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Improvement in shelf-life of pizza ingredients by the development of edible food packaging in vending machines sector

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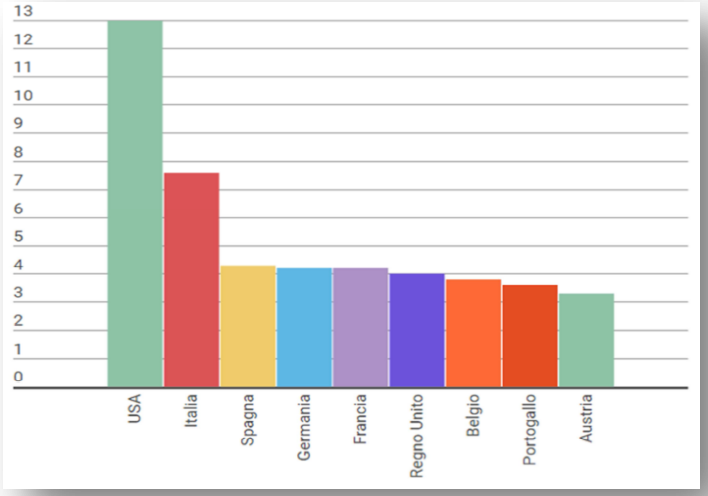
30/11/2018

Pizza and vending machine sector

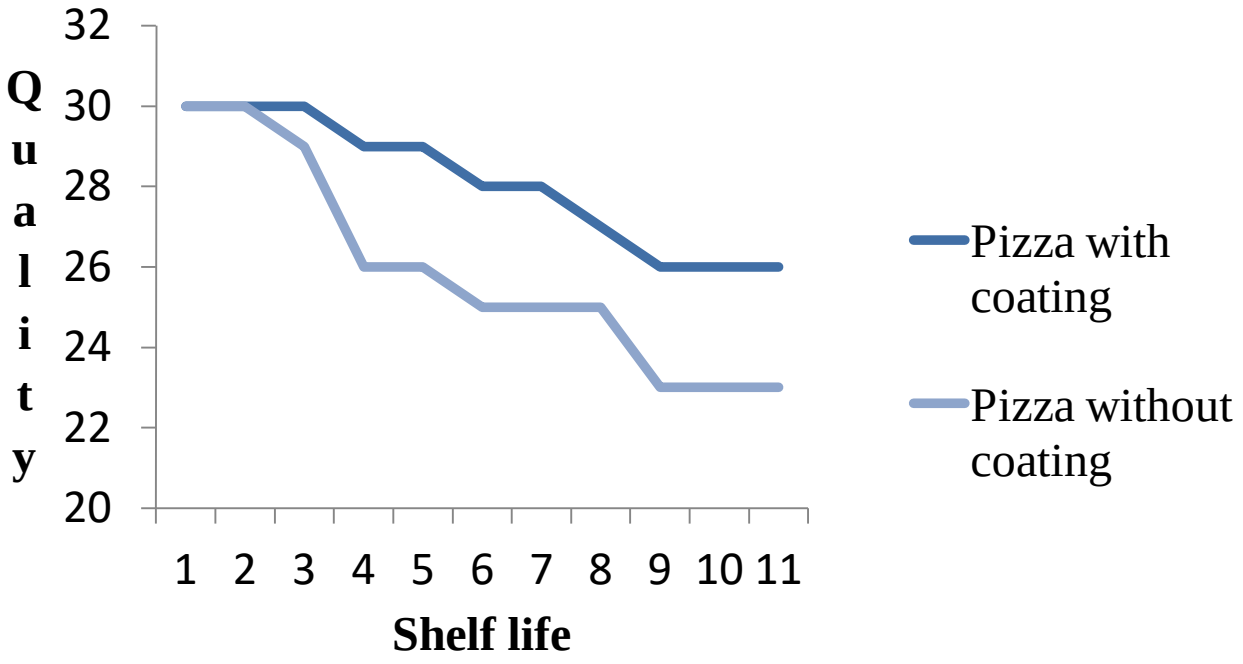


(**http://www.truenumbers.it/numeri-pizza/)**

The automatic distribution sector is worth more than EUR 400 billion in Italy with 800 million machine installed in all the peninsula

https://www.youtube.com/watch?v=ptMQH9pbBQQ

Edible coating choise



Improving the shelf-life of a pizza dough in a vending machine system

Before

After

Standard Recipe

- 500 g of wheat flour 00
- 250 g of wheat flour 0
- 500 mL of water (37 °C),
- 15 g of NaCl, and
- 1,5 g of fresh yeast

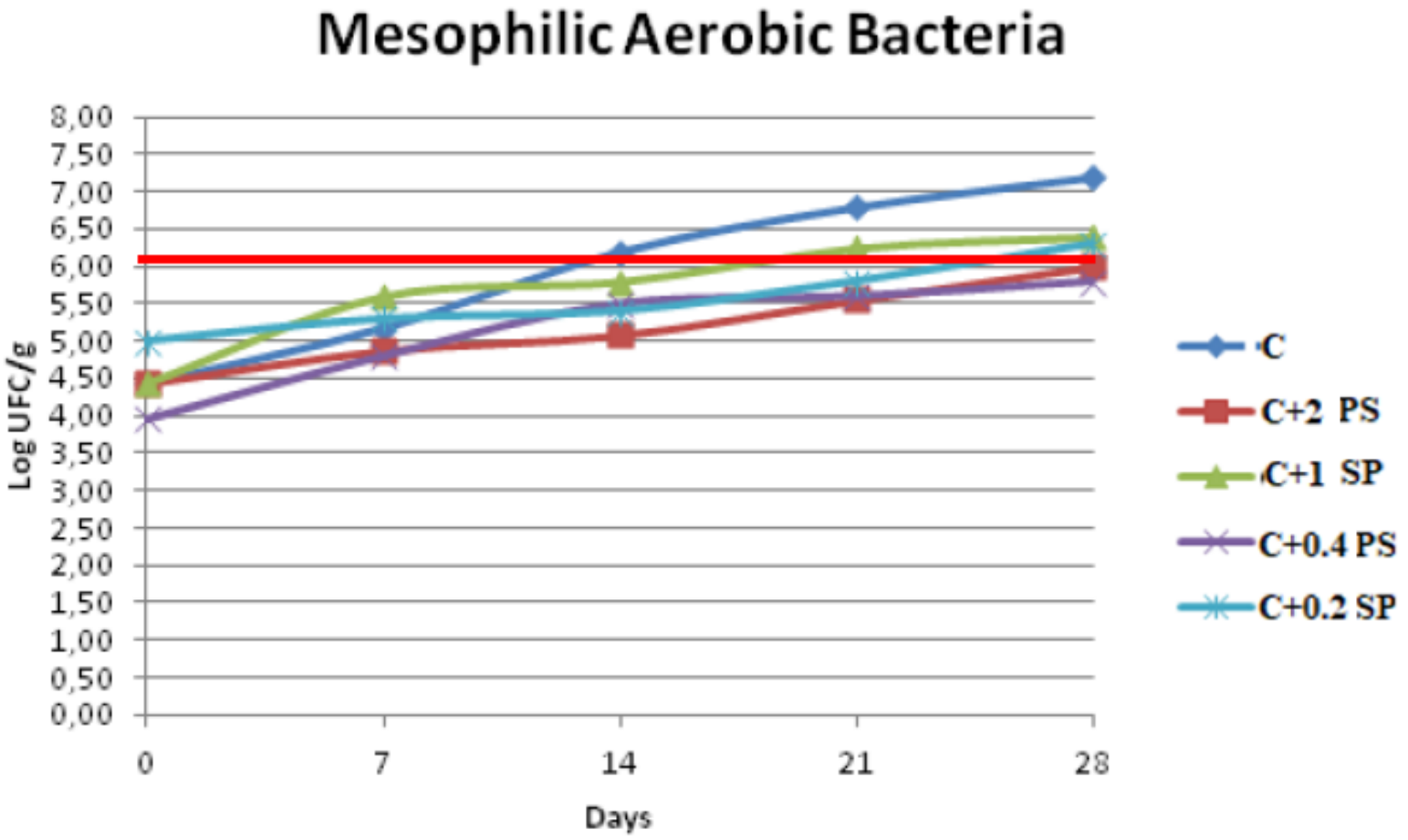
C: control dough with only basic pizza recipe

