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Impact of light on the levels of polyphenols, carotenoids and norisoprenoids in Sea buckthorn pulp

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CONTENTS

Background

- **Carotenoids** (Liang et al. 2022) and **Polyphenols** (Tkacz et al., 2020) plays a **crucial role** in Sea buckthorn（*Hippophae rhamnoides*） to determine the color, taste and functionality of fresh fruits and the products
- The **health benefits** of carotenoids has sparked interest in the stability of carotenoids for Foods （Caitlin et al., 2010）



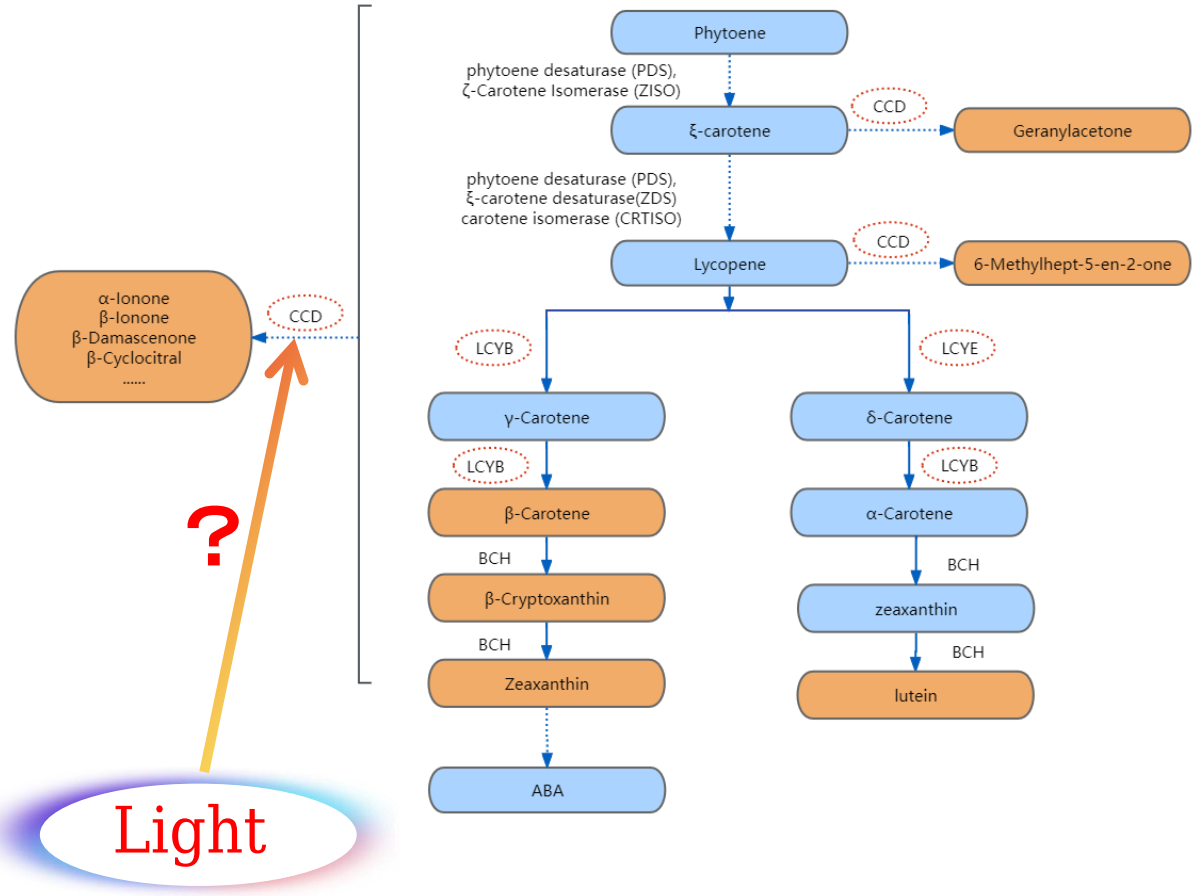


Background

- Carotenoids is **easily degraded**, is affected by the factors such as oxidation, heating, **light**, acid, metal ion, free radicals and so on （Caitlin et al., 2010）
- All **double bonds** of carotenoids could be oxidized and breakage (Marty and Berset, 1990)
- It is important to understand **the mechanisms of degradation** in order to protect carotenoids of the products （Caitlin et al., 2010）

Background

- Carotenoids is susceptible to degradation by **light** factors（Caitlin et al., 2010）
- **Carotenoid radical cations** would produce by photooxidation (Konovalova et al., 2001; Mortensen and Skibsted, 1996)
- Carotenoid CCD enzyme degradation products include **norisoprenoids**
- Norisoprenoids affect the **aroma** of fruits and products (Maria, 2009).



