INVESTIGATION OF COATING PINEAPPLE SLICES WITH DIFFERENT EMULSIONS BY ELECTRO-SPRAYING METHOD

G. Ela Gurpuz, Seher Kumcuoglu, Sebnem Tavman
Ege University Department of Food Engineering, İzmir, Turkey, sebnemtavman@ege.edu.tr

WHY EDIBLE COATING?

- Extend the shelf-life of coated food,
  - Improve water barrier properties
  - Control gas exchange (water vapor, O_2, C O_2, ethylene etc.)
  - Decrease or prevent increasing the microbial load
- Minimize the use of plastic packaging, therefore create a sustainable solution,
- Improve/protect sensory properties (color, texture, flavor)

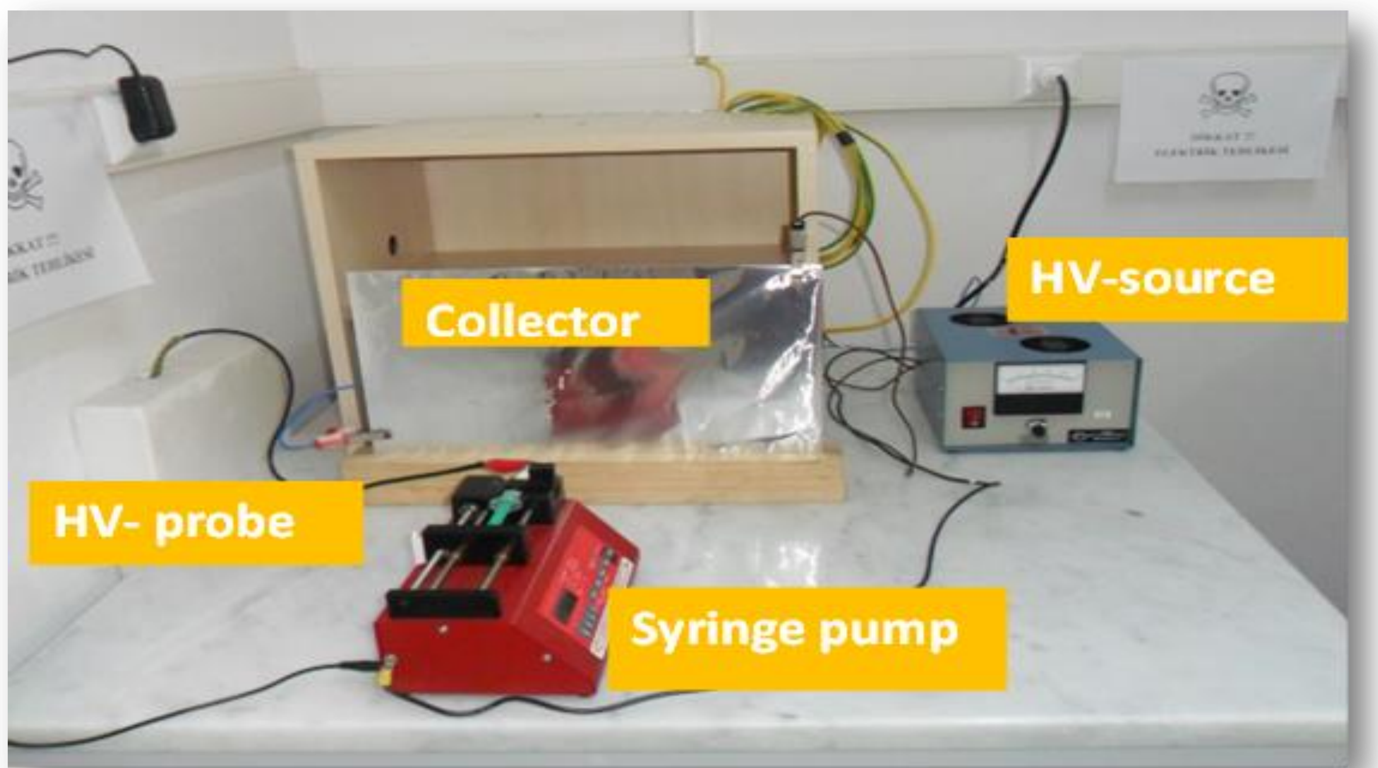
ELECTROSPRAYING

Production of small, uniform droplets from a liquid flowing through a capillary under applied electric potential. When the applied potential is increased, the liquid elongates and forms a steady spindle shape at the tip of the capillary (Hayati et al., 1987). This stable geometry is named as 'Taylor cone' (Cloupeau and Prunet-Foch, 1989). At the cone-jet geometry; liquid disrupts into monodisperse and fine droplets. Electrospraying has high deposition efficiency (up to 80%), because the charged droplets are attracted towards the material to be coated with the effect of Coulomb force.

