Carnj Soc. Coop. Agricola

Soc. Agr. Sorriso s.r.l.

Convegno finale progetto ABRIOPACK

VALUTAZIONE DELLE PERFORMANCES DEL BIOPACKAGING SULLA SHELF LIFE DELLA CARNE AVICOLA ANTIBIOTIC FREE

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Università di Camerino

Camerino, 13 aprile 2023

Progetto cofinanziato dal PSR MARCHE 2014 - 2020, Sottomisura 16.1 - Sostegno alla creazione e al funzionamento di Gruppi Operativi del PEI Azione 2 - "Finanziamento dei Gruppi Operativi" - ID 29057

È TEMPO DI AGRICOLTURA

Unione Europea / Regione Marche
PROGRAMMA DI SVILUPPO RURALE 2014-2022
FONDO EUROPEO AGRICOLO PER LO SVILUPPO RURALE: L'EUROPA INVESTE NELLE ZONE RURALI

SHELF-LIFE

“Vita di Scaffale”

Periodo di tempo che corrisponde a una tollerabile diminuzione della qualità di un prodotto confezionato, in definite circostanze (packaging, trasporto, condizioni di conservazione, clima)

$$SL = f\,(F_i, P_i, E_i)$$

SL=Shelf Life
F_i= variabili dell’alimento
P_i= variabili del packaging → **MICROAMBIENTE** interno alla confezione
E_i= variabili ambientali

SHELF LIFE STUDY

14 giorni, atmosfera protettiva 70% O_2, 20% CO_2, 10% N_2
+4°C, campionamento giorni 0, 3, 6, 10, 14
n=3, studio ripetuto 3 volte

Sviluppo metodi

Chemical markers →
- **Ammine biogene (BAs)**
- **Volatile Organic Compounds (VOCs)**
- **pH**

Microbiological markers →
- **Selezionati microrganismi**

Sensorial markers →
- **Parametri sensoriali**

AMMINE BIOGENE

RISCHIO TOSSICOLOGICO ⟷ INDICI DI QUALITÀ DELL'ALIMENTO

Alte concentrazioni:

- Rischio per la salute dei consumatori
- Malattie gastrointestinali
- Reazioni allergiche
- Mal di testa

Le alte concentrazioni nel cibo sono spesso correlate a una diminuzione della qualità

Carne

Salumi

Pesce

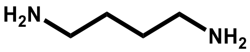
Formaggi

Bevande fermentate

Ruiz Capillas, Jimenez Colmenero, Critic. Rev. *Food Sci. Nutr.*, 44:489-499, 2004

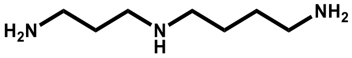
STRUTTURE CHIMICHE delle AMMINE BIOGENE

ALIFATICHE

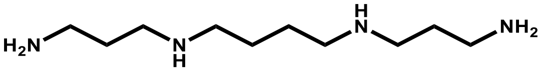


putrescina

cadaverina

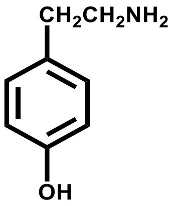


spermina

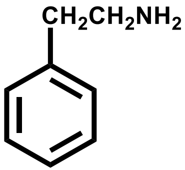


spermidina

AROMATICHE

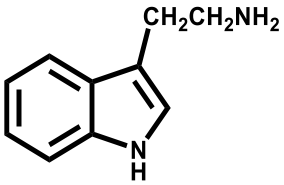


tiramina

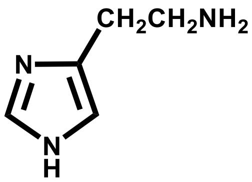


feniletilammina

ETEROCICLICHE



triptamina



istamina

AMMINE BIOGENE come INDICE di QUALITÀ

La concentrazione di alcune ammine (tiramina, putrescina, cadaverina) normalmente aumenta durante la lavorazione e la conservazione di carne, prodotti a base di carne e pesce, mentre quella di altre (spermina, spermidina) diminuisce o rimane costante.

