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Application of Essential Oils on the Preservation of Cucumber Fruit

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Abstract

Cucumber (*Cucumis sativus* L.) is one of the most significant and frequently produced vegetable crops. However, because of its high perishability, keeping its quality from the farm to the market is a challenging problem. Various techniques have been employed to extend the shelf life of vegetables and fruits. The purpose of this study was to assess the effectiveness of Essential Oils of myrtle, eucalyptus, and Spearmint essential oils based on vapor application technique on maintaining quality characteristics of cucumber fruits during storage at 11 ˚C and ~90% relative humidity (RH) for two weeks. The results showed that Mentha EO was successful in preserving cucumber fruit quality. Similarly, Fruit treated with the concentrations 2.5 & 5% of Eucalyptus EO maintained the quality during storage, while Myrtus EO with all concentrations didn't exhibited any antimicrobial activity after 14 days of storage. These findings indicate that the evaluated vapor can be a potential natural alternative to be used to preserve fresh produce instead of the synthesized agents. Nevertheless, the application method and conditions should be further optimized for every product.

Keywords: Steam Distillation, Essential Oils, Biological Activity, Food Preservation.

Introduction

The origin of cucumber (*Cucumis sativus* L.; family Cucurbitaceae) has been attributed to Africa, China, India, or the Near East. Cucumbers are now grown throughout the world using fields or greenhouse culture. In the food world, diseases that are caused by microorganisms lead to large postharvest losses. Fruits and vegetables can be attacked by microorganisms during the production and postharvest stages, leading to significant economic losses for the food industry (lawrence et al 1990).

In the case of *C. sativus*, fruits, and vegetables, the most common diseases were caused by *Pythium* spp. and *Erwinia tracheiphila*. Chemical agents are typically used to inhibit the growth of contaminating microorganisms. However, due to growing concerns over the safety of foods containing chemical additives, natural antibacterial products for fruit and vegetable preservation are attracting increasing attention (Camele et al 2021, AGRIOS et al 2005, Nuttall and Jasmin 1958).

EOs, that can be obtained by many methods, are naturally synthesized in aromatic plants as secondary metabolites and exhibit potent suppressive activity against bacteria, molds, and yeasts; and have therefore been used in food preservation. EOs have the added advantages of being volatile, eco-friendly, and biodegradable, which makes them acceptable to consumers. The main objective of this study was to assess the impact of myrtle, eucalyptus, and Spearmint essential oils) applied using vapor ways on cucumber fruit during storage at 11 ˚C and ~90% relative humidity (Daniella et al 2013, marco et al 2000, akin et al 2010,).

Materials and Methods

- **Preparing fruits**

The fresh cucumber material was purchased in the local marked in xabat and city Erbil, and the cucumber should be at young fresh state, and have no source of bacteria or fungal, and having one cucumber that have been contaminated by fungal or bacteria (Daniella et al 2013).

- **Distillation method**

Fresh Plant parts of Myrtle, eucalyptus, and Spearmint were collected in Erbil before the sun rise. The plant parts were cut into small pieces and hydrodistilled using a Clevenger-type apparatus 2 for 4 hours. The procedure was repeated until the required amount were gained. Sample oil was dried over anhydrous sodium sulfate (Kachkoul et al 2021).

Figure 1: steam distillation Clevenger apparatus

- **Oils application in Tupperware**

Stock solution of (10%) (V:V) from the EOs of tested plants were prepared by dissolving 0.1 mL of EO in DMSO (5%) (V:V). Then, three different concentrations (5%, 2.5%, 1%) (V:V) were prepared from Stock solution by diluting each EO in distilled water. After that, 2 mL of each EO was added to a separate container containing two cucumbers. The Tupperwares then sealed tightly and kept under laboratory condition (approximately 11 - 15°C) for 2 weeks. All tests were performed in triplicate. Distilled water was the control.

- **Decay Evaluation**

Fruit decay was visually evaluated at each storage period (7 and 14 days). All fresh produce from each container were used for the evaluation. A fruit was considered to be decayed when fungal or bacterial growth were visually seen. A scale from 1 to 10 showing the surface infection percentage; as 1: 0–10% infection; 2: 11–20% infection; 3: 21–30% infection; 4: 31–40% infection; 5: 41–50% infection; 6: 51–60% infection; 7: 61–70% infection; 8: 71–80% infection; 9: 81–90% infection; and 10: 91–100% infection was used to estimate the degree of produce infection.