Objectives

For sea buckthorn pulp

- Determining the **impact** of light on the accumulation of **polyphenols**
- Analyzing the **effects** of light on **carotenoids and chromatic quality**
- Clarifying **norisoprenoids changes** in light-treated sample
- Exploring the correlation between **polyphenols, carotenoids** and **norisoprenoids, color quality**
- Discussing the effects of **pasteurization and ultrahigh pressure(UHP)** on the stability of polyphenols and carotenoids

Methodology

Pasteurization

UHP

Dark

Intense

UV

Natural

Light

Polyphenols

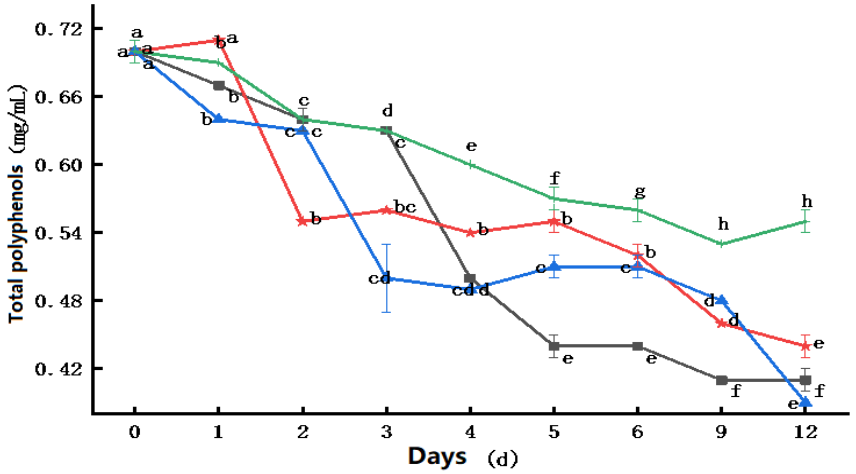
Chromatic quality

Carotenoids

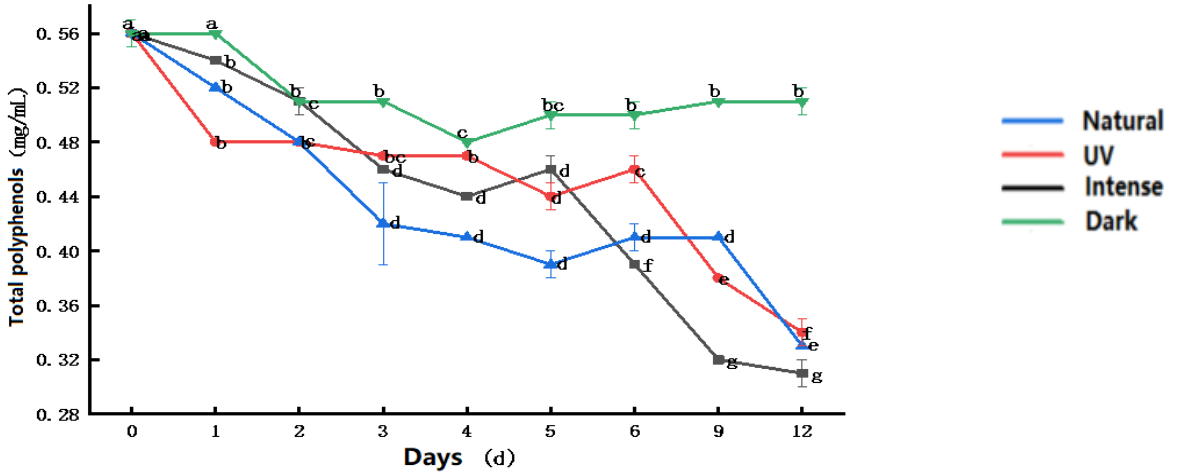
