0.2 M sodium thiosulfate solution; pour into the Petri dish.
6. Measure out 8 mL of 1 M hydrochloric acid solution; pour into the Petri dish.



7. If desired, the tape of Hawaiian music can be played.
8. Observe the color of the projected light on the screen or wall.

Discussion:

The thiosulfate ion decomposes in acid solution, producing colloidal sulfur according to the reaction:

$$S_2O_3^{2-}(aq) + 2H^+(aq) \rightarrow S(s) + SO_2(aq) + H_2O(l)$$

As the colloidal sulfur particles form, the light from the overhead projector is scattered. As the concentration of colloidal sulfur and its particle size increases, the shorter wavelengths of light (red) are scattered while the longer wavelengths pass through the solution, producing a red color in the projected beam. This is known as the Tyndall effect. Eventually, the concentration and size of the colloidal particles become so great that no light can be transmitted through the solution.

Safety Precautions:

Hydrochloric acid solutions are highly toxic by ingestion or inhalation; severely corrosive to skin and eyes. The sulfur produced in this reaction has low toxicity and may be a skin irritant. Sulfur dioxide is an irritant to eyes and other tissues. Wear chemical-resistant gloves, chemical splash goggles, and a chemical-resistant apron.

Disposal:

The resulting solution/mixture can be filtered, and the solid can be disposed of in a landfill according to Flinn Disposal Method #26a. The filtrate solution can be disposed of by first diluting with water, then neutralizing the solution with sodium carbonate, and finally by flushing the neutralized solution down the drain with a large excess of water, according to Flinn Suggested Disposal Method #24b. Consult your current *Flinn Chemical Catalog/Reference Manual.*

References:

Special thanks to David Katz of Cabrini College in Radnor, PA, for bringing this demonstration to our attention.

Materials for the "Aloha Chemical Sunset" are available from Flinn Scientific, Inc.:

Catalog No.	Description	Price
S0114Z	Sodium thiosulfate, 500 g	$ 9.85
H0013Z	Hydrochloric acid solution, 1 M, 500 mL	5.70
GP3019Z	Dish, culture (Petri), borosilicate glass, 6/pkg.	23.07
AP8988Z	The Aloha Chemical Sunset Chemistry Demo Kit—Contains notes and chemicals necessary to perform the demo seven times.	15.85

See pages 258–272 of the *1996 FLINN CHEMICAL CATALOG REFERENCE/MANUAL* for more exciting Flinn Chemical Demonstration Kits.