INNOVATIVE PACKAGING TECHNOLOGIES TO ENHANCE THE SAFETY AND THE QUALITY OF FRESH RASPBERRY

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Abstract

The goal of this project is to develop innovative packaging systems for fresh raspberry and other fruit to enhance quality and safety, and to extend shelf-life for the small grower. We are developing a science-based approach to extend the shelf life of fresh raspberry, and other small fruit using packaging as a delivery system to minimize microbial contamination through the controlled release of thyme oil, and to extend shelf life using modified atmosphere packages(MAP).

Introduction

The major postharvest pathogen of raspberry is *Botrytis cinerea*, the causal agent of gray mold disease. Essential oils (EO) from common herbs such as thyme and oregano have been known for centuries to have anti-microbial activity. We incorporated the EO's into controlled release packaging (CRP) that releases the active compounds at differentiable rates suitable for short-term inhibition of microorganisms in fresh fruits. For our delivery system, we encapsulated the EO's into cyclodextrin (CD), which stabilizes them, and then we wrap these capsules into a Tyvek™ sachet, which can be placed inside the packaging (Fig. 1). CRP can prolong shelf life without overloading the fruit with additives and can continually replenish the active compounds from the packaging to maintain freshness of the fruit. When the fruit releases water vapor naturally inside the package, the water vapor displaces the EO from the sachet, attached to the bottom of the package, into the package and the fruit, so the EO can inhibit the growth of microorganisms.

Fig. 1 Thyme oil is encapsulated by CD and placed in a Tyvek sachet allowing for CRP which is humidity dependent.

Results

Raspberries held in clamshells fitted with these sachets and then sealed with MAP lost less weight and had less disease as seen in Fig 2. and Table 1 and Table 2

Table 1. Effects of thyme oil (TO) sachets and MAP bags on raspberry fruit quality after 5 days storage at 1 °C[a].

Treatment	Disease Incidence (%)	Change in wt (% initial wt)	Firmness (N/cm²)	TSS (° Brix)	Total Anthocyanin (mg/100 g)
–TO +MAP	13.8 a	99.8 a	1.7 b	10.6 a	57 a
+TO +MAP	3.9 b	99.2 a	2.8 b	11.2 a	65.7 a
–TO –MAP	10.5 a	97.7 b	5.4 a	10.2 b	63.3 a
+TO –MAP	16.5 a	97.8 b	3.7 b	11.1 a	57.7 a
Initial			3.9 b	11.9 a	59.6 a

[a] Means in the same column with the same letter are not significantly different ($P \leq 0.05$).

Table 2. Effects of thyme oil (TO) sachets and MAP bags on raspberry fruit quality after 5 days storage at 1°C and 2 days at 10 °C[a]

Treatment	Disease Incidence (%)	Change in wt (% initial wt)	Firmness (N/cm²)	TSS (° Brix)	Total Anthocyanin (mg/100 g)
–TO +MAP	27.8 a	97.9 a	3.8 a	10.8 a	59.1 a
+TO +MAP	15.5 b	97.3 b	3.5 a	11.3 a	52 a
–TO –MAP	22.6 ab	96.0 c	0.8 b	11.2 a	41.6 b
+TO –MAP	26.8 a	95.9 c	1.3 b	10.5 b	44.4 a
Initial			3.9 a	11.9 a	59.6 a

[a] Means in the same column with the same letter are not significantly different ($P \leq 0.05$).

Fig. 2 Raspberries held in clamshells for 5d at 1°C . A. Clamshell was fitted with 2 (0.5 g) Thyme oil:CD Tyvek sachets and fruit was added. Prior to cold storage clamshell was sealed in MAP that provides an interior atmosphere of O2 (9%-15%) and CO2 (5%-12%). B. Clamshell was fitted with 2 (0.5 g) CD Tyvek sachets (control) and no MAP.

Acknowledgements

We would like to thank NARBA, NJAES-Rutgers University. And View Fresh , The Dalles, OR. For their support of this project.