Norisoprenoids

Results - Polyphenols

Pasteurized pulp



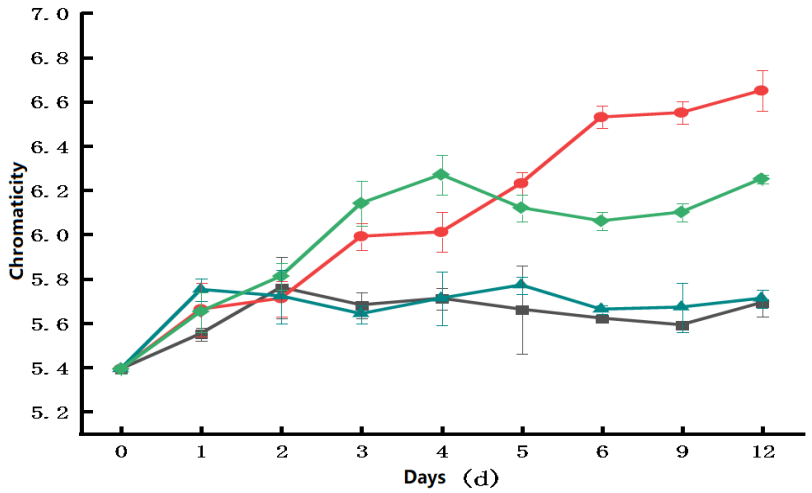
UHP pulp



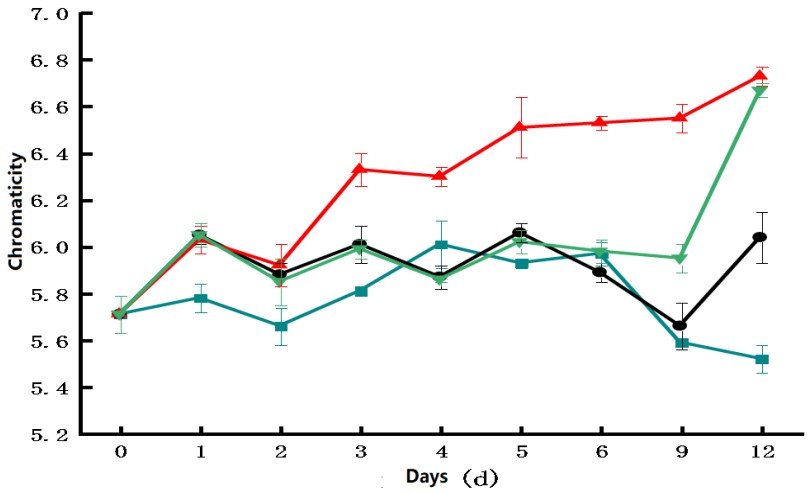
- Polyphenols of **pasteurized pulp was higher** than UHP pulp
- Polyphenols **decreased significantly** with light exposure **time** ($p<0.05$)
- The decrease was **faster in the intense and natural light** treated samples
- The effect of intense and natural light **on UHP-treated sample was stronger** than pasteurized samples,
- The dark treatment had the minimum effect on the polyphenols
- UV had a **stronger effect on the polyphenols of pasteurized samples** than UHP-treated samples