B.A.I. = putrescina + cadaverina + istamina + tiramina

- Carne fresca e pesce
- Alimenti fermentati

$$\text{C.Q.I.} = \frac{(\text{putrescina} + \text{cadaverina} + \text{istamina})}{(\text{spermina} + \text{spermidina} + 1)}$$

Pesce e derivati

SPD/SPM = spermidina/spermina

Carne fresca, produzione di poliammine indipendente dal tipo di flora

Σ BAs = Somma di tutte le ammine monitorate

ANALISI delle AMMINE BIOGENE in HPLC-DAD o FD

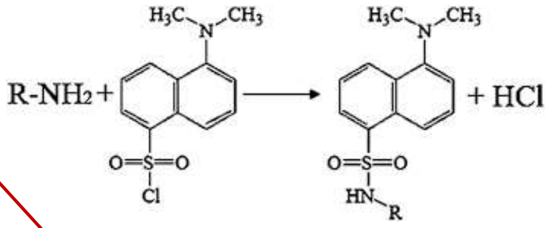
ESTRAZIONE

Omogenizzazione
5 g di carne + 25 ml TCA 5%
Centrifuga 10 min a 5000 rpm

→

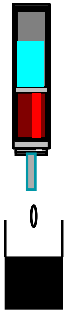
DERIVATIZZAZIONE

+ 300 µl $NaHCO_3$ sol. satura
+ 200 µl NaOH 2N
+ 2 ml dansil cloruro
(1 mg/ml in acetone)



+ 100 µl NH_4OH 28%,
evaporazione con flusso N_2

←



PURIFICAZIONE con SPE

- Attivazione con 5 ml CH_3CN
- Condizionamento con 5 ml H_2O
- Caricamento del campione
- Lavaggio con 5 ml H_2O
- Eluzione con 4 ml CH_3CN

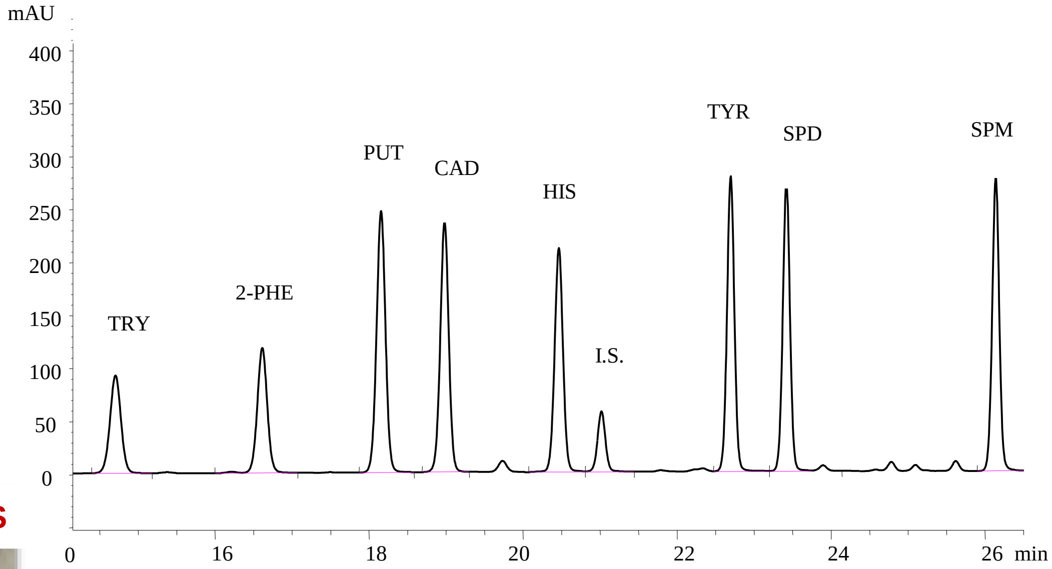
←

HPLC-DAD, FD, MS

V. Sirocchi, G. Caprioli, M. Ricciutelli, S. Vittori, G. Sagratini, Simultaneous determination of ten underivatized biogenic amines in meat by liquid chromatography-tandem mass spectrometry (HPLC-MS/MS), *Journal of Mass Spectrometry*, 2014, 49, 819-825

