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Determining how jam processing of blueberries affects the change in antioxidant capacity of anthocyanins using the CUPRAC assay

Through the CUPRAC assay, how does the antioxidant capacity of anthocyanins in blueberries change by adding different jam sugar concentrations (0%, 30%, 60%, 90%) over heat (86-92 °C)?

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INTRODUCTION AND BACKGROUND INFORMATION

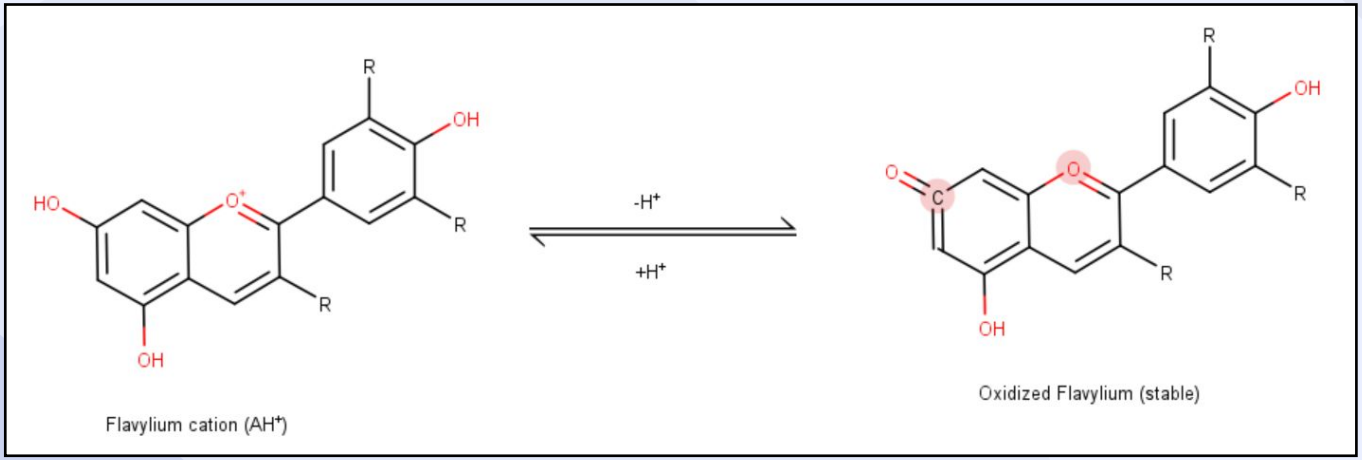
Blueberries are viewed as a superfood; they are included in most 'clean eating' diets and are known to have great antioxidant properties. However, people consume blueberry jam in the hopes of receiving the same antioxidant benefits as fresh blueberries, when in fact, these products have been heavily processed with heat and sugar.

My father was born with high myopia which progressively worsened as he aged. He always emphasises the importance of eye health, and the diet we can adapt to improve it. My dad ate blueberry jam for several years to help with his condition because fresh blueberries were unavailable in his home country. This raised a question in me: "would my dad's eye health have improved more if he had fresh berries instead of jam?", and thus motivated me to research to what degree jam processing affects the antioxidant capacity of blueberries, to see if my dad was receiving the most out of the jams, as opposed to eating fresh berries.