C+2PS: dough coated with pectin and potassium sorbate

C+1SP: dough coated with pectin and sodium propionate

C+0.4PS: dough with potassium sorbate as ingredients

C+0.2SP: dough with sodium propionate as ingredients



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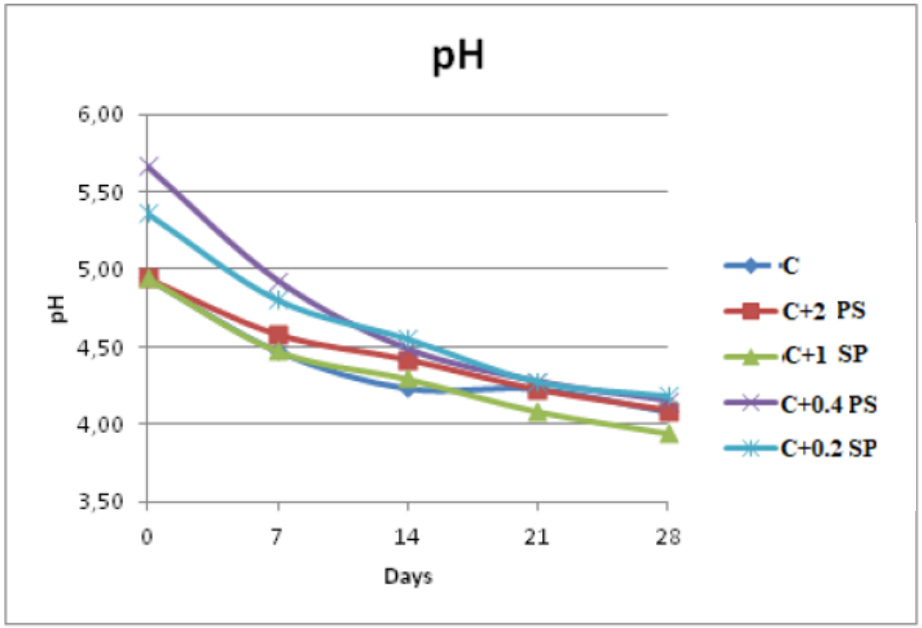
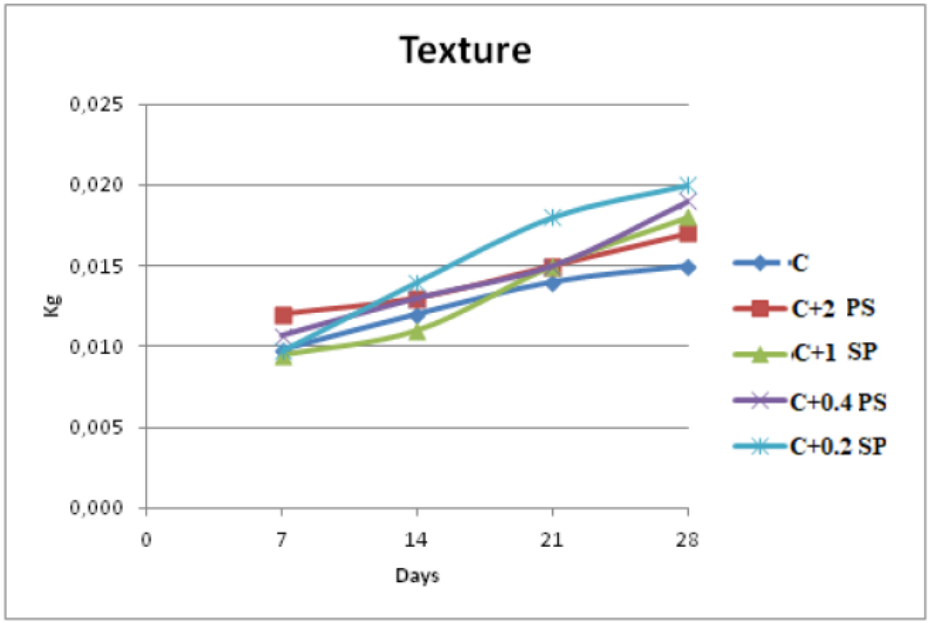
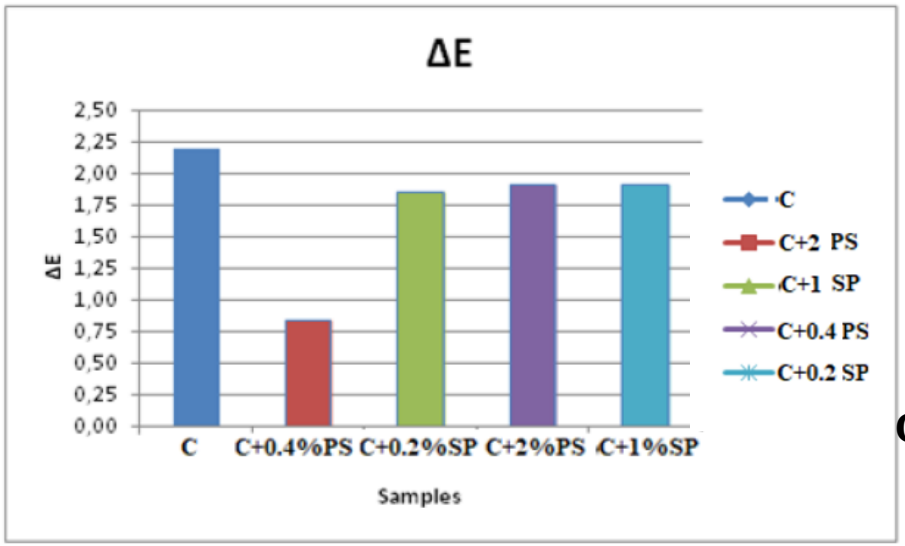






C: control dough with only basic pizza recipe
C+2PS: dough coated with pectin and potassium sorbate
C+1SP: dough coated with pectin and sodium propionate
C+0.4PS: dough with potassium sorbate as ingredients
C+0.2SP: dough with sodium propionate as ingredients

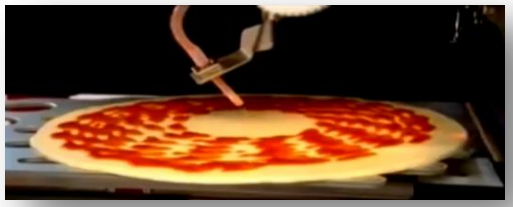
•The best sample was the dough containing potassium sorbate in its formulation with a **shelf-life near 1 months** (**C+0.4PS**).

•**C+0.4PS** had the best microbiological and physical-chemical results until the end of analysis (28 days).

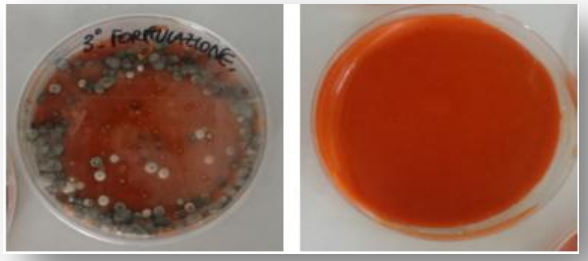
•The control sample and the others had a shelf-life of 2 weeks and 3 weeks of analysis, respectively.