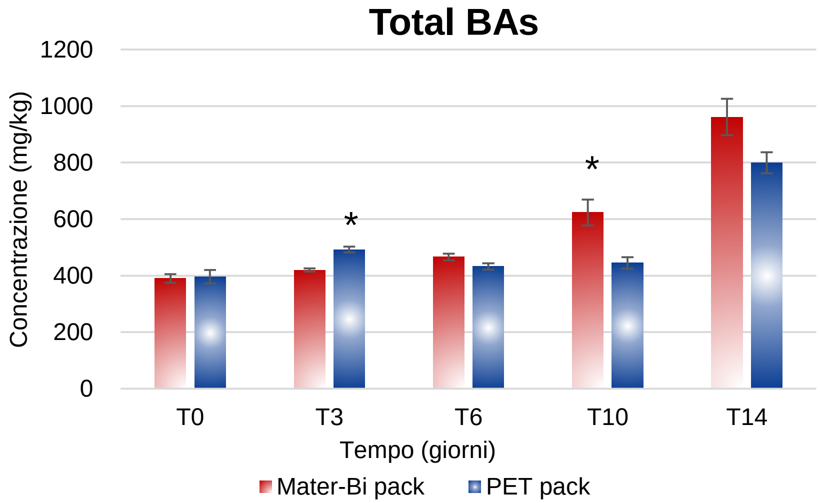
UHPLC-Q-TOF HRMS

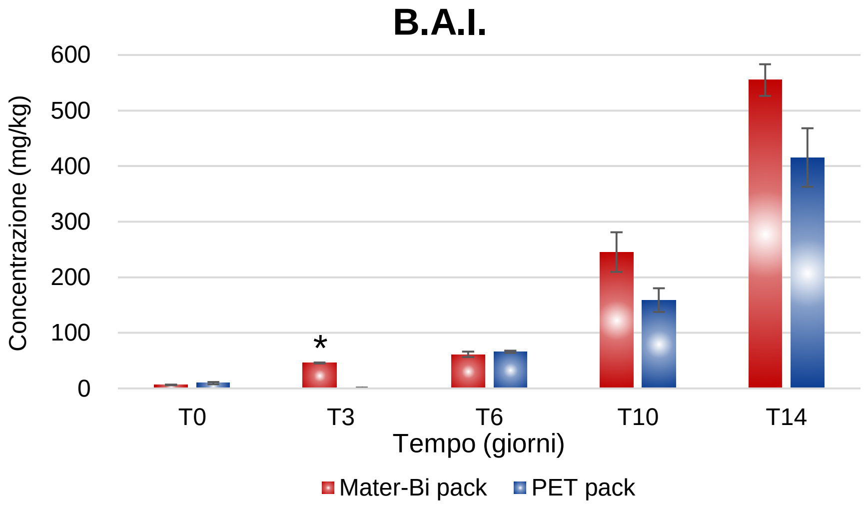
UHPLC-DAD-MS/MS

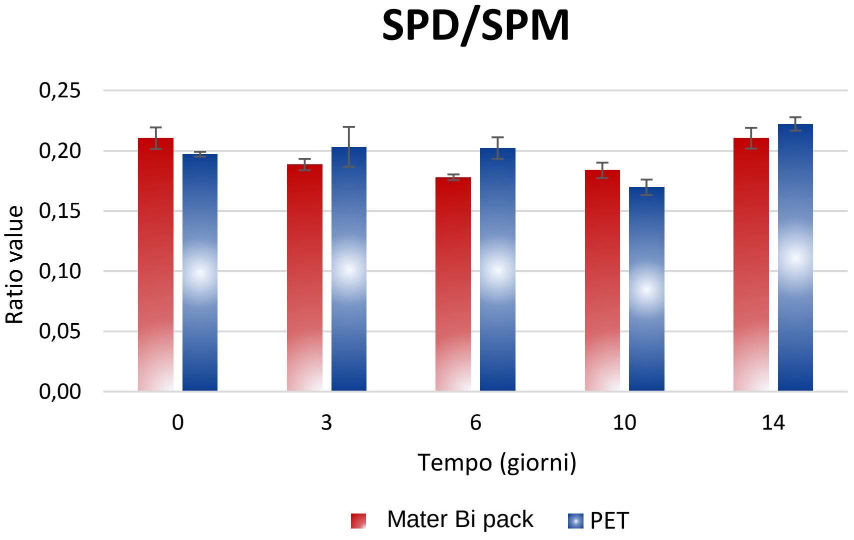


Cromatogramma HPLC-DAD di un campione di carne conservata in Biopackaging

Quantificazione delle AMMINE BIOGENE

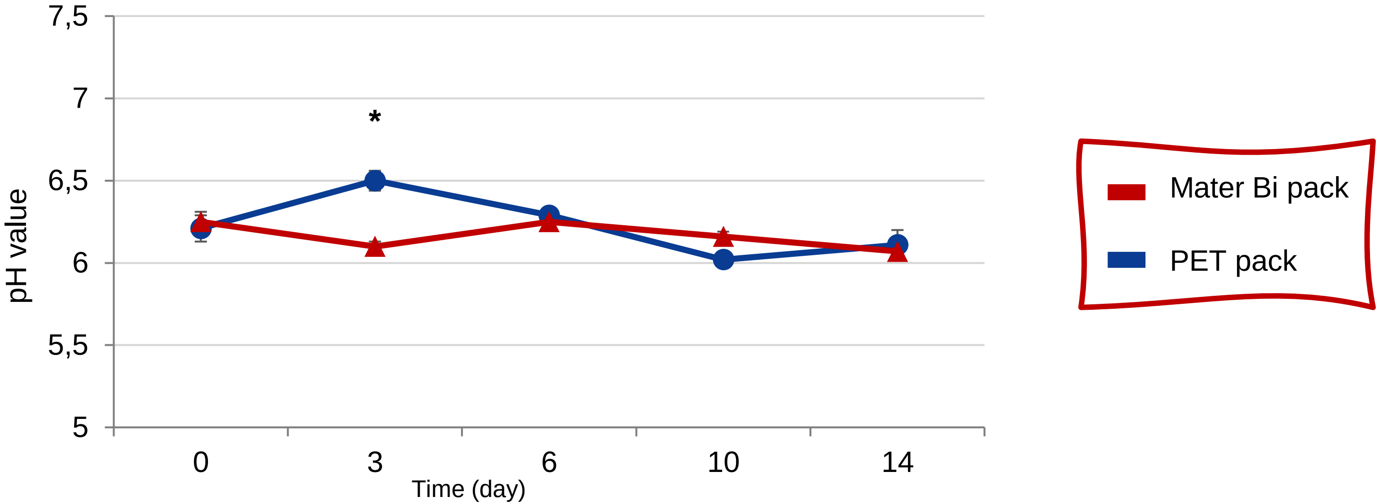