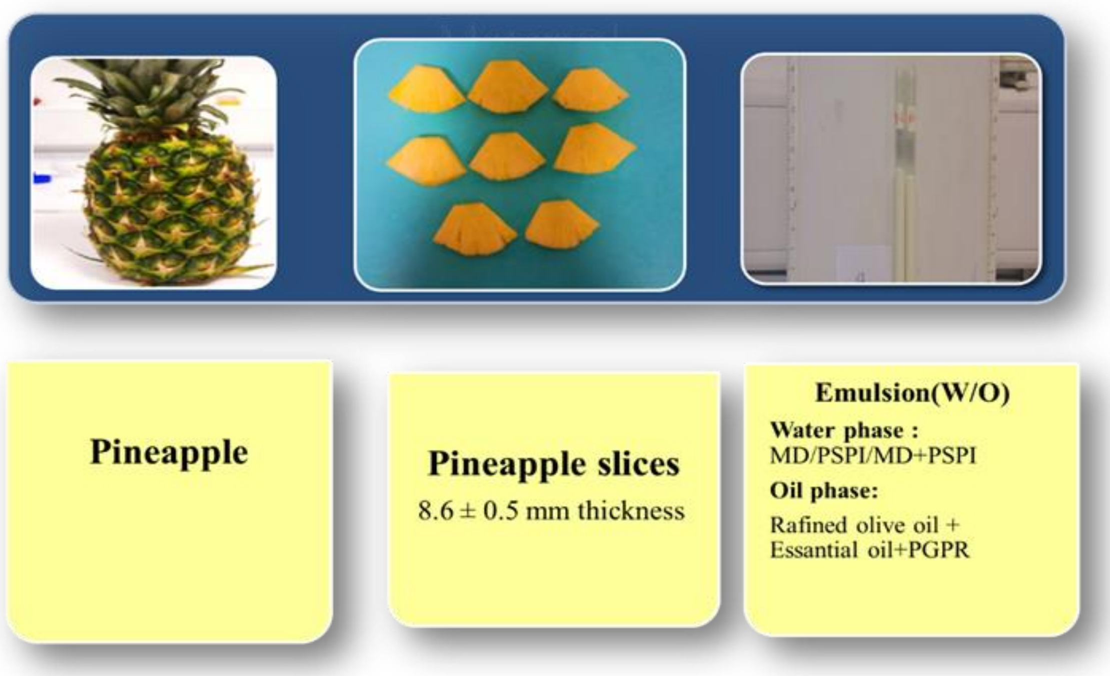
AIMS OF THE STUDY

- Extend the shelf life of fresh-cut pineapple
- Develop a novel edible coating production method as an alternative to conventional methods
- Determine the possibility of using w/o emulsion on a hydrophilic fruit surface

ELECTROSPRAYING SYSTEM



MATERIAL AND METHOD



Emulsions were prepared by high speed homogenizer and oil separation %, viscosity, electrical conductivity and surface tension analysis were conducted. Electrospraying process was realised the specified feed rate in a vertical electrospraying system for a certain period of time by applying the voltage that the emulsions could be steadily sprayed using the collector distance. Essential oils used as antimicrobial agents in coating materials which were added to the oil phase of the emulsions at 2%. The quality characteristics of the coated pineapple samples were evaluated by examining the weight loss (%), pH, titratable acidity, color, texture, total antioxidant activity (TAA) and total phenolic content (TPC), microbiological and sensory analysis results for both coating methods during storage period.