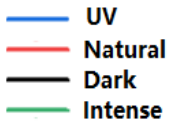
Results - Chromaticity

Pasteurized pulp



UHP pulp

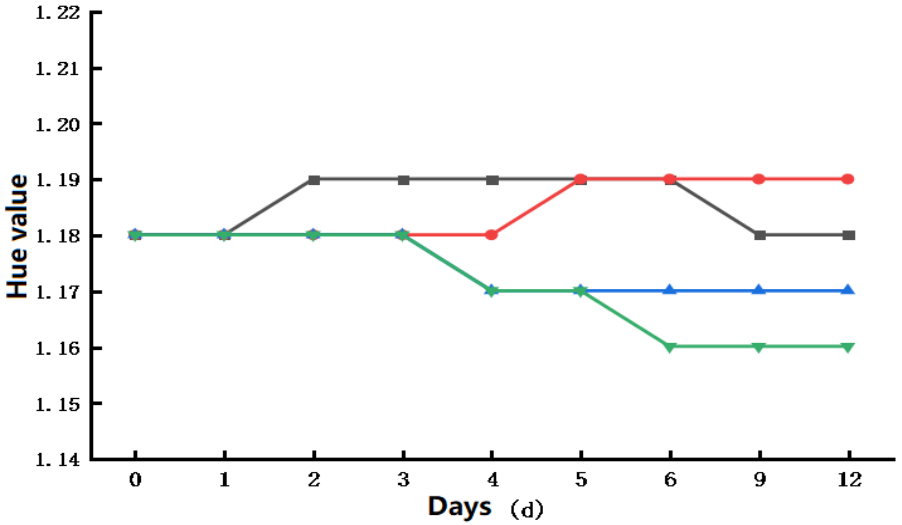




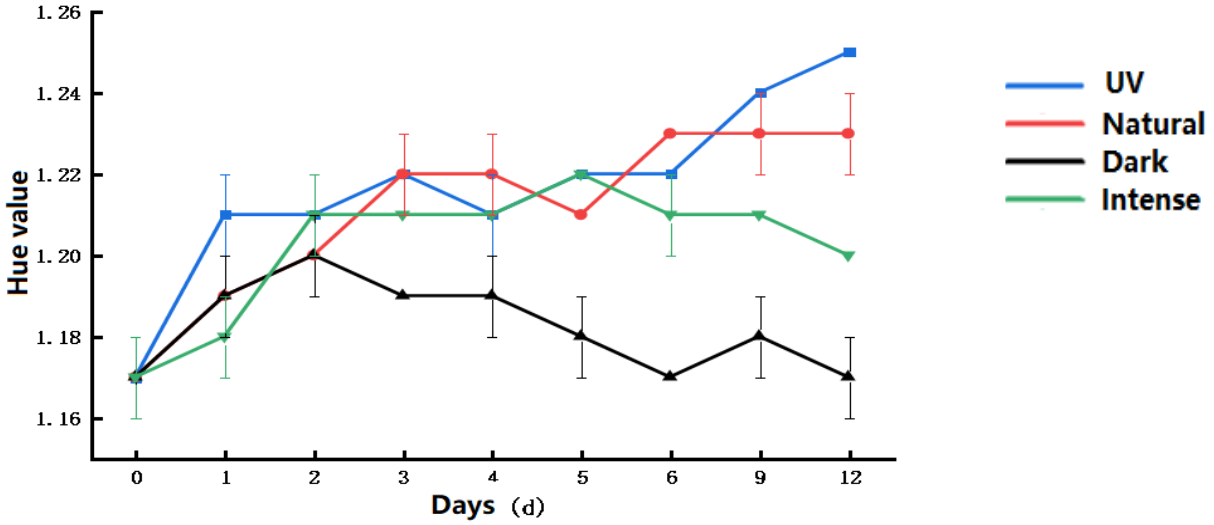
- The chromaticity of **UHP pulp was higher** than pasteurized pulp
- The chromaticity was increased with treated time of natural and intense light
- The effects of intense light on the UHP-treated samples was 5.47% stronger than pasteurized samples
- UV and dark treatment had a little effect on the chromaticity of the samples

Results - Hue

Pasteurized pulp



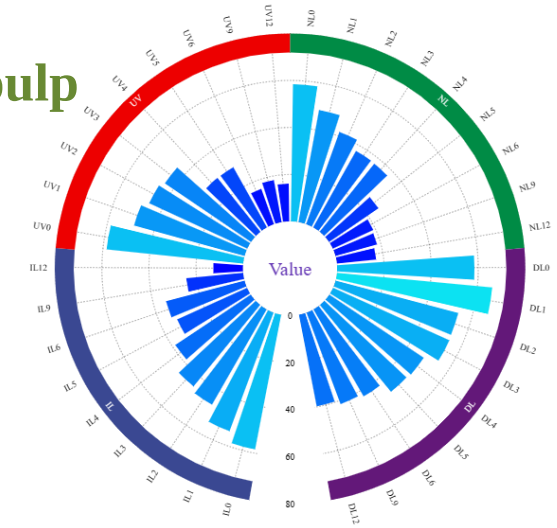
UHP pulp



- Light almost had not effect on the hue value of pasteurized samples
- Natural and intense light would darken the color of UHP treated sample

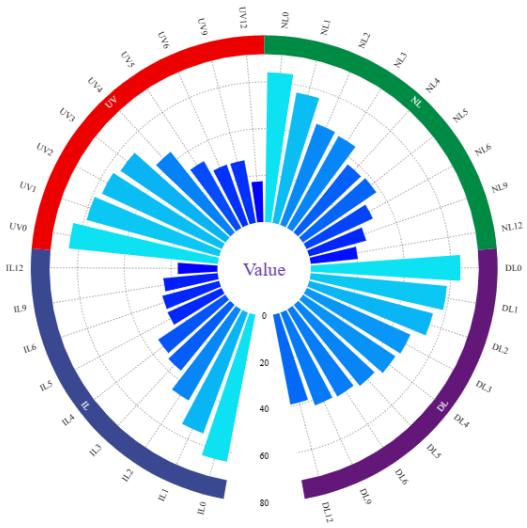
Results - Effects of light on carotenoids

Pasteurized pulp



Carotenoids were degraded 78.28% by intense light, 72.33% by UV, 71.24% by natural light, and 31.98% by dark

