Washing Away Identity: Tooth Erosion from Household Chemicals

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INTRODUCTION

Our study was to observe teeth of two different ages and their decomposition process in household chemicals. This comparative style of analysis would not only allow our experiment to be repeated, a key function of forensic science, but also allow us to easily observe and report our findings in concise data sets. This study is relevant to forensic anthropology because of several reasons. One goal of forensic anthropology is to help identify remains, and teeth can contribute greatly to this as teeth can tell us characteristics such as age and lifestyle, and further chemical analysis can lead to DNA matches and isotope analysis. Understanding the effects of household chemicals on teeth can help forensic anthropologists make better identifications.

RESULTS

Hydrogen Peroxide: After two days, the fresh tooth turned white in colour. The old tooth had fibrous black flecks covering most of the roots. After five days, there did not appear to be any changes. Day 8 showed the most change for the fresh tooth, it appeared white and translucent with deposits resting at the bottom. The old tooth had some residue began to turn soft and fabric-like. By day 18 both teeth were completely bleached and translucent-like.

Coca-Cola: After two days, the old tooth had taken on a light brown colour, stopped fizzing, and some precipitate was floating around the jar. The fresh tooth had some black flakes covering most of the roots. At day 5 the fresh tooth had turned mostly black, the roots started to develop a lichen looking black hang off, and mold started to develop on top. The old tooth had black floating material on the bottom of the jar. After eight days, the fresh tooth developed noticeable mold, and a grease film on top. The roots turned black, but the crown avoided blackening. Day 12 the old tooth had turned mostly brown with some white in the roots and a lot of surface mold. The fresh tooth had turned mostly black red, and had a viscous string floating around it. By day 22 both sets of teeth had experienced some morphological changes.

Sulfuric Acid: Initially, the old tooth did not visually react to the acid, while the fresh tooth floated to the top and started foaming. At hour five, one root started turning brown and flaking off. Some of the tissue turned black, fell off, and floated to the top. The acid had brown tint. At 24 hours, the fresh tooth had fallen to the bottom of the jar. Lots of flaking. Both teeth were bleaching. At 48 hours, visible deposits of tooth and bone. At hour 60, more deposits. The teeth seemed to be eroding at the same rate by this time. Hours 96-120 showed major morphological changes: flaking and cracking. The teeth were noticeably softer and delicate looking. During hours 120-148, they no longer looked like teeth. More deposits, acid looked cloudy. During hours 148-168 the teeth had completely eroded away and the acid was cloudy.

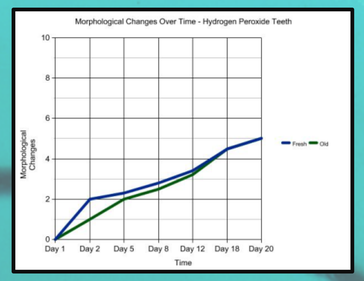
GRAPH DATA

0	No changes
1	Slight changes in colour
2	More changes in colour
3	Physical changes noted in morphology, slight
4	Colour change significant
5	Physical changes noted in morphology, medium
6	Colour change and structural changes
7	Physical changes noted in morphology, heavy
8	Physical structure is compromised and colour has rendered tooth disguisable
9	Loss of structural integrity, pieces crumbling off and is partially dissolved
10	Tooth has completely dissolved

