Biological Forum – An International Journal **7**(1): 1605-1608(2015)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

The Role of Essences on Post-Harvest Life of Garden Products

Mehdi Dastyaran*, Shahab Mirinejad* and Mehdi Hosseini Farahi*
**Young Researchers and Elite Club, Yasooj Branch, Islamic Azad University, Yasooj, IRAN.*

(Corresponding author: Mehdi Dastyaran)
(Received 29 March, 2015, Accepted 27 May, 2015)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: In recent years, the use of natural ingredients such as essences have been proposed as a new idea to control bacterial and fungal infections and reduced losses after the harvest of horticultural crops such as fruits, vegetables and flowers. Increasing interest in the use of natural ingredients instead of chemicals is due to health concerns in relation to the chemical composition and their adverse effects on human health and the environment. For this reason, efforts in the field of identification and discovery of natural compounds and their use in post-harvest technology for healthy horticultural crops are underway. Natural ingredients include a variety of aromatic compounds such as acetic acid, jasmonic acid, yeast, vegetable essence, chitosan, etc. In this paper, the essence group and their role in post-harvest of garden products in particular the fruit is discussed. Essences are natural colorless compounds composed of alcohol, aldehyde and ester which have their own smell and molecular weight less than water. Essences are volatile and are widely used as food flavoring, antioxidant and antibacterial.

Keywords: anti-fungal, Essence, post-harvest life.

INTRODUCTION

One of the modern techniques used to control pests and diseases after the harvest of fruits and vegetables is using natural materials and components. Although the use of chemical compounds can reduce the damages caused by pathological factors, the use of these compounds is limited day by day due to the side effects. Recently, non-chemical methods such as the use of gamma rays, ultraviolet light, heat treatment and the use of natural ingredients such as essences have been developed. Such operations are still in elementary stages and in early stages of research. Such strategies along with applying hygienic principles during the growth stage that effect the reduction of microbial growth can play an important role on reducing the damages caused by the invasion of pathogens (Hashemi Dezfuli and Meidani, 1997).

Antibacterial properties of the essences and plant extracts have a long history dating back to 1881 AD. For this reason, in bioassay methods gram-positive and particularly gram-negative bacteria are used, because gram-negative bacteria due to having cell membrane inhibit the penetration of hydrophobic compounds of essences and show more resistance (Masch and Ziller, 1998). Several reasons cause the use of essences as antimicrobial agents and antioxidants in foods. These include their natural sources (no use of fossil fuels in their production), low cost of production and low toxicity for mammals. In addition they are natural decomposers of the waste material and can play the role of several artificial materials at the same time including: protecting crops against pests and diseases by the essence due to the fact that they are not accumulated in the environment and do not cause environmental pollution and are they have a wide range of activities and therefore reduce the risk of development of resistant microbial strains, and these qualities are significant (Hi and Waterman, 1995).

Natural essences and mucilage are frequently produced and are easily available in Iran. On the other hand, the elimination of toxins and other chemical fungicide and formulation of effective material to control fungal growth and refrigeration waste that are part of the waste of agricultural products is essential. Considering the limitations of the increasing use of anti-microbial chemicals, it seems that volatile oils are better antimicrobial sources of food preservation and human disease control and have stronger achievement in the production of organic products (Bourize and Ozkan, 2005). In addition, interest in the possibility of using natural compounds to prevent microbial growth for the reduction or elimination of chemical additives to the fruit and vegetables is increasing as a result of consumer pressure (Lambert *et al.,* 2001). The essences are colorless natural compounds composed of alcohol, aldehyde and ester that have their own specific smell and molecular weight less than water. They are volatile and are widely used as a food flavoring, antioxidant and antibacterial (Omidbeigi, 2005).

Protective effects of some natural essences have long been known. For example, storage of fruit with clove powder and salt immersion has been suggested (Lambert *et al.,* 2001). According to sources, the benefits of natural essences on the quality of grapes, avocado and cherry has been shown (Psys *et al.,* 1998; Serrano *et al.,* 2005). But the active ingredients with varying degrees in quality and quantity in these volatile compounds show various anti-fungal and anti-microbial effects depending on the pathogen and the minimum practical strength (Dellaqueze *et al.,* 2002).

A. The Nature and Chemical Structure of Vegetable Essences

Currently, more than 70,000 chemical compounds are known in plants of which 30,000 types are secondary metabolites (Gholami, 2003). A total of 3000 essences or vegetable essences are known of which 300 have economic value (Barrett, 2004). Essences are volatile compounds that because they are not made of fat, they are not capable of being used to produce soap. Some of these have attracting properties and some have repellent properties (Barrett, 2004).

B. The Mechanism of Action of Essences

Given the diversity of antimicrobial compounds of essences, no independent mechanism can be imagined for their activity. Certainly, several intertwined mechanisms determine their anti-fungal and anti-microbial activity. Maybe the reason for the effectiveness of several combinations compared to one compound is affected by the above phenomenon. However, since essences are hydrophobic in nature and act as a catalyst, as a result of joint activities and overlapping of different combinations, the wall and cell membrane of pathogens is destroyed and permeability and ion leakage of cells increase. Following the breakdown of the lipid cell walls, mitochondria and membrane proteins and cytoplasm clots and unloading of proton motive force, damaged cells undergo cell death due to the presence of the essences (Barrett, 2004).