Effect of edible solution on shelf-life and quality of tomato sauce

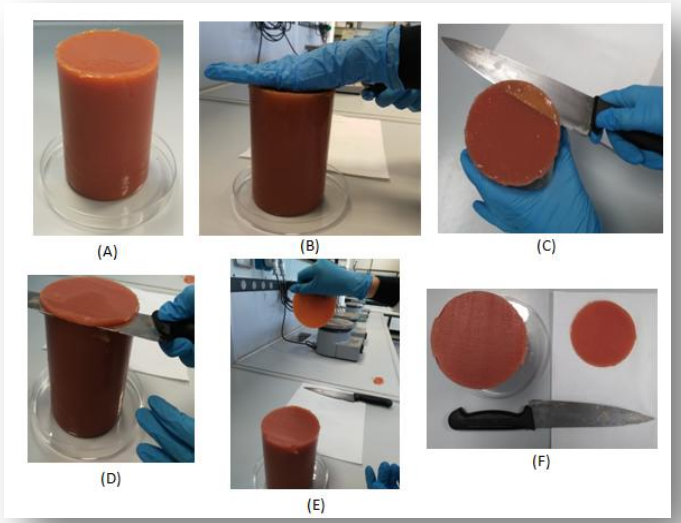
Before

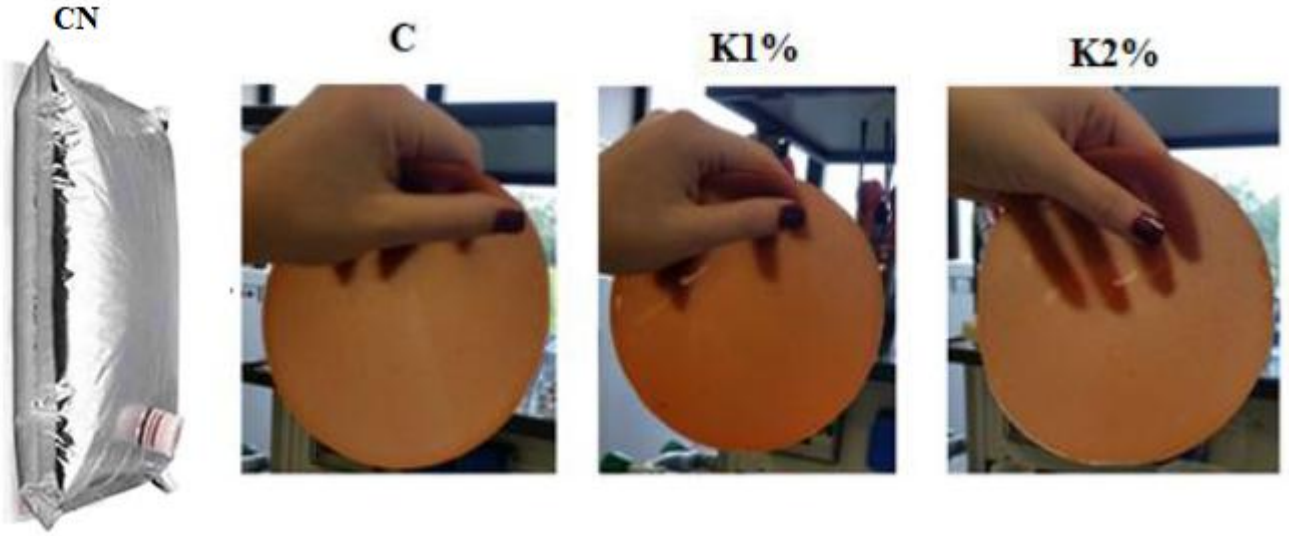


After



Pectin and agar



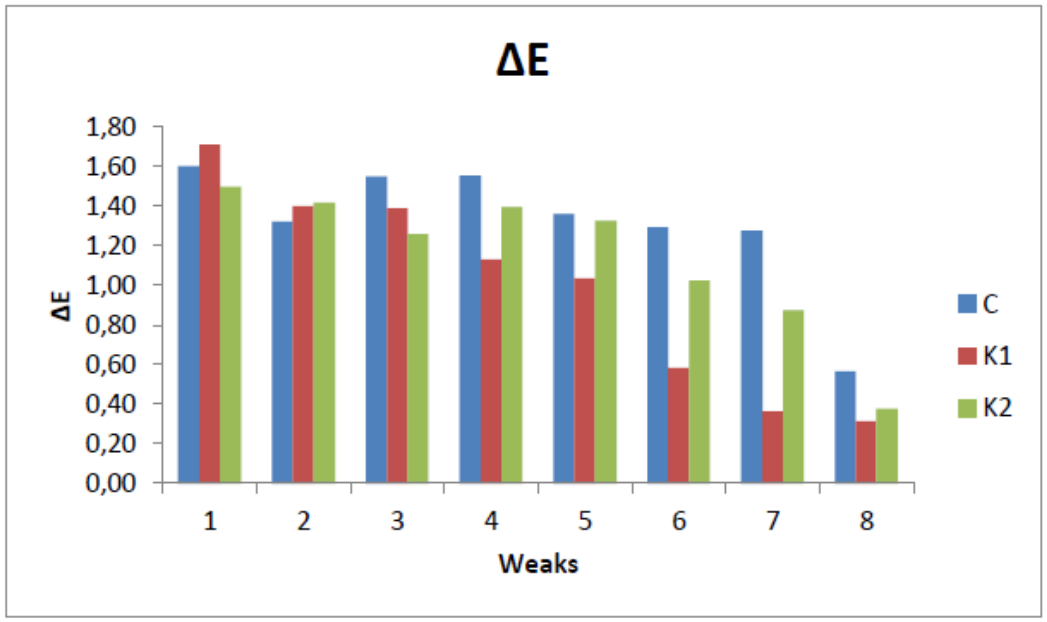


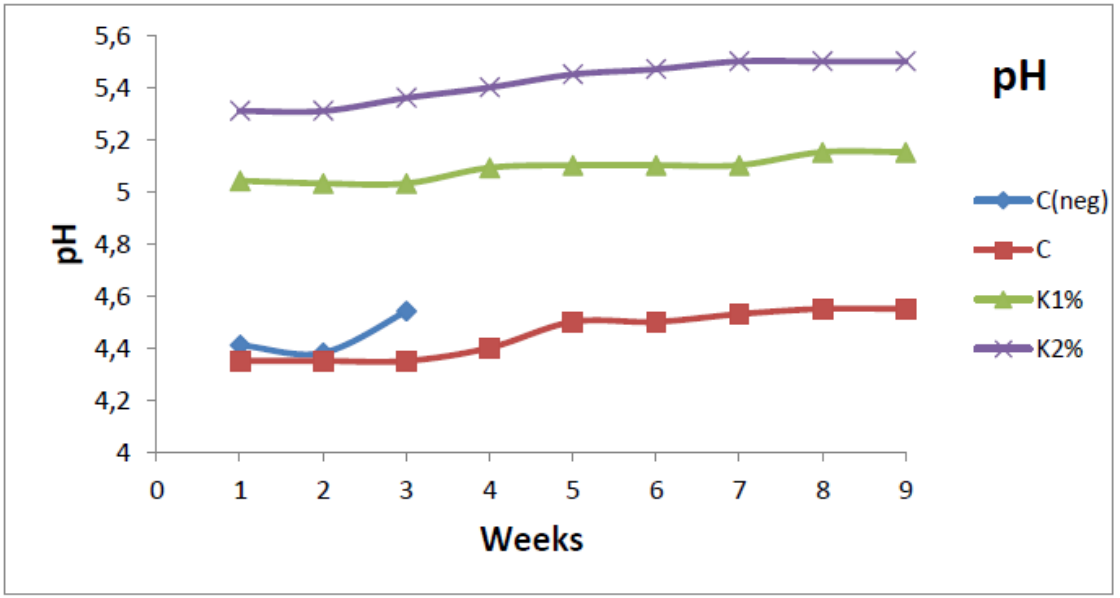
Aerobic mesophilic values

t (weeks)	CN (CFU/g)	C (CFU/g)	K1% (CFU/g)	K2% (CFU/g)
1	3.1×10^{2}	4.5×10^{2}	2.5×10^{2}	6.7×10^{2}
2	$>10^{6}$	4.1×10^{2}	1.3×10^{2}	5.3×10^{2}
3	$>10^{6}$	1.5×10^{2}	8.5×10^{2}	9.5×10^{2}
4	$>10^{6}$	2.6×10^{2}	2.4×10^{2}	3.6×10^{2}
5	$>10^{6}$	3.4×10^{2}	5.9×10^{2}	4.7×10^{2}
6	$>10^{6}$	2.0×10^{2}	5.3×10^{2}	2.3×10^{2}
7	$>10^{6}$	4.9×10^{2}	2.8×10^{3}	2×10^{4}
8	$>10^{6}$	3.9×10^{3}	2.5×10^{3}	2×10^{3}
9	$>10^{6}$	4.5×10^{3}	3×10^{1}	6×10^{1}

Molds values

t (weeks)	CN (CFU/g)	C (CFU/g)	K1% (CFU/g)	K2% (CFU/g)
1	4.3×10^{2}	2.3×10^{2}	4.5×10^{2}	2.5×10^{2}
2	5.6×10^{7}	6.8×10^{7}	2.4×10^{7}	6.4×10^{7}
3	3.2×10^{3}	3.1×10^{2}	3.1×10^{2}	1.3×10^{2}
4	$>10^{6}$	2.6×10^{2}	6.6×10^{2}	3.6×10^{2}
5	$>10^{6}$	4.5×10^{7}	5.4×10^{7}	2.4×10^{7}
6	$>10^{6}$	5.7×10^{2}	2.7×10^{2}	8.3×10^{2}
7	$>10^{6}$	3.6×10^{2}	4.7×10^{2}	2.9×10^{2}
8	$>10^{6}$	7.2×10^{3}	8.6×10^{7}	3.0×10^{7}