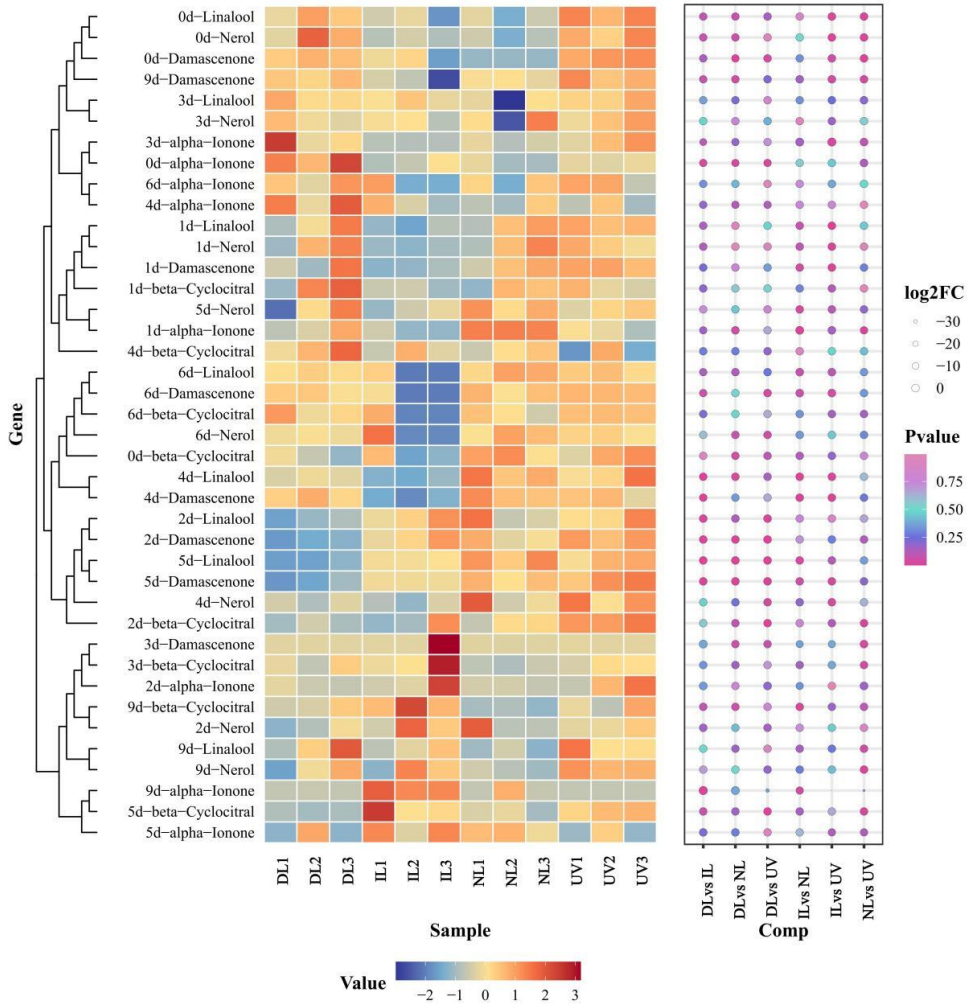
UHP pulp



Carotenoids were degraded 73.32% by intense light, 72.72% by UV, 68.22% by natural light, and 46.76% by dark

- **The Carotenoids of UHP pulp was higher than pasteurized pulp**
- **Carotenoids decreased significantly (P<0.05) with the duration of light exposure**
- **The carotenoids of sea buckthorn pulp were photosensitive**