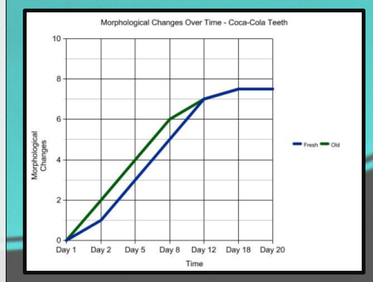
TOOTH DATA

	Age of tooth	Weight (g)	Type of tooth	Chemical	Appearance
Tooth A	3 years	Before: 24.0 After: 27.0	Molar	Coke	White enamel, one large yellow root.
Tooth B	Fresh	Before: 23.2 After: 27.3	Molar	Coke	White all around, some clear areas. Black residue on tooth (rot?). Two roots.
Tooth C	3 years	Before: 28.3 After: 34.3	Molar	Hydrogen peroxide	White enamel, 3 yellow roots with some dried pinkish tissue attached
Tooth D	Fresh	Before: 27.2 After: 26.2	Pre-molar	Hydrogen peroxide	White and clear with black reside. Some pinkish tissue attached. One root
Tooth E	3 years	No data.	Molar	Sulfuric acid	White enamel and 2 yellow roots.
Tooth F	Fresh	No data.	Pre-molar	Sulfuric acid	White enamel and roots (2).

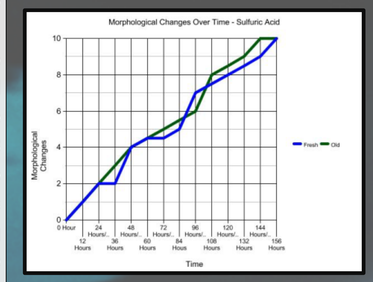
HYDROGEN PEROXIDE

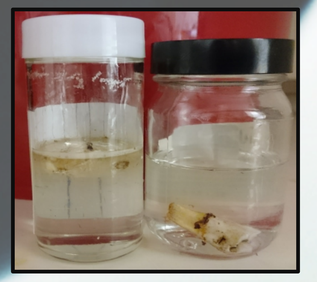


COCA-COLA



SULFURIC ACID





REFERENCES

Pictures, data sets, and graphs are all our own

MATERIALS & METHODS

We obtained our 3+ year old teeth from a previous hunting trip one of our researchers went on. The old teeth are from a mule deer (Odocoileus hemionus). A local butcher supplied us with a domestic pig (Sus domesticus) jaw for our fresh teeth.

The Coca- Cola and hydrogen peroxide (10% concentrated) were bought from a local grocery store. The sulfuric acid (95-98% concentrated) was obtained from the University of Victoria chemical stores. We chose a higher than readily available solution because we wanted the morphological changes progress faster. Since none of our chemicals affect glass we were able to use glass jars with lids for the teeth storage.

Kayla's technique was to use pliers and a knife to wiggle and pry the teeth free. Emily's method was very similar to Kayla's, but she had to pry and wiggle harder in order to get them loose. After all the teeth were collected they were weighed and labeled then separated into the solutions they would be going into. All of the information was recorded in the tooth information data sheet, Emily poured 200mL of each solution into the container with the corresponding tooth. The teeth in Coca-Cola and hydrogen peroxide went in to solution on October 27. These teeth were observed every 2 days over the course of twenty-five days. Emily used gloves while she was working with the teeth so there would be no contamination.

The sulfuric acid experiment started on November 17. Since we expected the teeth to completely dissolve we thought it pointless to weigh these teeth before adding the sulfuric acid. With the fume hood on Courtney filled the jars up halfway for each container. Observations were made every twelve hours until completely dissolved. Changes were recorded in our data sheets.

CONCLUSIONS

The teeth were successful in showing morphological change in submersion of various acids. While the results were not as we expected, the changes we were able to observe were interesting. The faster initial erosion rate of the old teeth could be due to the amount of air in the tooth allowing an acid to penetrate more of the tooth and sustain a fizzing or foaming reaction for a longer period of time. The hydrogen peroxide solution lost the acid concentration after 5 days because of the exposure to light and oxygen. This is potentially why the erosion process stopped at day 5 for both teeth. Similarly, the phosphoric acid in the Coke could have evaporated with exposure to light and air and therefore, only the sugar remained to inflict any change to the teeth. That would also explain the hard and candy-like feel of the teeth after 22 days as opposed to a soft texture that the sulfuric acid teeth had. Our results show that older teeth will begin the process of decay faster than fresh teeth. and household chemicals will not completely erode teeth.