INTRODUCTION AND BACKGROUND INFORMATION

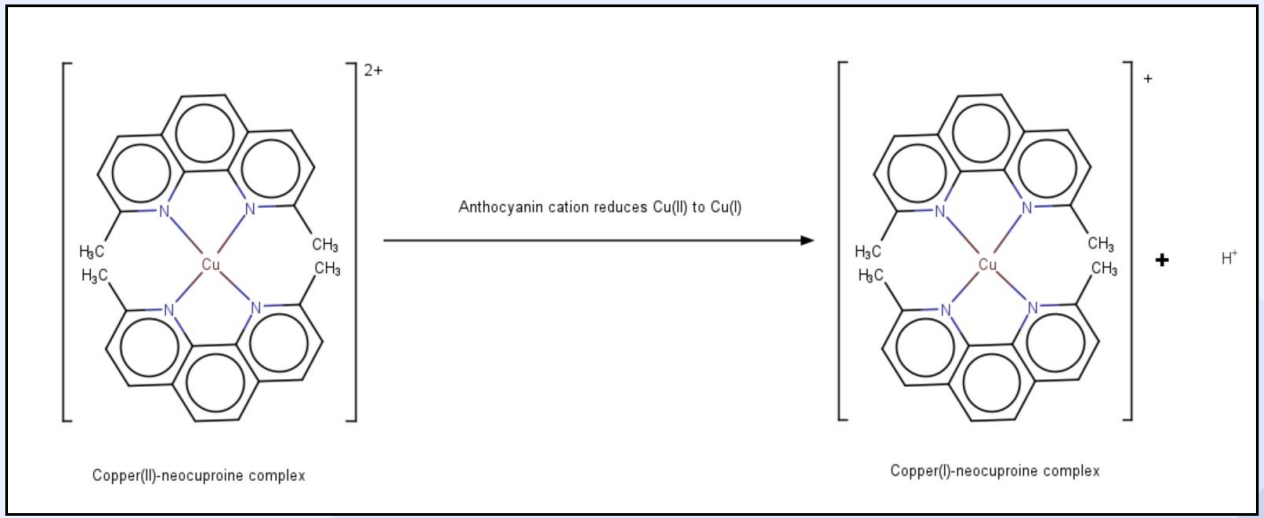
A pigment in the skin of blueberries contains the main antioxidant of the fruit called anthocyanins, which scavenges for free radicals in your body. These free radicals are usually known to contribute to oxidative stress on our tissues and cells, which may lead to faster aging, cancer, and neurodegenerative diseases.

By scavenging for ROS, anthocyanins ultimately inhibit oxidation, thus reducing oxidative stress on our tissues and cells:



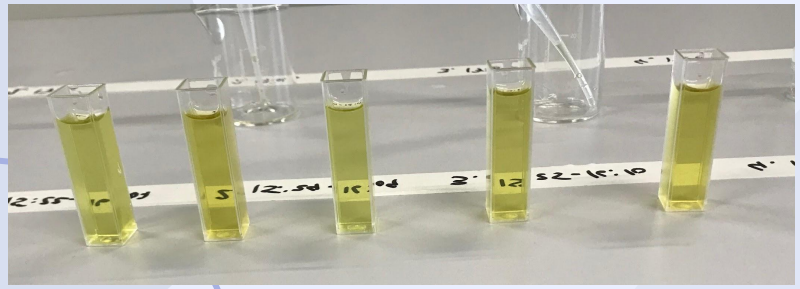
METHODOLOGY

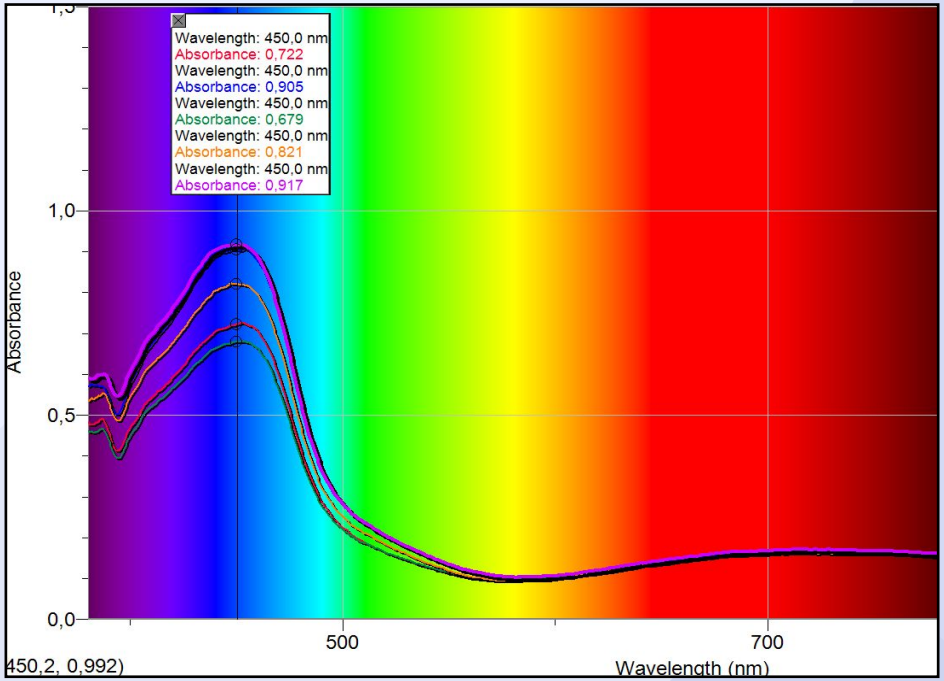
Blueberry jams with 0%, 30%, 60%, and 90% jams were created. They were analyzed using the CUPRAC assay: the antioxidant capacity was measured based on the reduction of copper(II) to copper(I) ion in the presence of the anthocyanins and neocuproine (2,9-dimethyl-1,10-phenanthroline) ligand.



METHODOLOGY

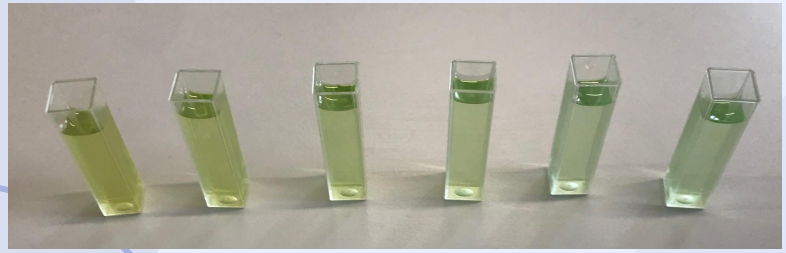
The absorbance of the Copper(I)neocuproine was measured using a spectrophotometer with a absorbance peak at 450 nm. The following data is from the 60% sucrose trial:

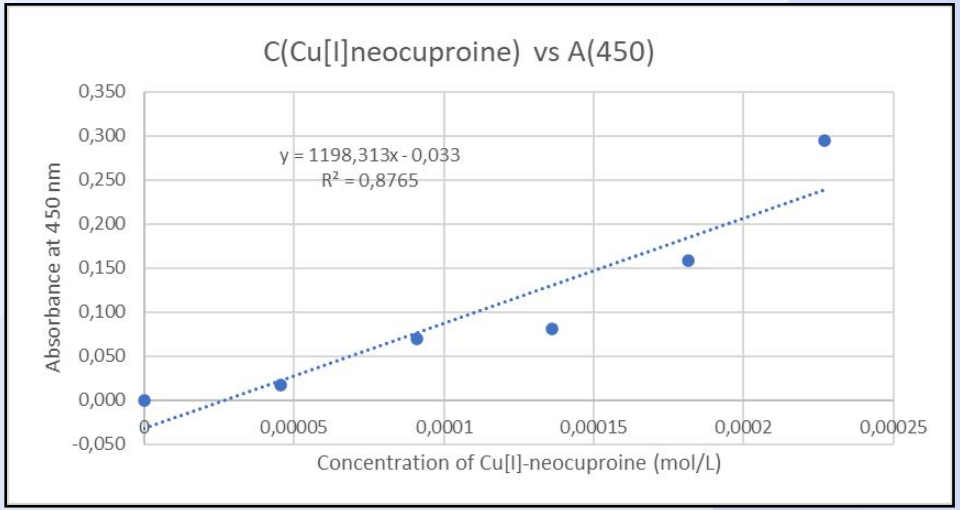




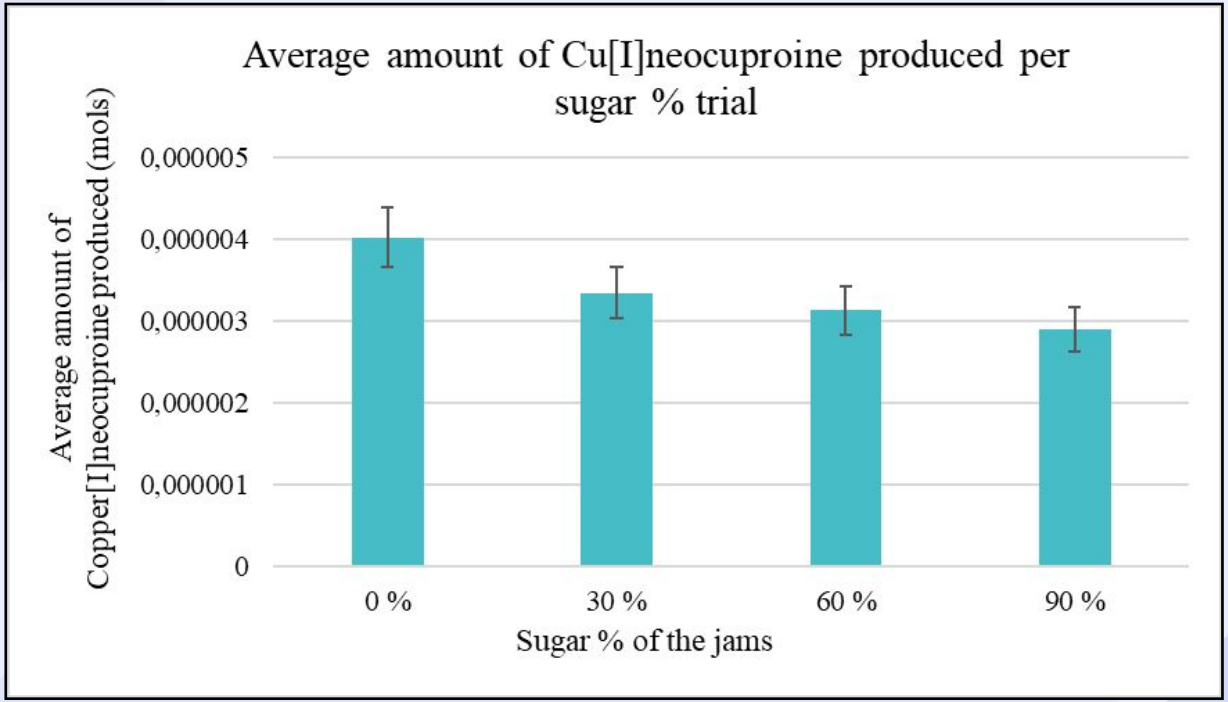
METHODOLOGY

Ascorbic Acid trials were conducted using CUPRAC Assay to determine the molar absorptivity constant of Cu(I)Neocuproine:





RESULTS AND CONCLUSION



The antioxidant capacity decreases as the sugar concentration increases

EVALUATION

Limitations

- unavailability of Trolox
- potential error with graduated pipettes
- pellet formed in centrifuge, loss of antioxidant material

Strengths

- despite CUPRAC assay being completely new, it was achieved with little to no complications
- clear and replicable method

SOURCES

Apak, R., Güçlü, K., Özyürek, M. and Çelik, S.E. (2007). Mechanism of antioxidant capacity assays and the CUPRAC (cupric ion reducing antioxidant capacity) assay. Microchimica Acta, [online] 160(4), pp.413–419. doi:https://doi.org/10.1007/s00604-007-0777-0.

Apak, R., Özyürek, M. and Güçlü, K. (2011). The main and modified CUPRAC methods of antioxidant measurement.pdf. [online] Google Docs. Available at: https://drive.google.com/file/d/13y5aXKDH9WFPVt9_amS_BooD75WWavnz/view [Accessed 4 Jul. 2023].

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