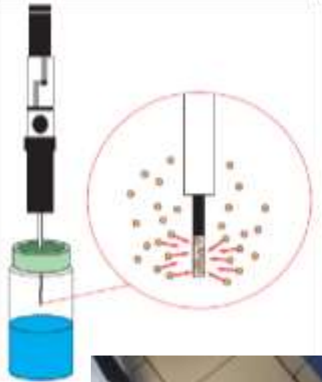
I 3 indici monitorati hanno mostrato valori e andamenti simili nelle carni conservate nei due imballaggi

Studio del pH



Dennis Fiorini

Analisi dei VOCs mediante Solid Phase Micro Extraction (SPME)



HS-SPME-GC-MS

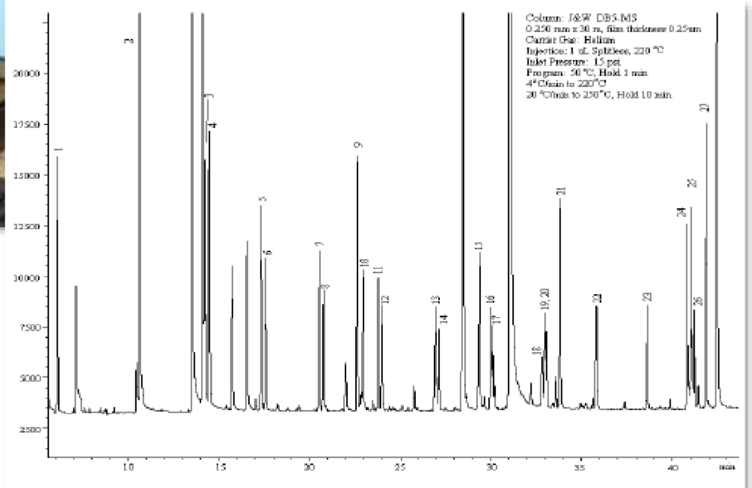
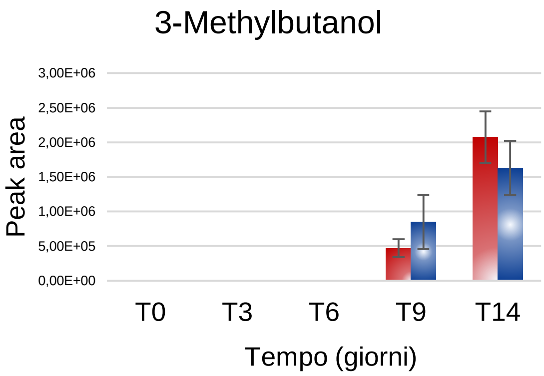