9	$>10^{6}$	3.9×10^{3}	6.7×10^{3}	6×10^{3}


ΔE
1,80
1,60
1,40
1,20
1,00
0,80
0,60
0,40
0,20
0,00
ΔE
1
2
3
4
5
6
7
8
Weaks
C
K1
K2


pH
5,6
5,4
5,2
5
4,8
4,6
4,4
4,2
4
pH
0
1
2
3
4
5
6
7
8
9
Weeks
C(neg)
C
K1%
K2%

• C, K1% and K2% are able to increase the microbiological safety of the tomato sauce, preserving its organoleptic characteristics.

•The change in the texture of tomato sauce improved the storability and the handy by automatisms.

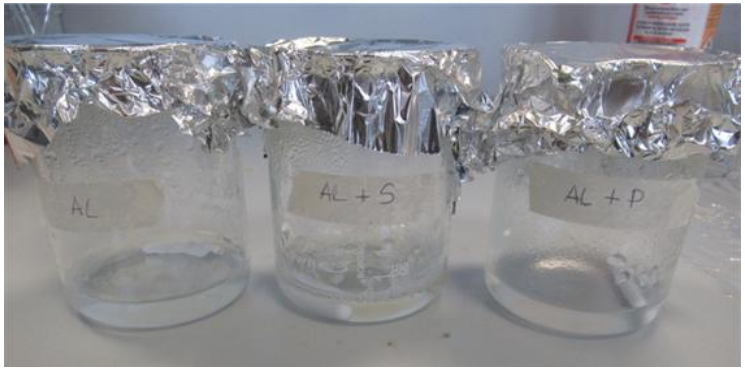
•All the treated samples proved to be suitable for the application tested until week 9

Alternative systems to improve the shelf-life of cheese pasta filata per pizza

- *In vitro* test to determine the antimicrobial effect of coatings against bacteria responsible of food-borne;

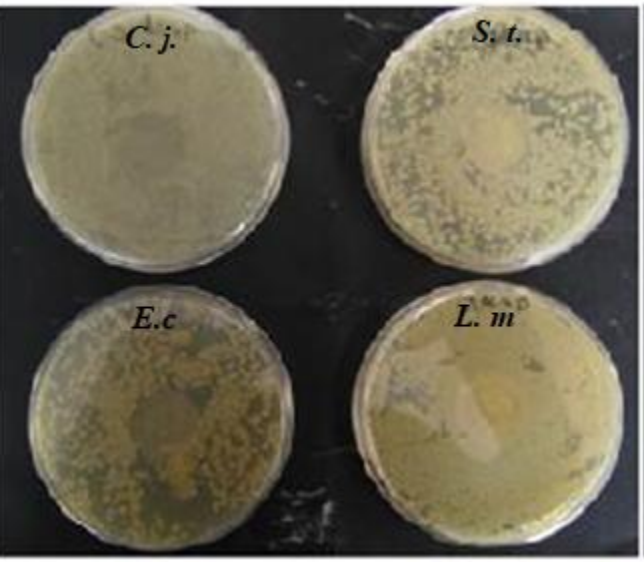
- *In vivo* test for the determination of the shelf-life of coated mozzarella samples

- Comparison between the best sample and the mozzarella sample actually presented in Vending machine

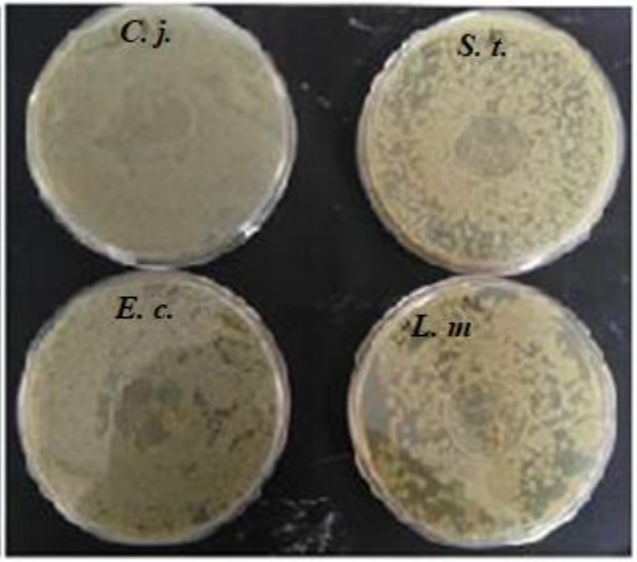


- "AL" coating with sodium alginate
- "ALP" sodium alginate coating and potassium sorbate;
- "ALS sodium alginate coating with sodium propionate;