RESULTS

- The present study showed that, the edible coatings produced with electrospraying have similar or even better results for decreasing moisture losses of fresh-cut pineapples.
- The amount of coating material was significantly reduced (300 times less than dip-coating) while the product quality during shelf life was improved compared to the conventional method.

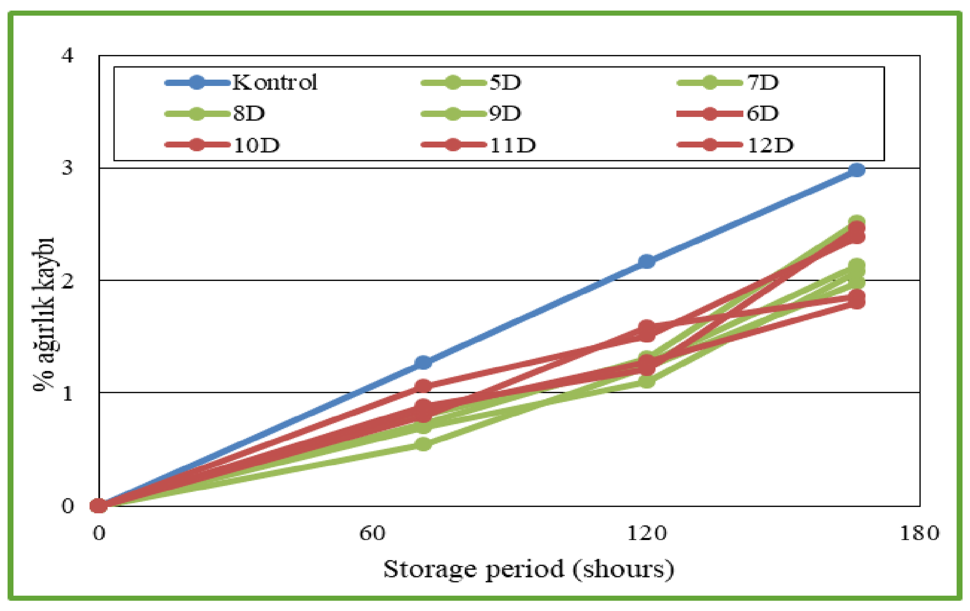


Fig. 1. Dipped pineapple slices weight losss during storage (%)