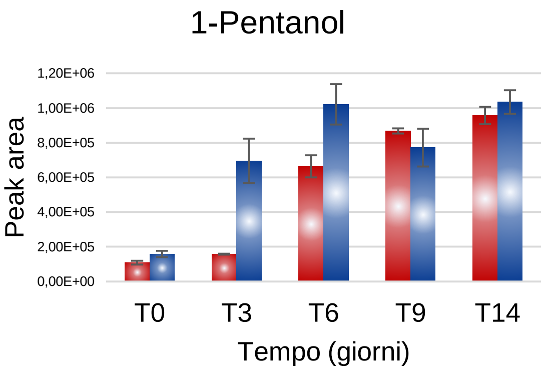
Figure 1

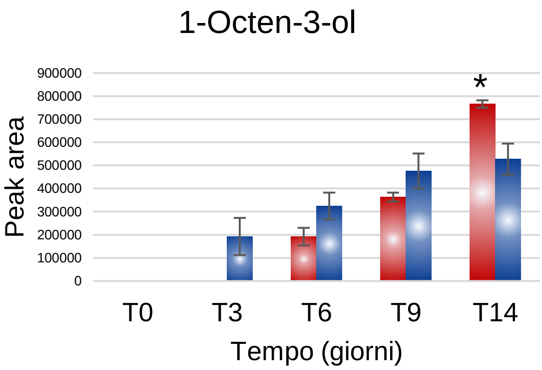
18 VOCs monitorati

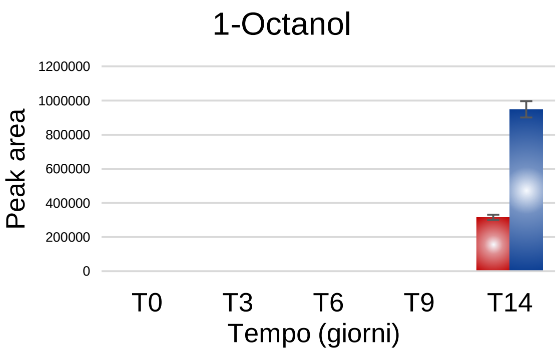
Compound	Odor attribute	LRI[1] (exptl)	LRI[2] (lit)		Day of storage										SI[3] (%)
					0		3		6		10		14		
					Area	RSD%	Area	RSD%	Area	RSD%	Area	RSD%	Area	RSD%	
	Alcohols and phenols														
Isopropyl alcohol	Musty	929	926	BP	5,04E+06[a] *	8.0	4,73E+06[a] *	4.3	2,14E+06[b] *	7.8	2,38E+06[b] *	0.3	7,22E+06[c] *	3.0	80
				PET	1,93E+07[a]	4.5	2,07E+07[a]	1.6	6,47E+06[b]	8.9	1,48E+07[c]	14.8	1,18E+07[c]	4.3	
1-Propanol	Musty	1038	1036	BP	2,86E+07[a] *	8.5	5,13E+07[b] *	0.7	1,49E+07[c] *	10.1	1,20E+07[c] *	11.0	4,25E+07[d] *	2.3	86
				PET	1,24E+08[a]	1.1	1,27E+08[a]	0.8	5,96E+07[b,d]	11.9	9,04E+07[c,d]	10.5	8,08E+07[d]	2.1	
3-Methylbutanol	Roasted	1213	1208	BP	nd	nd	nd	nd	nd	nd	4,70E+05[a]	27.6	2,08E+06[b]	17.9	80
				PET	nd	nd	nd	nd	nd	nd	8,46E+05	29.3	1,63E+06	6.4	
1-Pentanol	Fusel	1254	1252	BP	1,08E+05[a]	10.5	1,57E+05[a] *	1.7	6,64E+05[b]	9.7	8,68E+05[c]	1.6	9,56E+05[c]	5.2	88
				PET	1,58E+05[a]	12.1	6,97E+05[b]	18.3	1,02E+06[b]	11.4	7,72E+05[b]	14.2	1,03E+06[b]	6.6	
1-Hexanol	Fruity	1356	1354	BP	nd	nd	nd	nd	2,72E+05[a]	2.0	1,77E+05[b]	2.0	2,92E+05[a]	11.4	82
				PET	nd	nd	3,33E+05	11.1	2,61E+05	0.9	2,97E+05	22.3	3,66E+05	14.7	
1-Octen-3-ol	Earthy	1451	1449	BP	nd	nd	nd	nd	1,92E+05[a]	20.1	3,63E+05[b]	5.4	7,66E+05[c] *	2.1	83
				PET	nd	nd	1,57E+05[a]	26.0	3,25E+05[a,b]	17.9	4,76E+05[b]	15.9	5,27E+05[b]	14.7	
1-Octanol	Waxy	1566	1565	BP	nd	nd	nd	nd	nd	nd	nd	nd	3,15E+05*	33.3	85
				PET	nd	nd	nd	nd	nd	nd	nd	nd	9,48E+05	7.8	
Phenol	Sweet	1998	1996	BP	1.6E+05	10.4	nd	nd	1,29E+05	2.1	1,08E+05	16.8	1,30E+05 *	22.3	83
				PET	1,23E+05[a]	28.7	2,41E+05[a]	21.8	nd	nd	2,82E+05[a]	30.9	1,02E+06[b]	2.5	
	Ketones														
2-Butanone	Fruity	892	894	BP	3,76E+05[a]	22.7	2,82E+05[a]	13.8	8,70E+05[b] *	3.7	7,89E+05[b] *	0.5	2,99E+05[a]	18.8	82