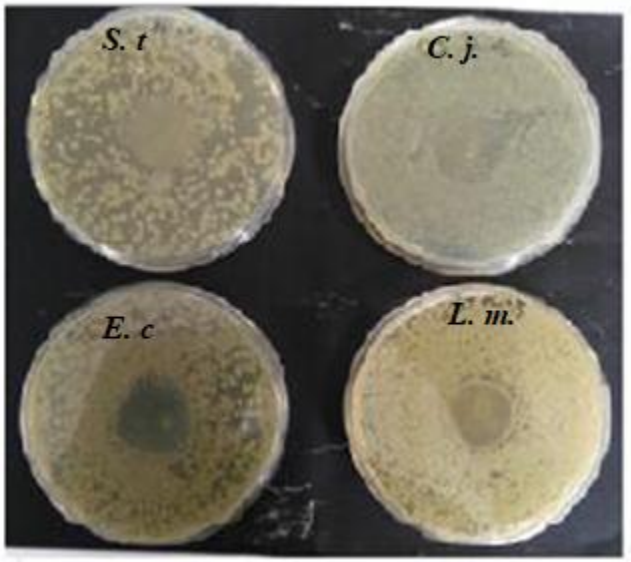
In vitro test



ALP coatings;

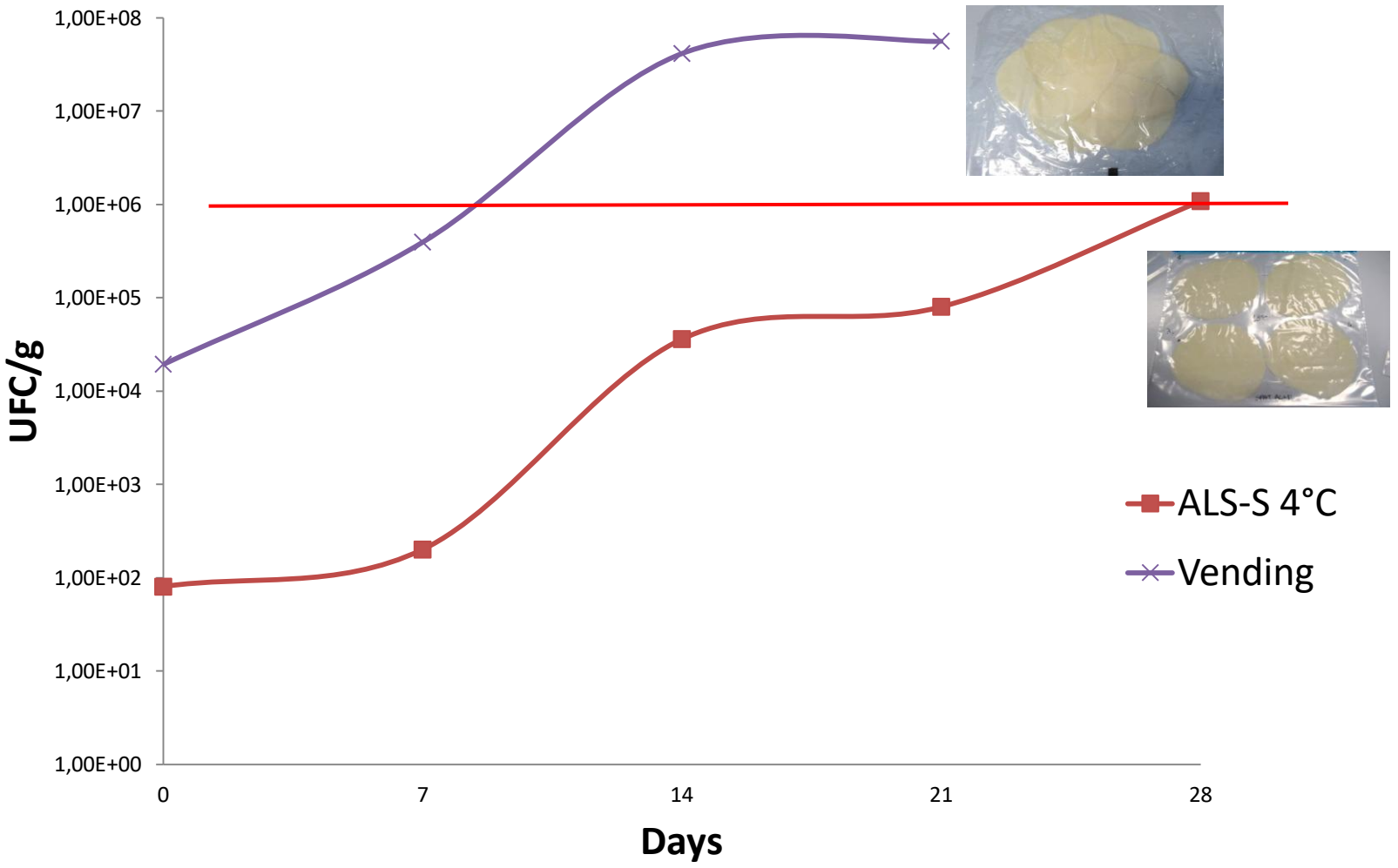


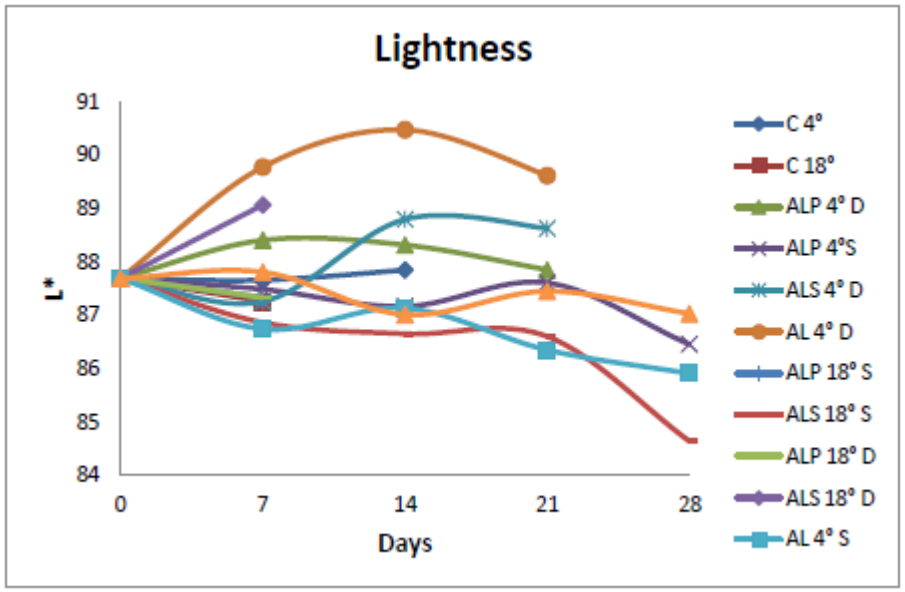
AL coating

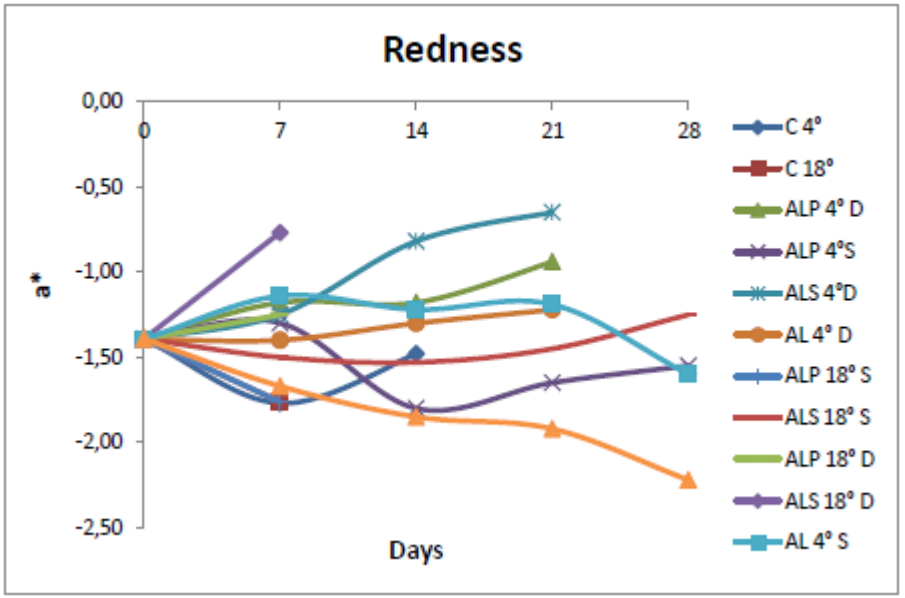


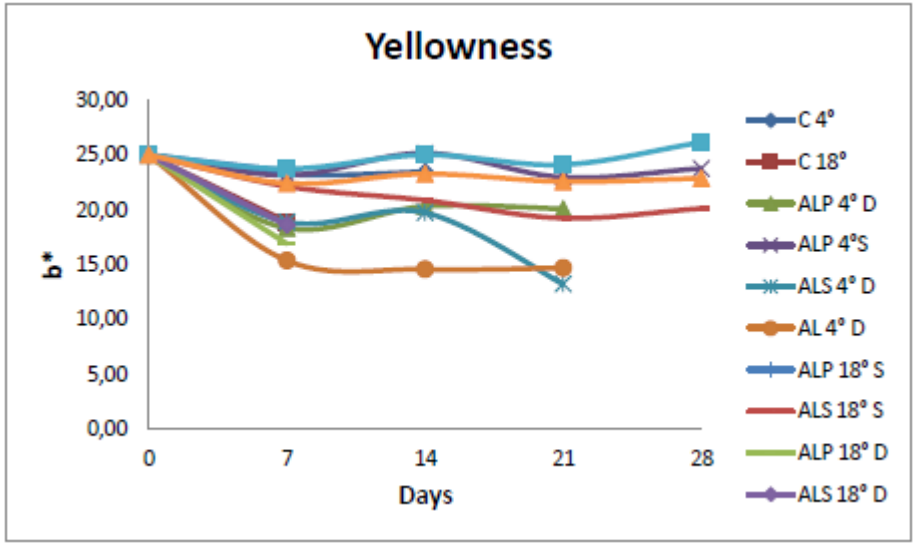
ALS Coating

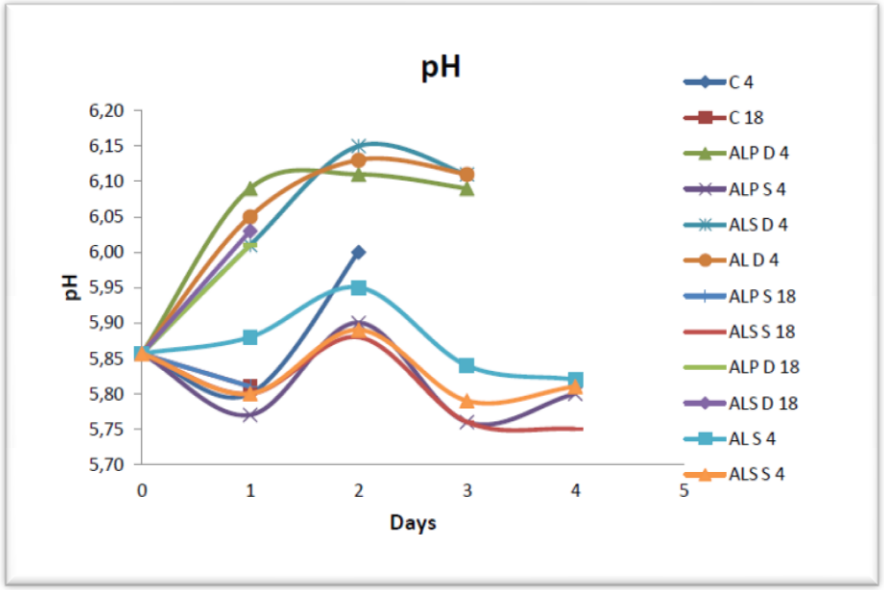
Microbiological comparison




Lightness
L*
91
90
89
88
87
86
85
84
0
7
14
21
28
Days
C 4°
C 18°
ALP 4° D
ALP 4°S
ALS 4° D
AL 4° D
ALP 18° S
ALS 18° S
ALP 18° D
ALS 18° D
AL 4° S


Redness
a*
0,00
-0,50
-1,00
-1,50
-2,00
-2,50
0
7
14
21
28
Days
C 4°
C 18°
ALP 4° D
ALP 4°S
ALS 4°D
AL 4° D
ALP 18° S
ALS 18° S
ALP 18° D
ALS 18° D
AL 4° S


Yellowness
b*
30,00
25,00
20,00
15,00
10,00
5,00
0,00
0
7
14
21
28
Days
C 4°
C 18°
ALP 4° D
ALP 4°S
ALS 4° D
AL 4° D
ALP 18° S
ALS 18° S
ALP 18° D
ALS 18° D


pH
pH
6,20
6,15
6,10
6,05
6,00
5,95
5,90
5,85
5,80
5,75
5,70
0
1
2
3
4
5
Days
C 4
C 18
ALP D 4
ALP S 4
ALS D 4
AL D 4
ALP S 18
ALS S 18
ALP D 18
ALS D 18
AL S 4
ALS S 4

•The best formulation was ALS-S4°C which preserve the food for all the duration of the analysis (4 weeks).

•This result was highlighted by *in vitro* microbiological test

• The best coated Pasta filata cheese had shelf-life higher of 2 weeks than the product currently used in the Vending Machine

•The best application method for the cheese product was the brushing method to maintain an adequate consistency (The dipping technique was unsuitable because it changed the texture)

Application of edible coatings to improve shelf-life of "ready to use" zucchini

- *In vitro* test where the antimicrobial effect of coating was tested against the main bacteria responsible of food-borne

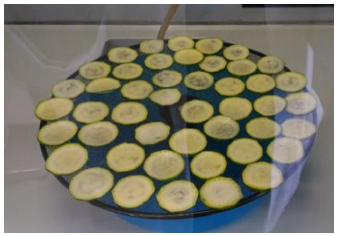
- *In vivo* test for the determination of the shelf-life through the microbiological and chemical physical analysis