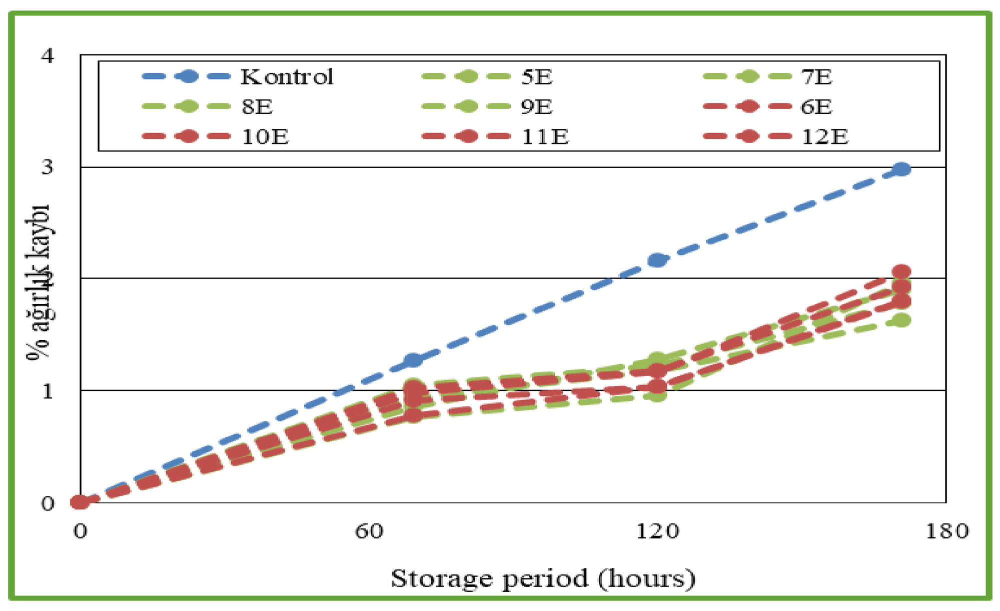


Fig. 2. Electro-Spray coated apineapple slices weight losss during storage(%)

- pH and titratable acidity of coated and control samples did not change significantly depending on the storage time or the coating formulation. Although coating material was higher in dip-coating method, there was no significant effect observed comparing the coating methods.

Table 1. Changes in total antioxidant activity and phenolic content of coated pineapple samples during storage period

Samples	Total Antioxidant Activity (µmol TEAC/g sample)	Total Phenolic Content (mg GAE/kg sample)
Control- 0.day	5.66^{b} ± 0.17	513.61^{b} ± 3.14
Control- After 5 days	5.88^{b} ± 0.11	402.92^{a} ± 9.44
5D- 0.day	6.76^{d} ± 0.35	781.61^{e} ± 1.89
5D- 5th days	4.54^{a} ± 0.17	598.24^{c} ± 22.74
6D- 0.day	5.80^{b} ± 0.13	678.76^{d} ± 34.74
6D- 5th days	4.80^{a} ± 0.25	619.51^{c}± 36.91
5E- 0.day	6.76^{d} ± 0.35	510.58^{b} ± 40.29
5E- 5th days	4.60^{a} ± 0.05	534.96^{b}± 31.11
6E- 0.day	6.37^{c} ± 0.12	534.06^{b} ± 28.66
6E- 5th days	6.01^{b} ± 0.22	525.11^{b} ± 40.09

Table 3. Changes in microbial load during storage period

Sample	Total (aerobic) bakteria count (log KOB /g)		Mold-yeast count (log KOB/g)	
	0.day	5th day	0.day	5th day
K	<1	<2	3.89	4.57
5D	1	<2	3.32	3.85
6D	<1	<2	3.41	3.97
7D	<1	<2	3.60	3.86
8D	1.32	<2	2.91	3.23
9D	<1	<2	2.98	3.45
10D	<1	<2	>4.69	4.96
11D	1.32	<2	3.04	3.97
12D	1.86	<2	4.23	3.91
5E	1	<2	3.40	3.76
6E	1.32	<2	3.15	3.84
7E	1	<2	2.91	3.56
8E	<1	<2	3.08	3.92
9E	1	<2	3.04	3.85
10E	<1	<2	2.45	4.04
11E	1.49	<2	2.75	4.43
12E	1	<2	3.23	3.68

Table 2. Total antioxidant activity and phenolic content of coated oils

Sample	Total antioxidant activity (µmol TEAC/g sample)*	Total phenolics (mg GAE/kg sample) **
Pomegranate seed oil	2.41^{b} ± 0.16	93.61^{c} ± 4.49
Grape seed oil	1.98^{a} ± 0.12	67.43^{b} ± 2.49
Rafined olive oil	1.85^{a} ± 0.05	16.24^{a} ± 0.62