Results - Effects of light on norisoprenoids

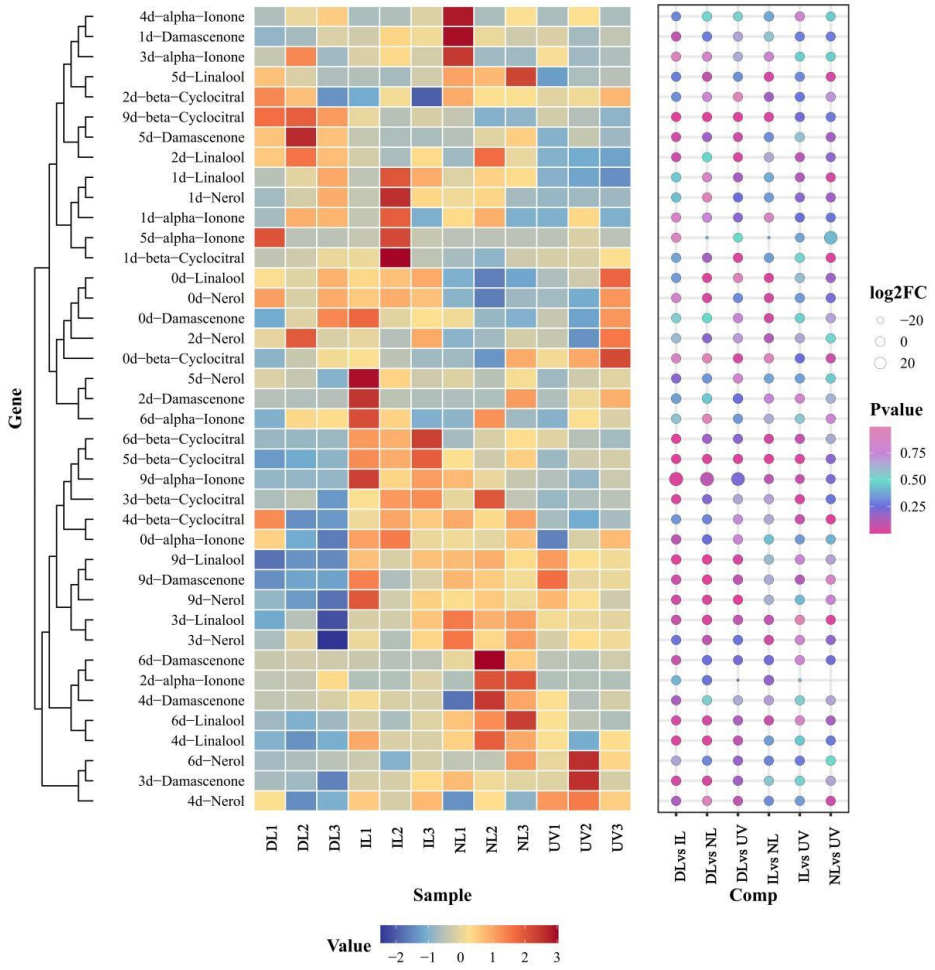


- **5 norisoprenoids were qualified and quantified: Linalool, Nerol, α-Ionone, Damascenone, β-Cyclocitral**
- **The norisoprenoids of UHP pulp was higher than pasteurized pulp.**
- **Pasteurized samples**

α-Ionone, and nerol decreased significantly in light treatments for 12 days

Slight increase in β-cyclocitral and linalool, little difference in damascenone

Results - Effects of light on norisoprenoids



- **UHP treated samples**

α-Ionone, nerol, β-cyclocitral and damascenone were significantly increased by intense and natural light.

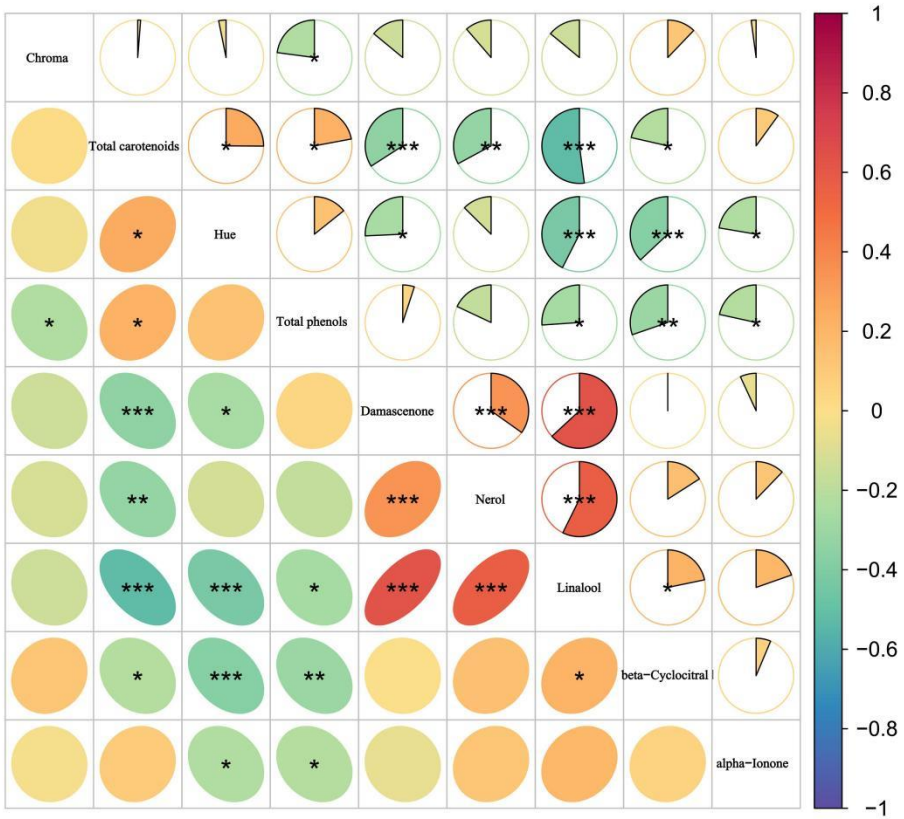
Linalool was significantly decreased in the intense light treated samples

Natural light treatment had little change in linalool.