Low methoxil pectin

Glicerol

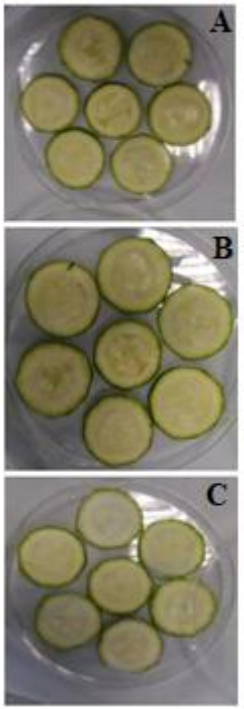
Potassium sorbate

Dipping



Drying phase

Under vacuum phase

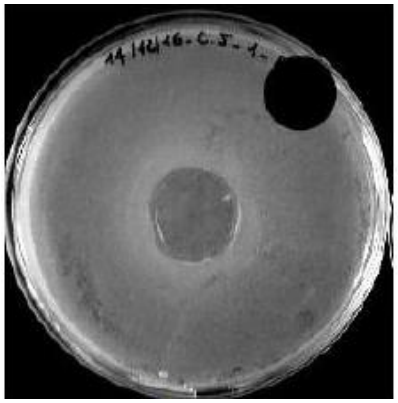


X % of sorbate potassium

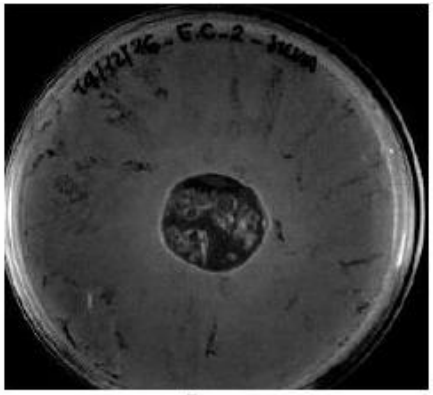
Y% of sorbate potassium

zucchini control

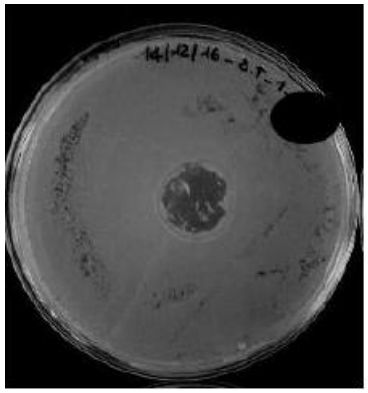
In vitro test



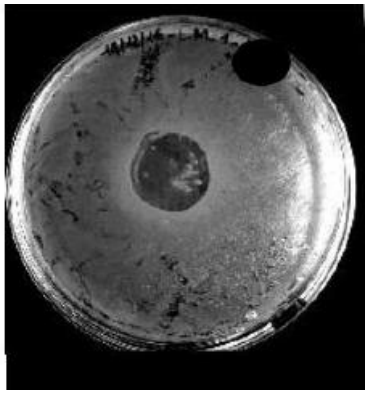
Campylobacter jejuni



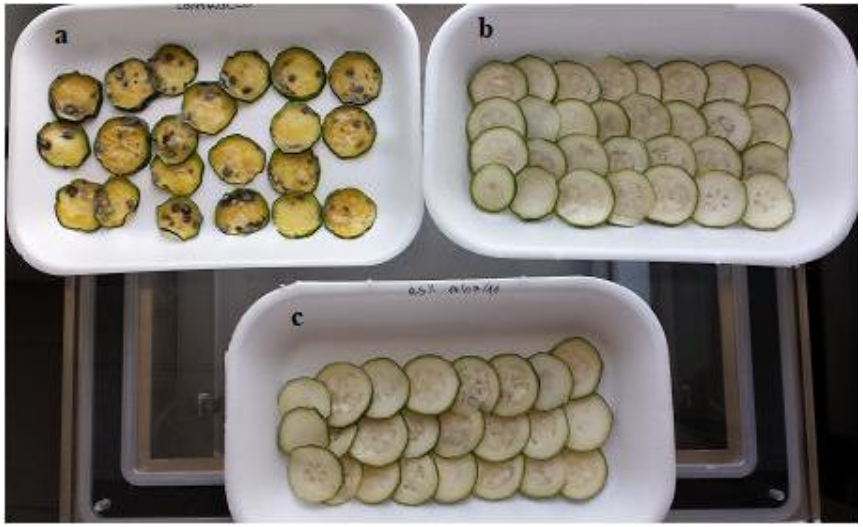
Listeria monocytogenes



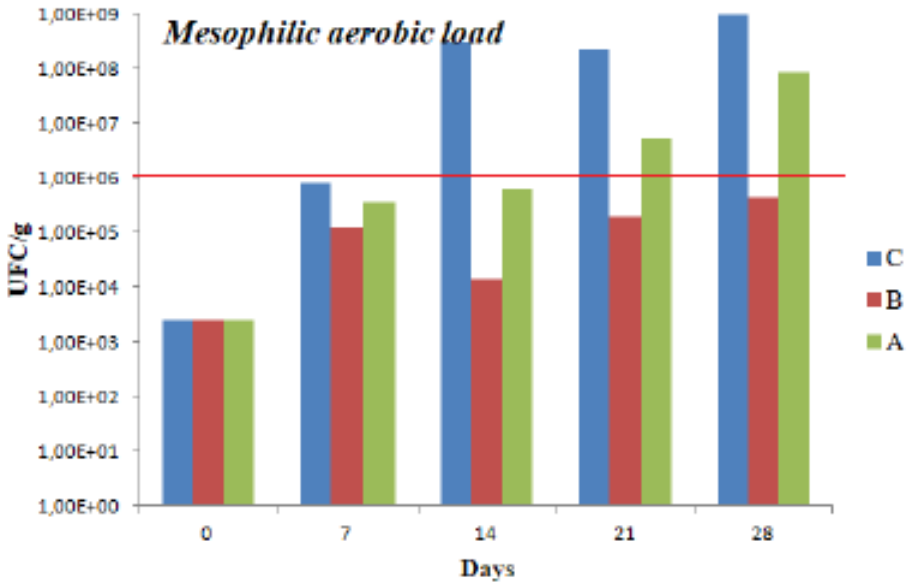
Salmonella tiphymurium

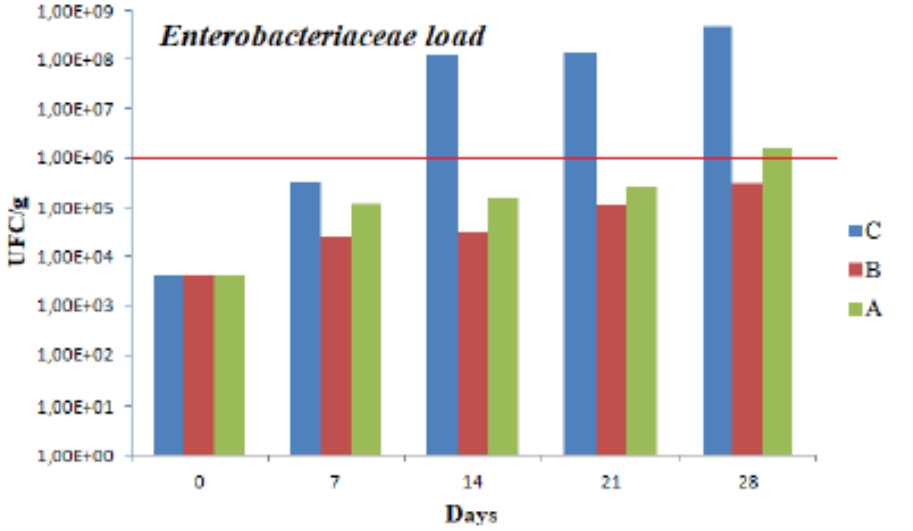


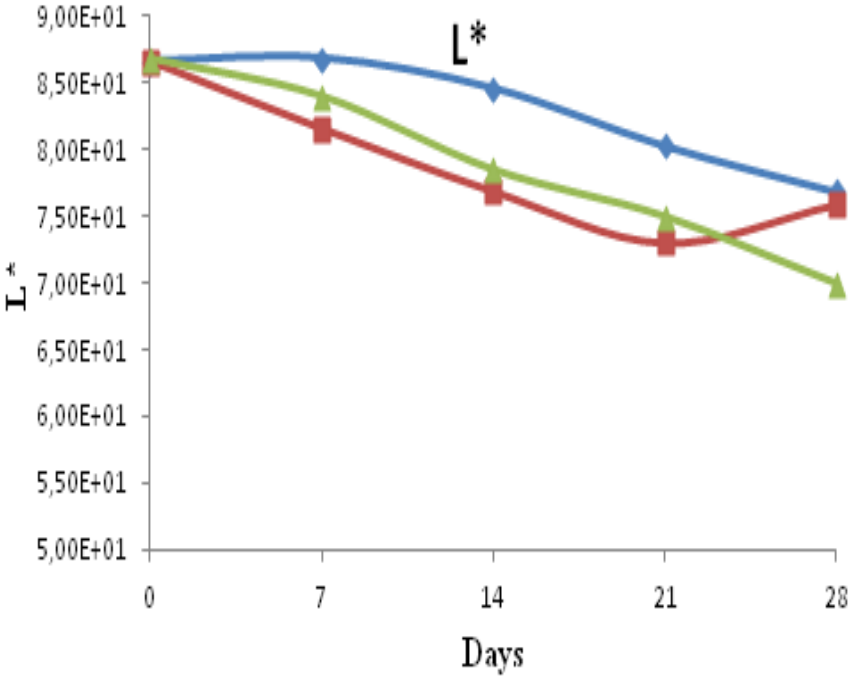
Escherichia coli

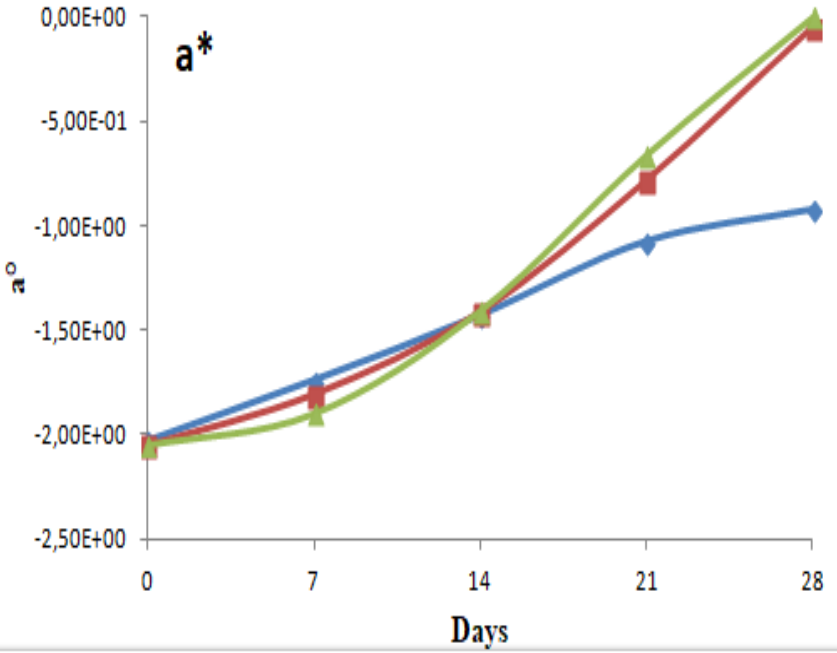


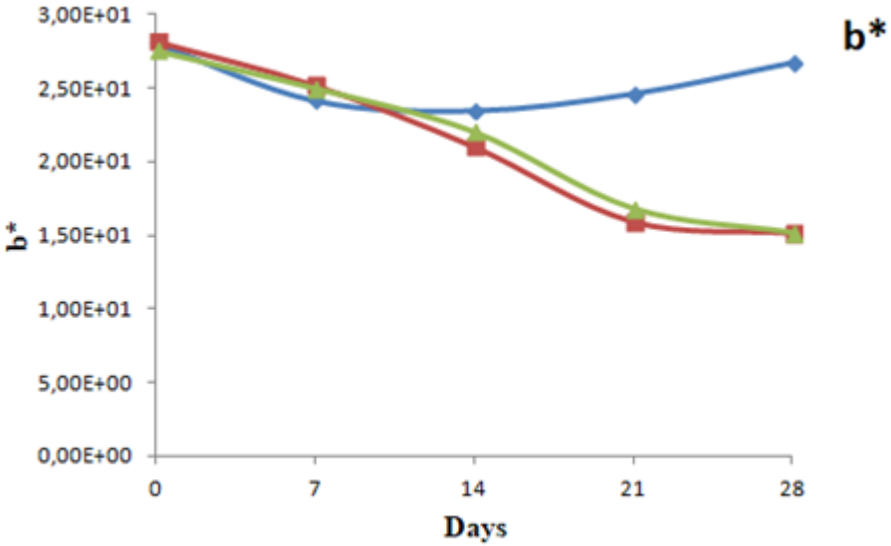
A: X% of PS
B: Y% of PS
C: Control

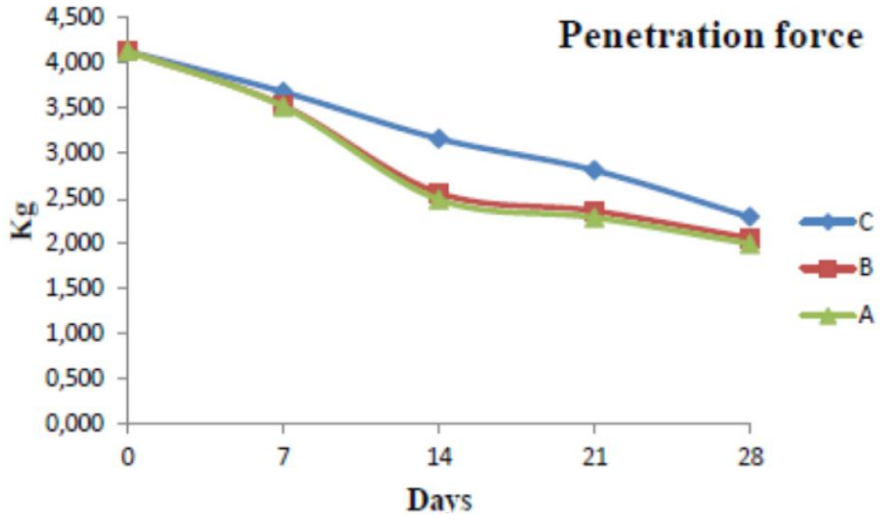





L*
9,00E+01
8,50E+01
8,00E+01
7,50E+01
7,00E+01
6,50E+01
6,00E+01
5,50E+01
5,00E+01
L*
0
7
14
21
28
Days


a*
0,00E+00
-5,00E-01
-1,00E+00
-1,50E+00
-2,00E+00
-2,50E+00
a°
0
7
14
21
28
Days


b*
3,00E+01
2,50E+01
2,00E+01
1,50E+01
1,00E+01
5,00E+00
0,00E+00
b*
0
7
14
21
28
Days