				PET	nd	nd	2.75E+05[a]	5.1	3,64E+05[a,b]	8.4	3,96E+05[b]	11.9	1,31E+05[c]	4.4	
2,3-Butanedione	Buttery	966	970	BP	nd	nd	7,87E+05[a]	25.3	3,25E+05[b]	1.5	6,64E+05[a,b]	5.1	1,54E+06[c]	4.3	81
				PET	3.75E+05[a]	30.1	1,45E+06[b]	21.6	2,70E+05[a,c]	30.2	1,04E+06[a,b]	23.4	1,71E+06[b,d]	7.6	
3-Hydroxy-2-butanone	Creamy	1280	1278	BP	nd	nd	nd	nd	7,88E+05[a]	1.2	1,80E+06[b] *	6.7	4,96E+06[c] *	3.2	84
				PET	nd	nd	nd	nd	nd	nd	1,11E+06[a]	6.7	6,41E+06[b]	3.8	
	Acids														
Acetic acid	Vinegar	1446	1453	BP	1,84E+05[a]	25.3	1,52E+05[a]	4.7	4,02E+05[a,b]	23.5	2,64E+05[a]	14.6	7,36E+05[b]	23.3	90
				PET	nd	nd	1,66E+05[a]	7.0	2,82E+05[a,b]	6.6	3,08E+05[b]	17.1	1,12E+06[c]	0.8	
Propanoic acid	Pungent	1539	1538	BP	nd	nd	7,68E+05[a] *	6.3	6,96E+04[b]	23.8	nd	nd	8,75E+04[b] *	35.2	89
				PET	nd	nd	9,55E+05[a]	2.2	6,33E+04[b]	13.3	2,98E+05[c]	5.6	2,22E+05[d]	3.6	
Isovaleric acid	Cheesy	1670	1670	BP	nd	nd	nd	nd	6,22E+05	28.0	6,43E+05 *	12.6	2,41E+05 *	16.8	83
				PET	nd	nd	nd	nd	1,41E+05[a]	4.7	4,00E+06[b]	8.5	9,29E+05	4.0	
Hexanoic acid	Sour	1843	1839	BP	1,62E+05[a,b]	4.5	1,49E+05[a,b]	2.3	2,84E+05[a]	12.5	1,33E+05[b]	12.8	1,79E+05[a,b]	34.3	80
				PET	1,55E+05[a]	16.7	nd	nd	2,12E+05[a,b]	1.3	2,63E+05[a,b]	22.3	3,32E+05[b]	11.6	
Nonanoic acid	Rancid	2161	2168	BP	2,25E+05	28.3	1,86E+05	30.1	3,32E+05	21.9	2,19E+05	14.2	2.74E+05	21.9	81
				PET	2,19E+05	31.1	2.25E+05	12.8	2,85E+05	9.3	2,06E+05	17.8	2,76E+05	18.2	
	Sulfur containing compounds														
Carbon disulfide	Ether-like	714	710	BP	2.27E+05[a]	31.8	2,05E+05[a]	8.9	2,00E+06[b]	33.0	8.57E+05[a,b]	16.1	2,05E+05[a]	28.9	94
				PET	1,15E+06[a,b]	11.0	1,95E+05[a]	1.7	2,14E+06[b]	38.9	7,66E+05[a,b]	22.6	nd	nd	
Dimethyl sulfone	Cabbage-like	1904	1911	BP	4,11E+05[a] *	8.6	9,78E+04[b]	14.2	1,16E+05[b,c]	39.3	1,72E+05[b,c]	11.7	2,40E+05[c]	13.6	96
				PET	5,38E+04[a]	7.1	1,14E+05[a]	26.7	3,68E+05[b]	27.4	8,17E+04[a]	33.0	2,42E+05[a,b]	0.6	

