

SUCCESS STORY...#A008

ACETIC ACID RELEASE DURING SILICONE RTV CURE

Project Background

Single component room temperature vulcanizing ('RTV') silicones are widely used as sealants and adhesives in the fabrication of many products; including medical devices. For 'acid cure' systems, exposure of the material to atmospheric moisture initiates a catalyzed reaction of the acetoxy silane crosslinker with hydroxyl capped polydimethylsiloxane linear polymer which leads to the formation of a three-dimensional silicone polymer network and acetic acid.

The Problem

It is the evolution of the acetic acid, a corrosive, weak organic acid, which requires device design, materials selection, cure conditions and manufacturing process to minimize the contact of the released acid with sensitive components of the construction and its retention in the final product.

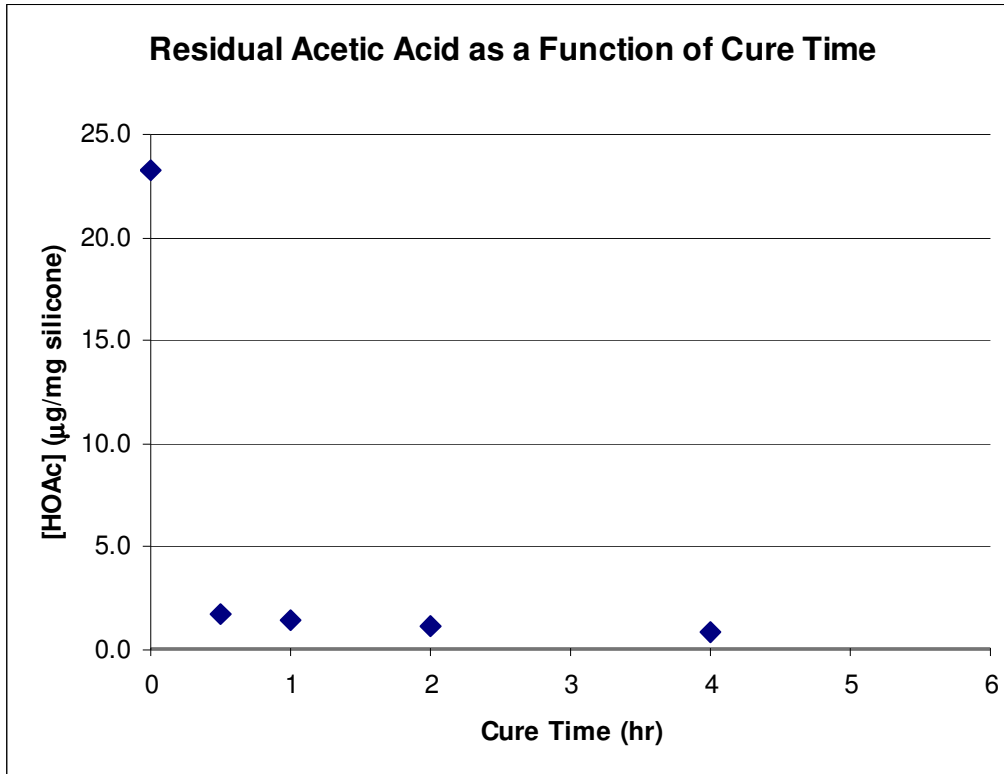
ANALYZE'S Approach To Resolve The Problem

While we have used thermal desorption-gas chromatography-mass spectroscopy (TD-GC-MS) to detect and identify volatile products, including acetic acid, remaining in the silicone as a function of cure time and environmental conditions, we have found that ion chromatography provides a specific, highly sensitive and accurate method for the determination of residual acetic acid.

Weighed amounts of silicone RTV were applied as thin films to substrates and cured for a series of times ranging from 0.5 hour to 72 hours. After cure, de-ionized water was added to each of the sample vials and the capped sample vials heated for three days. Control samples (uncured silicone and no silicone) were also prepared in this manner. The acetate anion (from the acetic acid) contained in the aqueous solution were separated and analyzed by ion chromatography.

The Result

The assay results are summarized in the following graph.



While a majority of the acetic acid is rapidly lost from the silicone, there is still ca. 0.4% of the available acetic acid remaining after three days of cure. It is noted that complete cure of the silicone RTV resulting in maximum values for mechanical properties may require 14-21 days depending upon cure conditions.

Conclusion and Benefit To The Client

Knowledge of acetic acid evolution allowed the client to tailor their manufacturing process to accommodate the cure requirements of the silicone RTV and avoid corrosion in the finished medical device.