Effects of UV light and dark storage conditions on stability of ascorbyl palmitate encapsulated in normal and high amylose maize starch

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INTRODUCTION

Diet related non-communicable diseases

Storage stability of encapsulated ascorbyl palmitate
INTRODUCTION

Bioactive compounds (ascorbic acid, Vit E and β-carotene) have health promoting properties (Correia et al., 2012)

Storage stability of encapsulated ascorbyl palmitate
INTRODUCTION

- Ascorbic acid (Vitamin C) is a common antioxidant
- Ascorbic acid is water soluble and cannot penetrate body cells
- Ascorbic acid readily oxidized to dehydroascorbic acid

Conversion of ascorbic acid to dehydroascorbic acid (Aguirre and May, 2008) modified

- Ascorbic acid is very labile to heat
- Ascorbyl palmitate is a better replacement for ascorbic acid

Oxidized form of ascorbic acids and it is unstable

Storage stability of encapsulated ascorbyl palmitate
INTRODUCTION

Ascorbyl palmitate is derivatives of ascorbic acid. It is more heat stable (Yun-Zhong et al., 2002). Readily absorbed by cell membranes (Yun-Zhong et al., 2002).

It has been used as antioxidants. Preventing oil oxidation (Gwo et al., 1986)
Prevent cancer in human body (Kamatham et al., 2001).
INTRODUCTION

Stability of bioactive compound is important during storage.

What happened to bioactive compound during storage?
- Antioxidant potency decreased
- Transformation to other inactive compounds
- Changes in colour and taste
- Change in flavour

Methods of preservation of bioactive compounds during storage
- Encapsulation using various techniques (Spray drying, Wet heat process (pasteing), extrusion technology.....)
INTRODUCTION CONT.....

- Starch can encapsulate hydrophobic compounds by formation of amylose inclusion complexes.

- Ascorbyl palmitate was encapsulated in normal maize starch by pasting (Bamidele et al., 2017) and spray drying (Bamidele et al., 2019).
PREVIOUS FINDINGS

Figure 2: Effect of ascorbyl palmitate on thermal properties of maize starch after pasting

Keys:
- F is pasted maize starch without ascorbyl palmitate
- G is unwashed pasted maize starch with 50 mg ascorbyl palmitate
- H is unwashed pasted maize starch with 50 mg ascorbyl palmitate
- I is ethanol washed pasted maize starch with 15 mg ascorbyl palmitate
- J is ethanol washed pasted maize starch with 50 mg ascorbyl palmitate

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Previous Findings Cont.....

Figure 2: Effect of ascorbyl palmitate on thermal properties of maize starch after spray drying

Keys
A is spray dried maize starch without ascorbyl palmitate
B is unwashed spray dried maize starch with 15 mg ascorbyl palmitate
C is unwashed spray dried maize starch with 50 mg ascorbyl palmitate
D is unwashed spray dried maize starch with 100 mg ascorbyl palmitate
E is unwashed spray dried maize starch with 200 mg ascorbyl palmitate
F is ethanol washed spray dried maize starch with 100 mg ascorbyl palmitate
G is ethanol washed spray dried maize starch with 200 mg ascorbyl palmitate

Storage stability of encapsulated ascorbyl palmitate
Previous Findings Cont.....

Figure 3: Effect of ascorbyl palmitate on thermal properties of high amyllose maize starch after spray drying

Keys
A is spray dried maize starch without ascorbyl palmitate
B is unwashed spray dried maize starch with 15 mg ascorbyl palmitate
C is unwashed spray dried maize starch with 50 mg ascorbyl palmitate
D is unwashed spray dried maize starch with 100 mg ascorbyl palmitate
E is unwashed spray dried maize starch with 200 mg ascorbyl palmitate
F is ethanol washed spray dried maize starch with 100 mg ascorbyl palmitate
G is ethanol washed spray dried maize starch with 200 mg ascorbyl palmitate

Storage stability of encapsulated ascorbyl palmitate
Research Question & Hypothesis

• Can encapsulated ascorbyl palmitate stable under light (UV) and dark condition with accelerated temperature of 40 °C?

• Encapsulated ascorbyl palmitate in maize starches (normal and high amylose maize starch) will be stable under light (UV) and dark condition at accelerated temperature of 40 °C because ascorbyl palmitate formed a amylose-ascorbyl palmitate complexes with amylose during pasting (Bamidele et al., 2017) or spray drying (Bamidele et al., 2019).
Objective

- To determine the stability of free and encapsulated ascorbyl palmitate in both normal and high amylose maize starch before and after pasting and spray drying with accelerated storage condition (40 °C, with both light (UV) and dark environment).
Experimental Design

Free, pasted and spray dried maize starch with ascorbyl palmitate (50 mg/g normal starch pasted, 200 mg/g normal maize starch, 200 mg/g high amylose maize starch)

Storage for 3 months (Conditions: Light (UV) + 40 °C, Dark + 40 °C)

Analysis at 2 weeks interval
- Antioxidant activities of released ascorbyl palmitate from stored samples
Results and Discussions

Figure 1: Effect of storage condition (dark and 40 °C) for 12 weeks on antioxidant activities of ascorbyl palmitate before and after pasting and spray drying with maize starches (normal and high amylose maize starch) over a period (30 to 180 min)

AP is Ascorbyl palmitate

Keys
A is 50 mg AP/g normal maize starch before pasting
B is 200 mg AP/g normal maize starch before spray drying
C is 200 mg AP/g high amylose maize starch before spray drying
D is 50 mg AP/g normal maize starch after pasting
E is 200 mg AP/g normal maize starch after spray drying
F is 200 mg AP/g high amylose maize starch after spray drying

Error bars represent standard deviation

Storage stability of encapsulated ascorbyl palmitate
Figure 2: Effect of storage condition (UV light and 40°C) for 12 weeks on antioxidant activities of ascorbyl palmitate before and after pasting and spray drying with maize starches (normal and high amylose maize starch) over a period (30 to 180 min).

- A is 50 mg AP/g normal maize starch before pasting
- B is 200 mg AP/g normal maize starch before spray drying
- C is 200 mg AP/g high amylose maize starch before spray drying
- D is 50 mg AP/g normal maize starch after pasting
- E is 200 mg AP/g normal maize starch after spray drying
- F is 200 mg AP/g high amylose maize starch after spray drying

Error bar represents standard deviation.

Storage stability of encapsulated ascorbyl palmitate.
**Figure 3: Schematic diagram showing how encapsulation prevent ascorbyl palmitate from UV light**
Figure 4: Degradation of ascorbyl palmitate
Applications

• Encapsulated ascorbyl palmitate can withstand processing
• It can be used in production of functional food
• Severs as raw material in confectionary industry
Conclusions

Encapsulated ascorbyl palmitate is stable when stored in the dark and UV light conditions at 40 °C.

Free ascorbyl palmitate (Non-encapsulated), degraded under UV light in respect to their antioxidant activities.
Acknowledgement

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