Analisi dei VOCs tramite HS-SPME-GC-MS









Mater Bi pack

PET pack

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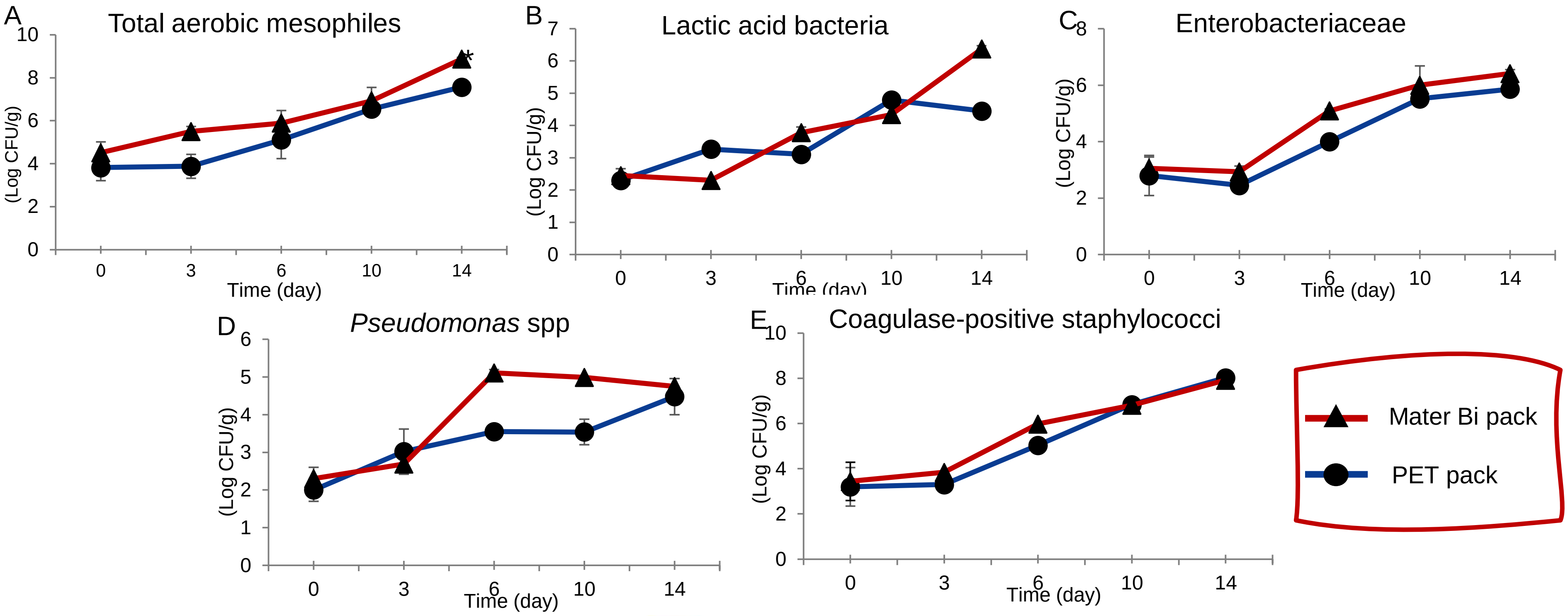
Stefania Silvi