Nerol, β-cyclocitral and damascenone increased significantly with UV and dark treatments

α-Ionone and linalool were slightly decreased in UV-treated samples and significantly decreased in dark treated samples

Results - Correlation

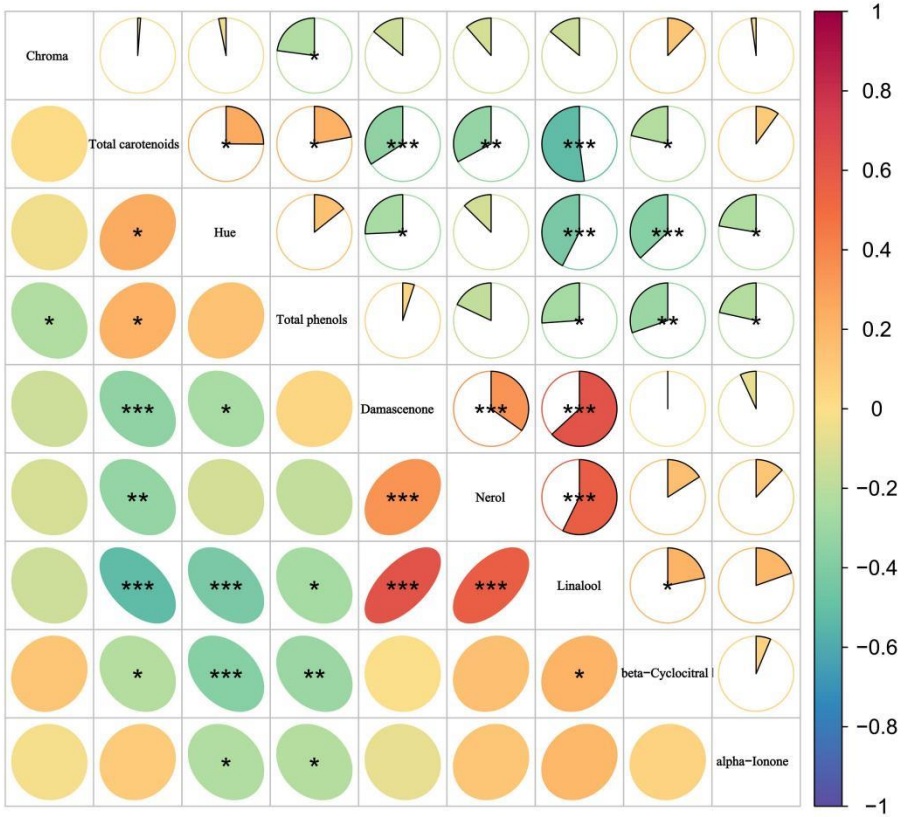


UHP-treated samples: Norisoprenoids and the degradation of carotenoids have significant correlation

Enzymes were not inactivated by UHP

Light strongly influenced enzymes, which might break the C9-C10 linkage of carotenoids to produce α-ionone and damascenone or break the C7-C8 linkage of carotenoids to produce β-cyclocitral, and hence nerol and linalool