Penetration force
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
0,500
0,000
Kg
0
7
14
21
28
Days
C
B
A

•The use of pectin with addiction of potassium sorbate was able to delay the growth of microorganisms in the treated zucchini respect at the control sample.

• In *vitro* analysis demonstrated that the coating was able to contrast the main microorganisms responsible of foodborne such as *Escherichia coli*, *Salmonella typhimurium and Listeria monocytogenes*. *Campylobacter jejuni*, would be inhibited at higher percentage of potassium sorbate.

• The coating showed little ability in colorimetric and consistency characteristics.


THANK
YOU
GRACIAS
ARIGATO
SHUKURIA
JUSPAXAR
DANKSCHEEN
BOLZÏN
MERCI
BÏYAN
SHUKRIA
TINGKI
YAQHANYELAY
TASHAKKUR ATU
SUKSAMA
EKHMET
GRAZIE
MEHRBANI
MAAKE
KOMAPSUMNIDA
GOZAIMASHITA
EFCHARISTO
PALDIES
SPASSIBO
SNACHALHUYA
NUHUN
CHALTU
YUSPAGABÁTAM
HUI
WABEEJA
MAITEKA
DHANYABAAD
ANIHA
ATTO
MERSI
SPASIBO
DENKAUJA
NENACHALHYA
UNALCHÉESH
GUI
HÄTUR
EKOJU
SIKOMO
HAKETAI
MINMONCHAR
SANCO
MERASTAWHY
GAEJTHO
LAH
TAVTAPUCH
MEDAWAGSE
AGUYJE
FAKAAUE
BAINA