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The use of natural **antimicrobial** compounds in **packaging** of leafy greens

- impact on microbial load and sensory quality

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Introduction

Microbial growth is one of the main causes of deterioration in fresh produce. Control of microorganisms is essential, especially in organic produce, as microbial loads can be high. Active packaging is one of several ways to control the microbial load after harvest (Fig. 1).

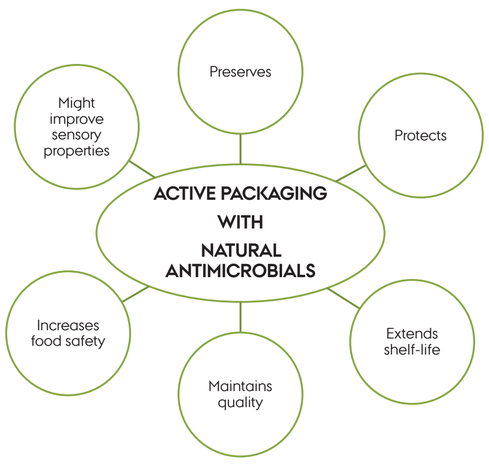

Figure 1. The benefits of active packaging

Active packaging of leafy greens

An industrial scale experiment with 100 g packages of organic wild rocket was performed (Fig. 2). A sachet with pellets containing an antimicrobial compound was embedded into each tray. **Eugenol, carvacrol, *trans*-anethole** were tested. All compounds showed high antimicrobial activity in laboratory tests.

The produce was stored for 7 days at 5 °C and analyzed for microbial load and sensory quality.

Figure 2. The experimental setup for active packaging at industrial scale.

Sensory quality

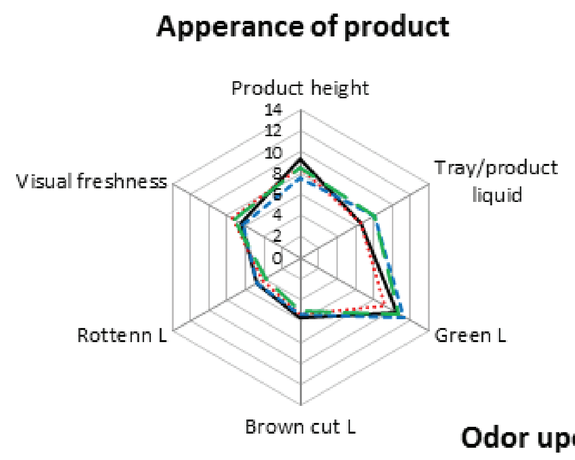

Figure 3. The effect of antimicrobial compounds on the sensory quality of packaged organic wild rocket stored for 7 days at 5 °C. Asterisks indicate significant differences between treatments. L: leaves; O: odor

Antimicrobial effect

Table 1. Effect of the antimicrobial compounds on microbial load.

Compound	Sensory impression	Microorganisms (log CFU g^{-1})*	
		Aerobic bacteria	Yeast & mold
Control (almond oil)	-	8.6a	6.6a
Eugenol	Clove odor	8.6a	6.6a
Carvacrol	Thyme or oregano odor	8.5a	6.6a
trans-Anethole	Fennel, anise or liquorice odor	8.8a	6.6a

*Different letters within a column indicate significant differences between treatments at $P = 0.05$.

Conclusions

- Eugenol, carvacrol and *trans*-anethole have sensory impressions that differ from those of wild rocket.
- Natural antimicrobial compounds impair the odor of decaying wild rocket at first but the positive effect on off-odor scores disappears.
- The antimicrobial effect was insignificant at high relative humidity as with packaged fresh leafy greens.
- Use of natural antimicrobial compounds in packaging is promising but the technology needs to be optimized.

Several steps are involved in development of active packaging solutions:

Test for **antimicrobial activity**

↓

Incorporation of essential oils into **materials** for a steady release

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Test of efficacy in **laboratory tests**

↓

Test of efficacy at **industrial scale**

↓

Produce **quality** & Consumer **acceptance**

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