Aluminum Concentrations in Deodorants Determined through ICP-OES

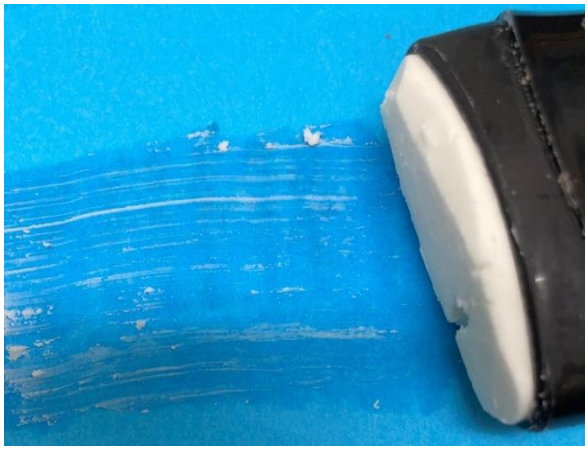

Figure 1. Visualization of deodorant application.

Deodorants serve as indispensable personal care products that are designed to minimize body odor by inhibiting perspiration and bacterial growth. Among the active ingredients in deodorant formulations, Al^{3+} (aluminum (III)) salt plays a key role in limiting perspiration. The antiperspirant effect occurs when Al^{3+} salt hydrolysis to form an occlusive mass to stop the flow of sweat to the skin's surface.

However, concerns have been raised regarding some potential adverse effects of aluminum on skin health, including irritation and allergic reactions. As a result, the precise determination of elemental concentrations in deodorants, especially for aluminum, becomes very important in order to ensure both product efficacy and product safety for consumers.

In this study, elemental concentrations of three distinct deodorant samples were analyzed utilizing Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) at Ebatco. ICP-OES enables simultaneous detection and quantification of numerous elements with high precision and sensitivity, offering a comprehensive assessment of elemental composition in complex matrices. This study was aimed to provide some insights into the elemental compositions of deodorant formulations currently available on the commercial market, particularly on aluminum concentrations.

Three commercially available deodorant samples were selected and purchased from stores for elemental analysis. Each sample, including a spiked matrix sample and a method blank, underwent acid digestion to solubilize its components prior to analysis on an ICP-OES instrument. Deodorant #1 and Deodorant #2 were labeled with no aluminum as an ingredient while Deodorant #3 had aluminum listed in its ingredient list.

A matrix spike was added to deodorant #1 at 30 ppm and the recovery was found to be within the acceptable range of ±20%. Additionally, a method blank was run to show the instrument was running efficiently and the process had no residual cross contamination between samples.

Table 1 Elemental Concentrations of Commercial Deodorant Samples

Sample / Element	Deodorant #1 (ppm)	Deodorant #2 (ppm)	Deodorant #3 (ppm)	Deodorant #1 with Matrix Spike (ppm)	Method Blank (ppm)
Aluminum (394.4 nm)*	0.02	0.04	122.63	0.36	0.01
Copper (324.7 nm)*	0.00	0.00	0.00	0.32	0.00
Iron (239.5 nm)*	0.03	0.02	0.11	0.34	0.02
Manganese (257.6 nm)*	0.01	0.00	0.00	0.30	0.00
Nickel (231.6 nm)*	0.00	0.00	0.00	0.30	0.00
Zinc (213.8 nm)*	0.02	0.01	0.06	0.28	0.01

*Optical emission wavelength used for the elemental concentration analysis in ICP-OES

The results of the elemental analysis for the deodorant samples were summarized in Table 1. As can be seen from Table 1, varying concentrations of aluminum along with the concentrations of a few other elements were measured through ICP-OES at the selected specific optical emission wavelength for the elements. While aluminum contents were within permissible limits in accordance with regulatory guidelines, notable differences were observed among the samples. Deodorants #1 and #2 were found to possess less than 0.1 ppm aluminum, while Deodorant #3 contained over 122 ppm aluminum. These findings underscore the significance of meticulous monitoring of elemental composition during deodorant production as well as consumer awareness of ingredient labeling in order to mitigate potential health concerns.

To ensure ultimate consumer well-being, continuing research efforts to further assess the safety profiles of deodorants and refine manufacturing practices are warranted. ICP-OES tehnicque is capable of reliably discerning concentrations of elements to a high degree of certainty and thus provides a dependable measure for deororant quality control. Similarly, ICP-OES could be very useful in quantifying the elemental compositions of many other health, beauty, food, and pharmaceutical products where trace elements and ingridents are of significance.