* DPPH method "TEAC " ** Phenolic content" GAE

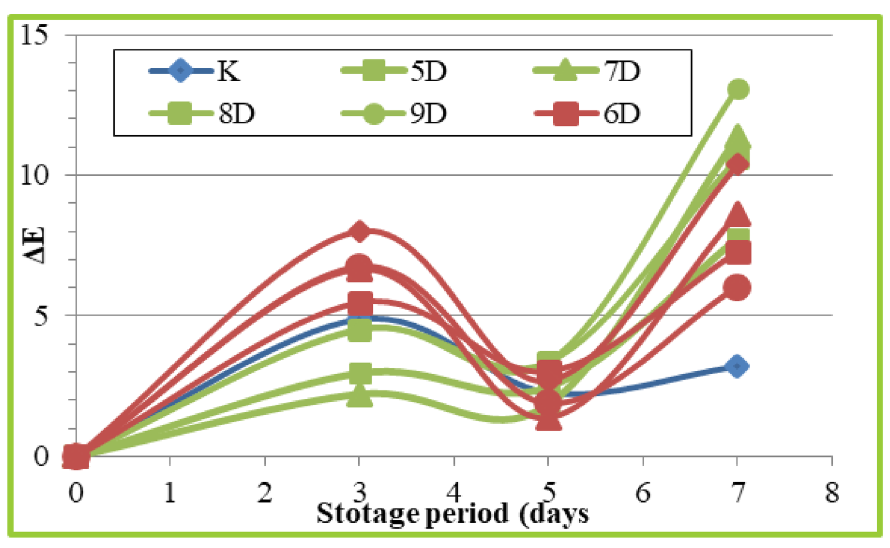


Fig. 3. Color changes for dipped pinaapples

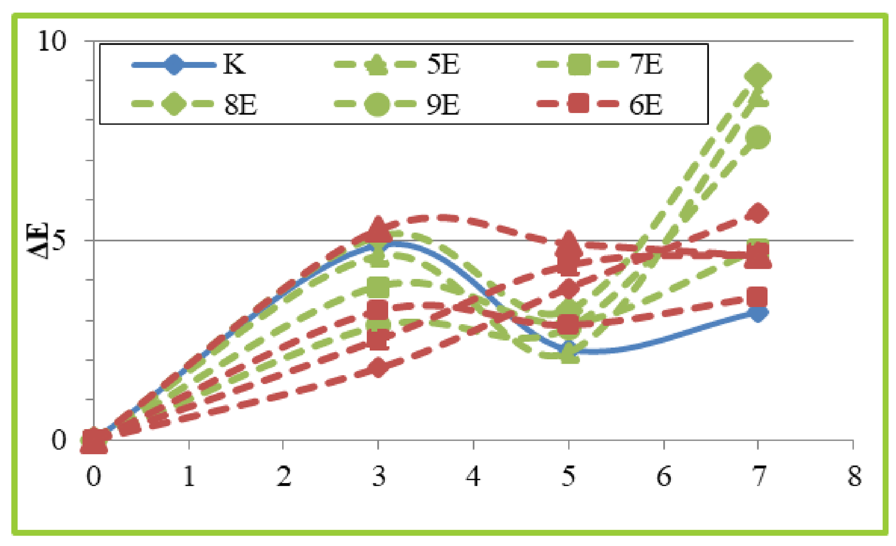


Fig. 4. Color changes for electrosprayed pinaapples

CONCLUSIONS

According to the weight loss (%), pH, titratable acidity, color, texture, total antioxidant activity (TAA) and total phenolic content (TPC), microbiological and sensory analysis results; electrospraying method indicated close or better quality properties compared to samples coated with immersion method or control samples. It has been determined that pineapple slices can be stored with this method without losing quality properties and positive results are obtained in investigating the effectiveness of the method for future studies.

ACKNOWLEDGEMENT

This work was supported by TUBITAK [project number: 214O405, 2017]; Ege University Scientific Research Fund [project number: 15-BIL-024, 2017]. Authors would like thank Assist. Prof. Dr. Huseyin Kurtuldu for helping image processing.

ActInPak
cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY
Funded by the Horizon 2020 Framework Programme of the European Union