Results - Correlation

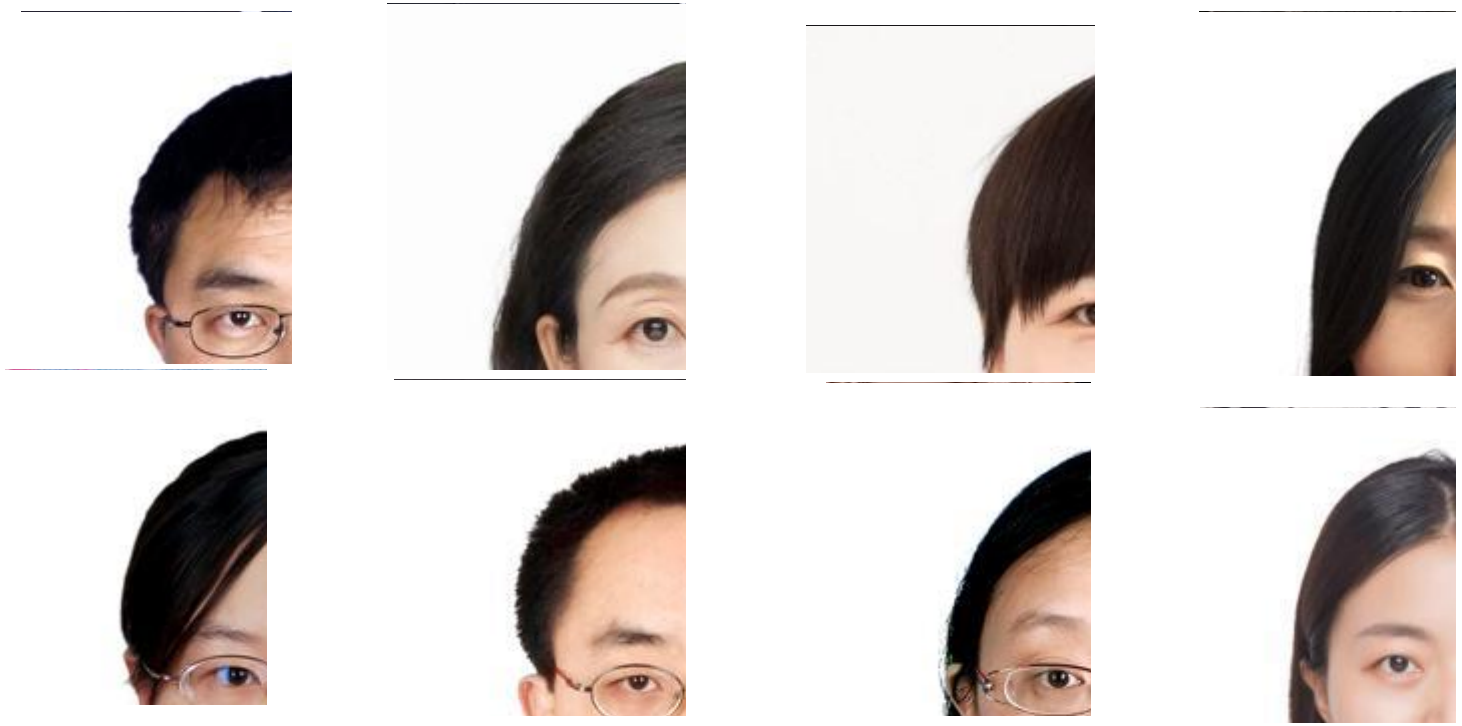


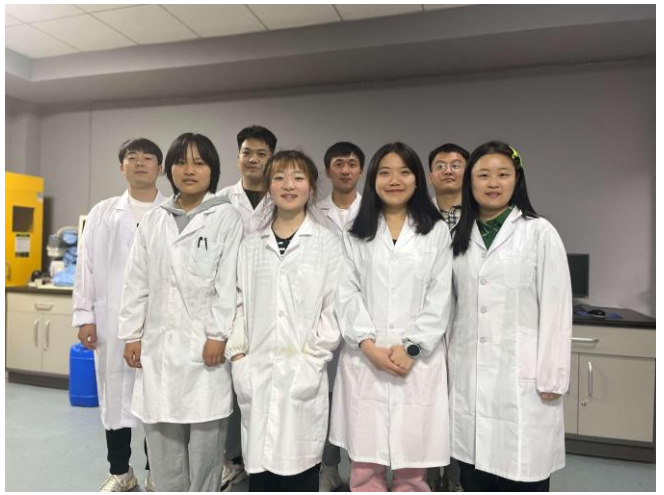
- A positive correlation between damascenone and linalool
- Significant positive correlation between color intensity and carotenoids indicates that the carotenoids directly affects the intensity of color and visual appeal of sea buckthorn pulp
- The positive correlation between polyphenols and hue

Conclusions and perspective

- **Light would enhance the degradation of carotenoids, reduce the color and nutritional quality of sea buckthorn pulp**
- **The photostability of carotenoids and polyphenols was lower in UHP-treated samples as the enzymes were not inactivated**
- **Light would influence enzyme and increase the accumulation of norisoprenoids in UHP-treated samples, and improve the aroma quality**
- **Dark packaging is favorable to maintain the quality of sea buckthorn pulp**

Acknowledgements





- China-Russia International Science and Technology Cooperation Base of Sea Buckthorn Processing Technology
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Thanks for your attention