Results and Discussion

Results:

Eucal 1% - no effect

Eucal 2.5%- show effect

Eucal 5%- show effect

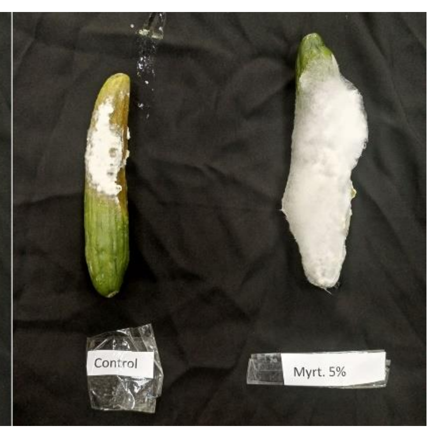
Mentha 1%- show effect

Mentha 2.5%- show effect

Menyha 5%- show effect

Myr 1% - no effect

Myr 2.5%- no effect



Myr 5%- no effect

Table 1: chemical composition of (mp, ecd, mcl)

N	Chemical Composition	MP	ECD	MCL	References (MP)	References (ECD)	References (MCL)
1.	**α-Pinene**	0.47 0.8 0.32	2.57 1.5 ---	0.92 49.1 29.4	Camele et al 2021 Euloge et al 2017 Mohammad et al 2012	Kachkoul et al 2021 Ebadollahi et al 2020 Akin et al,2009	**Akin et al,2009 Amel et al 2010 Rasooli et al 2002**
2.	**β-Pinene**	0.45 1,2 1.45	0.2 0.1 0.24	--- 0.4 ---	Camele et al 2021 Euloge et al 2017 Mohammad et al 2012	Kachkoul et al 2021 Ebadollahi et al 2020 Akin et al,2009	**Akin et al,2009 Amel et al 2010 Rasooli et al 2002**
3.	**P-Cymene**	--- --- ---	17.06 24.8 4.80	--- --- ---	Camele et al 2021 Euloge et al 2017 Mohammad et al 2012	Kachkoul et al 2021 Ebadollahi et al 2020 Akin et al,2009	**Akin et al,2009 Amel et al 2010 Rasooli et al 2002**
4.	**Linalool**	--- --- ---	--- --- ---	12.65 --- 10.6	Camele et al 2021 Euloge et al 2017 Mohammad et al 2012	Kachkoul et al 2021 Ebadollahi et al 2020 Akin et al,2009	**Akin et al,2009 Amel et al 2010 Rasooli et al 2002**
5.	**Limonene**	4.32 2.8 ---	--- --- ---	4.26 6.7 21.2	Camele et al 2021 Euloge et al 2017 Mohammad et al 2012	Kachkoul et al 2021 Ebadollahi et al 2020 Akin et al,2009	**Akin et al,2009 Amel et al 2010 Rasooli et al 2002**
6.	**1,8 Cineole**	--- 6.5 6.69	19.05 6.9 ---	--- 25.0 18.0	Camele et al 2021 Euloge et al 2017 Mohammad et al 2012	Kachkoul et al 2021 Ebadollahi et al 2020 Akin et al,2009	**Akin et al,2009 Amel et al 2010 Rasooli et al 2002**
7.	**Menthone**	14.49 7.4 2.45	--- --- ---	--- --- ---	Camele et al 2021 Euloge et al 2017 Mohammad et al 2012	Kachkoul et al 2021 Ebadollahi et al 2020 Akin et al,2009	**Akin et al,2009 Amel et al 2010 Rasooli et al 2002**
8.	**Menthol**	70.08 46.7 53.28	--- --- ---	--- --- ---	Camele et al 2021 Euloge et al 2017 Mohammad et al 2012	Kachkoul et al 2021 Ebadollahi et al 2020 Akin et al,2009	**Akin et al,2009 Amel et al 2010 Rasooli et al 2002**
9.	**Menthyl acetate**	3.76 6.7 15.10	--- --- ---	--- --- ---	Camele et al 2021 Euloge et al 2017 Mohammad et al 2012	Kachkoul et al 2021 Ebadollahi et al 2020 Akin et al,2009	**Akin et al,2009 Amel et al 2010 Rasooli et al 2002**
10.	**Terpinen-4-ol**	0.37 0.3 0.5	3.39 --- 3.32	--- --- ---	Camele et al 2021 Euloge et al 2017 Mohammad et al 2012	Kachkoul et al 2021 Ebadollahi et al 2020 Akin et al,2009	**Akin et al,2009 Amel et al 2010 Rasooli et al 2002**