As Seen On TV!

Silver Lightning

by David Shaw

There is money to be made by selling a piece of metal wrapped in a scientific principle. Let's investigate how a slab of aluminum and rudimentary electrochemistry can be combined to *clean silverware with* ***no*** *scrubbing.*

This miracle product claim is made by Silver Lightning, touted on television by none other than Robin Leach. An inspired choice: the voice of the "rich and famous" exhorting you to clean all that silverware you've got lying around the mansion! (Unused marketing slogan: Let Silver Lightning *leach* your tarnish away!) According to Mr. Leach, Silver Lightning enables you to clean silver merely by dipping it in water.

Rather than purchase a Silver Lightning of my own, I examined the display model at the local K-Mart. $19.95 buys a piece of brushed aluminum about 5 by 7 inches and 1/16 inch thick.

According to the accompanying instruction booklet, the plate of aluminum is placed in a glass container full of boiling water to which a teaspoon of baking soda has been added. You then dip the tarnished silver into the container, making sure that it makes contact with the plate, and a few minutes later, remove the silverware, free of tarnish.

The product was simulated in the Skeptical Eye Research Kitchen by placing a piece of aluminum foil in the bottom of a glass baking dish. The skeptical investigators followed the Silver Lightning instructions to the letter — hot water, baking soda, contact with the plate with the advertised results. The tarnish was removed only from the area of silver submerged below the water line, and the time for removal increased as the water cooled. There was also a noticeable rotten-egg smell in the kitchen.

Where did the smell come from? I consulted a chemistry text for the answer (*Chemistry: The Molecular Science*, John Olmstead III and Gregory M. Williams, 1994, Mosby-Year Book) and found the following information on page 828:

To test the effectiveness of the cleaning reaction, *Chem Matters* asked Jennifer (right) to treat only half of a tarnished silver bowl. After just two or three minutes, much of the tarnish was gone, and the test left a diagonal line on the bowl (above).

"The tarnish that collects on objects made of silver is silver sulfide, a black solid. Tarnish forms from trace amounts of hydrogen sulfide present in the atmosphere."

The redox equation is $4\,Ag + 2\,H_2S + O_2 \rightarrow 2\,Ag_2S + 2\,H_2O$

So the odor is hydrogen sulfide gas being released as the tarnish is dissolved, but how do the aluminum and baking soda contribute to the process? Another chemistry text that I consulted (*Chemistry: A First Course*; Garrett, Richardson, and Kiefer, 1961, Ginn) explains:

"Silver sulfide tarnish may be removed chemically, using an aluminum pan and baking soda, $NaHCO_3$, solution. A solution of about one gram of salt and one gram of baking soda to one liter of hot water is made, and the tarnished silver is immersed in the solution. It is important that all the silver articles are in contact with the aluminum pan. The solution is then boiled. This method of cleaning silverware depends on the formation of an electrochemical cell in which the aluminum pan is the anode, the silver is the cathode, and the baking soda and salt form the electrolyte. The reduction of the silver in the silver sulfide takes place gradually, and no silver metal is lost from the silverware."

A similar method is described in an article called "Cleaning Silver" by Peter Fowler and Rosemary Fowler (in the book *But The Crackling Is Superb: An Anthology on Food and Drink by Fellows and Foreign Members of The Royal Society*; Nicholas Kurti and Giana Kurti, Editors, 1988, IOP Publishing: New York). The Fowlers note that "tarnish is often silver sulphide, which is readily formed when silver forks and spoons are used with eggs or green vegetables, especially Brussels sprouts."

So the Silver Lightning works as advertised and will last forever. Is there any need to buy one? As my experiment and Garrett et. al. note, *any* aluminum or aluminum-lined container will do. I recommend the cheap foil baking pans available in any supermarket; pick a size that accommodates your silver cleaning needs.

There is one other solution to the tarnished silverware problem: Lay off the eggs and Brussels sprouts!

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