Development and application of a new Edible Coating on fruits and fresh-cut fruits

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This PhD project aims the post-harvest management improvement of fruit (whole and fresh-cut fruit), extending its shelf-life; considering the use of compound from waste materials of food production chain or alternative resources, to develop new Edible Coatings. Novelty is the use of edible coatings obtained from crop residues of *Posidonia oceanica*, a Mediterranean seagrass widely spread on the coasts of Sicily, which is responsible for accumulation of biomass on the beaches. To satisfy the objective we would like to create an interaction between 1-MCP and coating.

Sviluppo di un nuovo edible coating e applicazione su frutti interi e di IV gamma

Il progetto di ricerca ha come scopo il miglioramento della gestione post-raccolta dei frutti (interi e di IV gamma), intervenendo sull'estensione della *shelf-life*; valutando l'utilizzo di composti provenienti da materiali di scarto delle filiere produttive agroalimentari o risorse alternative da utilizzare come nuovi rivestimenti commestibili (edible coating: EC). La novità riguarda lo sviluppo di un edible coating a partire da residui vegetali di *Posidonia oceanica*, pianta acquatica mediterranea ampiamente diffusa sulle coste siciliane, responsabile di accumulo di biomassa sulle spiagge.
Per soddisfare, in maniera efficace, l'obiettivo iniziale si vorrebbe creare una interazione tra 1-MCP e coating.

1. State of the Art

During storage/processing/marketing periods climacteric fruits continue the ripening process due to the biosynthesis of ethylene; cellular respiration causes the consumption of O_2 and the respective CO_2 emission.
Furthermore, respiration process causes the modification of the substrate, with subsequent conversion of sugars and hydrolysis of pectins, with a consequent loss of firmness and browning of tissues.
Thus over the years, have been developed different combinations of Controlled Atmosphere in order to delay the process of senescence and prolong the shelf-life (Kader, 1986). The mixture of gases used, as well as the percentage of relative humidity (% RH), O_2 and CO_2, depend on the packaged product (Kader, 2000).
Generally, using low levels of O_2 (<2%) and high levels of CO_2 (> 5%), allowing the slow of browning reactions, reduction of respiration rate and ethylene biosynthesis (Gorny, 1997).
In recent years, several physical, chemical and technological solutions have been used to reduce the perishability of fresh-cut produce and to increase its shelf-life. From the technological point of view, the edible films have been quite successful in recent times but the technique is not yet widely consolidated.
The edible coatings are thin layers of biopolymeric material, based on polysaccharides, proteins, lipids or blend of these components (Bourtoom, 2008). These films act as barriers against moisture, oxygen, carbon dioxide and solutes that migrate from the food; reduce microbial growth, oxidative and browning processes (Silva-Weiss *et al.*, 2013), allowing the increase of shelf-life (Lin & Zhao, 2007).
In addition, the ECs play a role of carriers towards antimicrobials and antioxidants, improving the efficiency of these compounds (Min & Krochta, 2005; Bourtoom, 2008).
The ECs can be applied to the product by dipping or spray, each technique influence in different ways the permeability properties (against gas and water vapor) of the materials (Silva-Weiss *et al.*, 2013).
Among the most widely used chemicals for the control of the senescence of fruits, appears 1-MCP. This is an antagonist of ethylene gas; this antagonism is carried out by the occupation of the ethylene receptors, present on the surface of the fruit.
In this way, the ethylene is no longer able to bind, causing the interruption of the biosynthesis (Sisler & Serek, 1997) until such receptors will not be restored (Blankenship & Dole, 2003). The affinity of 1-MCP for the ethylene receptors is about 10 times greater than hormone.
The enzymes responsible of the ethylene synthesis, ACC synthase and ACC oxidase, are inhibited from 1-MCP (Owino *et al.*, 2002; Dong *et al.*, 2001), at different concentrations of the molecule and on the basis of temperature, exposure time and depending on the type of species (Blankenship & Dole, 2003).
Few experiments have been carried out on the application of 1-MCP on minimal processed fruits, since the consumer avoids chemical solutions, seeking alternatives of natural origin.
Currently, few studies on *Posidonia oceanica* have been carried out, no one about developments of edible films.
This seagrass has a good content of phenolic compounds (Cuny *et al.*, 1995; Dumay *et al.*, 2004; Gokce & Haznedaroglu, 2008) used by the plant as a defense system against predators, competitors and pathogens (Agostini *et al.*, 1998).

2. PhD Thesis Objectives and Milestones

Within the overall objective mentioned above this PhD thesis project can be subdivided into the following activities according to the Gantt diagram given in Table 1:

A1) **Bibliographic research**. Literature research of ECs and their applications, to identify the best chemical and technological combinations.

A2) **Application of EC and interaction with 1-MCP**. Whole fruits of peach will be treated with 1-MCP and covered with EC based on *A. arborescens*.

A3) **Development of a new EC.** Will develop a new edible film using, as a source, *P.oceanica* endemic seagrass of the Mediterranean area.

A4) **Application of the new EC on whole and fresh-cut fruits.** On whole and fresh-cut fruits of peach, will be treated with new and *A. arborescens* ECs.

A5) **Optimization of the new EC.** The new EC will be optimized with use of antioxidants and antimicrobial compounds derive from waste of food production chain (ex. inositol by stems of *C. scolymus*; essential oils extracted from leaves of *M. communis*).

A6) **Application of the new optimized EC.** Optimized EC will be applied on whole and fresh-cut fruits, to test its efficiency on the extension of shelf-life, in relation to antioxidant and antimicrobial added component.

A7) **Writing and Editing** of the PhD thesis, scientific papers and oral and/or poster communications.

Table 1 Gantt diagram for "Development and application of a new Edible Coating on fruits and fresh-cut fruits"

Year		2015												2016											
Activity \ Months		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
A1	***Bibliographic research***																								
A2	***Application of EC and interaction with 1-MCP***																								
A3	***Development of a new EC***																								
	1) Purification																								
	2) Extraction																								
	3) Suitability test																								
A4	***Application of the new EC on whole and fresh-cut fruits***																								
A5	***Optimization of the new EC***																								
	1) Extraction of EO																								
	2) Extraction of inositol																								
	3) Application of additives in EC																								
A6	***Application of the new optimized EC***																								
A7	***Thesis and Paper Preparation***																								

3. Selected References

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