Studio di selezionati microrganismi

Meat Microbiota

Mesofili totali
Batteri acido lattici (LAB)
Escherichia coli
Enterobacteriaceae
Presunto *Pseudomonas* spp.
Stafilococchi coagulasi positivi
Anaerobi sulfito-riduttori
Clostridium perfringens

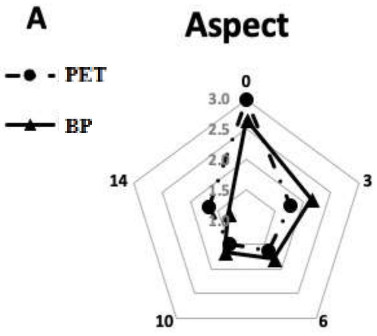
STUDI MICROBIOLOGICI

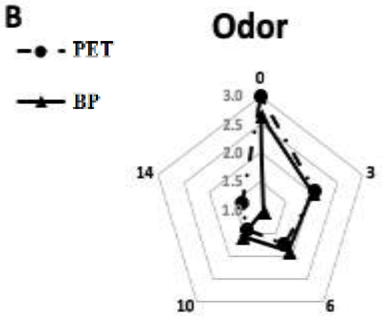


Stefania Silvi

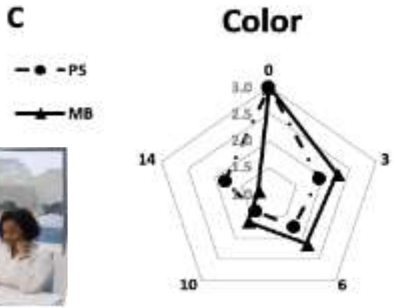
Analisi sensoriale

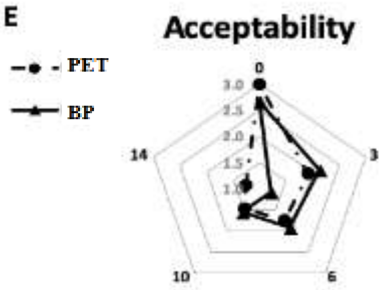
Attributes	Description	Score*
Aspect (Slime)	Without slime	3
	Slime present in some parts	2
	Slime on all surface	1
Odor	Characteristic	3
	Off-odor	2
	Foreign	1
Color	Pink to light red	3
	Pale pink to slight brown	2
	Earthly to brown	1
Elasticity	Fast return	3
	Slow return	2
	No return	1
Acceptability	Satisfied	3
	Acceptable	2
	Reject	1

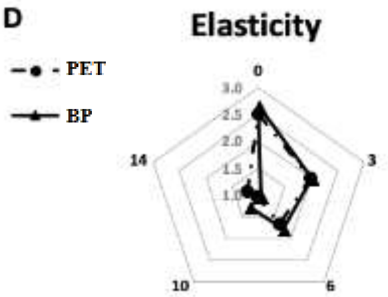




Sensory Panel: 10







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A shelf-life study for the evaluation of a new biopackaging to preserve the quality of organic chicken meat

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ABSTRACT

Widespread use of traditional packaging constitutes a serious ecological problem leading to a shift to biodegradable and compostable materials. The aim of this work is to study the ability of a new biopackaging (BP), based on biodegradable and compostable material, to preserve the quality of organic chicken meat for 14 days in comparison with a polyethylene terephthalate (PET) material. Results showed that the indices of Biogenic Amines (BAs) and the 10 monitored Volatile Organic Compounds (VOCs) have a similar trend in both packaged meats. For example, the total BAs concentration in meat increased from 390 to 961 mg Kg^{-1} in BP and from 393 to 800 mg Kg^{-1} in PET, as well as the microbiological counts. The new biopackaging (BP) showed similar properties of non-biodegradable material (PET) to preserve the shelf life of organic chicken meat and it could be used instead of plastic materials to promote a circular economy.

Conclusioni

- Lo studio ha rivelato la capacità del nuovo Biopackaging di conservare la carne avicola antibiotic free in maniera similare ai packaging convenzionali in plastica (PET)

- I marker chimici, microbiologici e sensoriali hanno dimostrato andamenti simili durante l'intera shelf life

- L'innovazione introdotta è di estrema importanza nel rispetto dell'economia circolare e dell'ambiente

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