Induced systemic resistance in plants, lysis of fungi and lack of access to water for growing the organs of plants are other known mechanisms. In general, the essences as molecules containing oxygen and negative ions have antimicrobial properties, they are anti-tumor, facilitate the absorption of nutrients and reinforce the cells resistance. They remove dust from the environment and release oxygen molecules into space. The recent feature has caused the essences to act as a healthy and natural air conditioner (Shaya *et al.,* 1991).

C. Evaluation of Biological Activities

The deterrent level of the compounds of natural essences against gram-negative and gram-positive bacteria and arable fungi is done via bioassay method or aromatogram. For this purpose plates with a diameter of 4.2 micro liters of the intended extracts is added into each plate. After uniform spraying of bacteria suspension or fungal spores to the medium and the incubation of the petri for 48-24 hours, the diameter of inhibition around the plates is measured. Obviously, the amount of inoculums, pathogen growth phase, type, thickness and pH of the medium, ambient temperature and incubation period effect inhibition. Alternative methods include the use of discs containing the essences on solid medium and culturing the target bacteria in liquid medium and determining the deterrence degree of the essences by counting the number of bacterial colonies or turbidimetery.

To determine the minimum inhibitory concentration (MIC) which is the criterion to determine antifungal and antibacterial power of essences, the essence to be tested inhibits the growth of fungi or bacteria at the lowest concentration. To assess the effect of essences and plant extracts on organs such as flowers, leaves and immature fruits, minimum inhibitory concentrations are used, because the mentioned organs are highly sensitive to natural and pure essences and in a few seconds the plant is completely burnt. Plant burning level of diluted essentials could be evaluated between 0 to 24 hours (Barrett, 2004).

D. A Review of a Number of Studies in this Area

The results of a research showed that essences extracted from thyme has a significant effect in reducing soft rot and gray mold of strawberries (Reddy *et al.,* 1997). The effect of clove essence on increasing the shelf life of cherries was studied in an experiment. The results showed that clove oil at a concentration of 1000 ppm has significant effect in reducing fungal contamination and increased storage life of cherries. Minimal necrosis was observed in the tail of cherries (Aziz *et al.,* 2007).

In another experiment, strawberries and tomatoes were exposed to volatile compounds extracted from eucalyptus and cinnamon. The results showed that treatment with natural ingredients enhance the quality of post-harvest and they make the fruit stiff (Trzort Zakys, 2007). The results of the study by Ranjbar *et al* (2008) conducted on strawberry showed that in general the essence of cumin compared to the essences of lavender, funnel and peppermint have stronger anti-fungal effect and the essence of peppermint has the lowest effect.

Asghari Mrjanloo *et al.,* (2008) showed that basil essence in concentrations (60, 250, 500 and 1000 micro liters per liter) significantly prevented the growth of the fungus *B. cinerea* on strawberry (Selva) compared to the control.

Basil essence in low concentrations of 60 and 250 microlitres per liter had positive effect on some quality parameters (color, titratable acidity, soluble solids, vitamin C and tissue stiffness) of the fruit.

Jalili Marandi *et al.,* (2010) in the research that examined the effect of thyme and sweet basil on grapes, found that thyme essence at 500 microlitres per liter has a better effect than sweet basil in maintaining the quality of the fruit and with increasing the concentration, its effectiveness increased. A study found that zataria in concentrations of 400 microlitres per liter (20 minutes immersion) control the green fungus on the Washington Navel orange effectively (pollution reduction of 80% in the control group to 17% in the treatment) but the results were not acceptable on blue fungus (Soleimani *et al.,* 2009).

One research showed that extracts of cloves, cinnamon and lemongrass with a concentration of 15 microlitres per liter completely inhibited the activity of Botrytis fungus, but ginger had a weak inhibitory effect at a concentration of 25 microlitres per liter. The antifungal activity of extracts of lemongrass and clove were the most powerful and cinnamon extract was in the next rank (Siri portoisal *et al.,* 2009).

CONCLUSIONS

The global approach today is toward organic agriculture. The system is trying to avoid factors with chemical origin. The adverse impact and residues of chemical fertilizers, pesticides, hormones, etc. in food products have caused agriculture move to avoid using any chemical or synthetic inputs (Malakouti, 2009). The use of vegetable essences for the control of postharvest diseases of fruits and vegetables has been proposed as an effective biological way in recent years and has secured the attention of many researchers as an effective and safe way. The use of essences can help reduce waste while providing product safety and health of the fruit (Pluto *et al.,* 2003).

Given that the sensitivity of fungus species are different depending on the type of essence, its composition and its concentration, wider applied research shall be performed in this field and the results shall be put into practice.

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