The Effects of Ascorbic Acid on Iron in Bread

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Introduction

- Iron is an essential nutrient for humans, it is a major component of hemoglobin
- Anemia is a common disorder in humans caused by a deficiency of iron.
- Ferrous Iron [Fe(II)] is more absorbable than Ferric Iron [Fe(III)]
- Ascorbic acid reduces Fe(III) to Fe(II)
- Fe(III) found in plant products, and Fe(II) in animal products

OBJECTIVES:
- To examine the effects of ascorbic acid in bread fortified with Fe(III) Sulfate
- To observe speciation change from Fe(III) to Fe(II)
- To compare effects of heat on iron speciation
- Looking for the best combination of factors that change ferric sulphate to ferrous sulphate

Hypothesis

We know:
Fe (III) + Ascorbic Acid $\rightleftharpoons$ Fe (II)
Fe (II) + Heat $\rightleftharpoons$ Fe (III)

-HYPOTHESIS: Ascorbic acid prevents oxidizing effect of heat on iron, to produce Fe(II):
Fe (III) + Ascorbic Acid + Heat $\rightleftharpoons$ Fe (II)

Analyses

- Peak shape and position for standard with ascorbic acid and Fe(III) was the same as for Fe(II) sulphate
- Ascorbic acid reduced Fe(III) to Fe(II)
- Fe peak in baked samples was closer to the Fe(II) sulphate peak than the Fe peak for dough, which was closer to the Fe(III) sulphate peak
- Baking (heat) caused Fe(III) to reduce to Fe(II)
- Bleached flour samples reduced more Fe(III) than whole wheat. We believe bleached flour has certain components that help in reduction of Fe(III) that whole wheat lacks

Conclusions

- By adding ascorbic acid to bread, the iron present in the bread will reduce to the Fe(II) state and become more available for the human body to absorb
- The addition of heat caused Fe(III) to reduce to Fe(II)
- The iron in the bleached flour samples reduced more than the whole wheat flour samples
- We expect heat should cause Fe(II) to oxidize to the Fe(III), not reduce it further towards Fe(II). Likely cause was heat from baking causing yeast in bread to reduce Fe(III) at accelerated rate

Future Research

- Effect of heat on the reduction of Fe(III) to Fe(II)
- Effects of yeast on iron speciation
- Iron levels and speciation differences between the outside to the inside of the bread
- Test other types of flours on the effect of reduction of Fe(III) to Fe(II)

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