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In conclusion, powdered rosemary proved to be the most effective antioxidant at all three concentration levels. In concentration one, this was followed by green tea. In concentration two, this was followed by vitamin E. In concentration three, this was followed by ginger. As expected, iron sulfate did indeed accelerate oxidation. Higher concentrations of iron sulfate increased the rate of oxidation. Without the addition of any antioxidants, control showed a high rate of oxidation, second only to iron sulfate.

Our hypothesis and prediction were partially correct. Although higher concentrations of antioxidants seemed to be more effective against oxidation to an extent, the differences were minimal (e.g. concentration one and two). Excessive amounts of antioxidant did not enhance the effects (e.g. concentration three). In other words, higher concentrations of antioxidant do not always result in greater effectiveness. The optimum antioxidant concentration in our experiment appears to be between 0.1% and 0.5%.

Our predictions for the most effective antioxidants were incorrect. In all concentrations, rosemary, not garlic, was the most effective antioxidant.

Some of our results may have been influenced by human error. Perhaps the time lapsed between the removal of the jars from the oven and the actual sensory test affected the strength of the odor present. Also, human bias may have been a factor in the interpretation of the scents for the various samples. When beginning the actual experimentation, some of our expected results possibly colored our judgement. However, the naturally strong odor of garlic may have influenced us to judge more critically the odor of the garlic samples.

We experienced many difficulties during experimentation. At first, we could not perform our peroxide value test because of safety issues with chloroform, so we couldn't quantify our findings. By the time we had learned of a substitute, several of our samples were already unavailable.

Vitamin E, vitamin A, and sesame seed oil dissolved completely in the oil. However, the oil solubility of these antioxidants did not pose as an advantage for them, because their levels of effectiveness were about the same as the solid antioxidants. Rosemary and green tea dispersed, but also accumulated on the bottom of the jar. Vitamin C, iron sulfate, ginger, and garlic remained in their smashed or chopped solid form on the bottom of the jars.

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From our research and experimentation, we can make the following conclusions:

* + Rosemary is an effective antioxidant in soybean oil.
  + Antioxidant effectiveness is not enhanced by greater concentrations. Rather, the antioxidants appear to function best at a concentration between 0.1% and 0.5%.
  + Other natural substances with apparent high antioxidant characteristics are green tea, vitamin E, and ginger.
  + Our sensory test method can be an accurate and reliable measure on antioxidant effectiveness.

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There are many practical applications for antioxidants. Our research can be applied to the common household. This can also be applied to the food processing industry. Natural antioxidants can be added to food products, in the place of chemical antioxidants, to prolong a product's shelf life. If the industry is concerned with the unwanted color or flavor caused by the antioxidant, then deodorized, decolorized, tasteless antioxidants are available.

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[Amador Valley High School](http://www.pleasanton.k12.ca.us/Amador/index.htm) | [Project Creek Watch](http://www.pleasanton.k12.ca.us/avh_science/creek/creek.html)

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