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GELS DEVELOPMENT TO MANAGE BOAR TAINT: PHYSICAL-CHEMICAL AND TEXTURAL CHARACTERIZATION

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I. INTRODUCTION

Due to the high prevalence of entire male pigs in Spain, the developing of boar taint masking strategies to manage this fact in meat industry would be highly desirable. Previous studies have reported approaches to mask boar taint in different fresh meat pieces and products derived from pork to re-value this meat. Although some texture-related parameters may be affected by the animal, due to the fat intramuscular percentage this aspect is a secondary item since the objective was to have an animal with high levels of AND and SKA to validate the efficacy of the masking strategy developed. In this sense, certain spices (garlic, oregano, rosemary, marjoram, coriander, ginger, nutmeg, fennel, parsley or curry) have been highly described in literature due to their positive effect on boar taint reduction, Zapata et al [1]; Egea et al., [2]. Gels with spices were made in the form of gelled cubes, so that the consumer would cook the meat with these gels before consumption Iniesta [3].Due to edible coating such as gels based on polysaccharides, protein and/or lipids could expand shelf life by allowing the additives incorporation, such as species and others condiments, organoleptic (flavour and colour) and textural properties (hardness) could change, thus the aim of this study was to study the physical-chemical (appearance) and textural polysaccharides-gels characterisation as a technological solution to revalorize pork from entire animals.

II. MATERIALS AND METHODS

Edible gels were elaborated by using thermo-reversible hydrocolloids based on polysaccharides which are well known to interact with food polymers such as meat protein to conform good gelling properties under the formulation reported in Table 1. The pH, colour coordinates, trasnparency and textural properties were carried out in accordance with Linares et al. [3].

Table 1. Ingredients used in the production of Agar agar gel (G1) and Carrageenan gel (G2)

Ingredients	Agar agar G1(g)	Carrageenan G2(g)
Water[1]	194	194
Agar-agar[2]	6	-
Carrageenan[2]	-	6
Spices		
Marjoram[3] 2.4; Ginger[4] 3; Sweet paprika[4] 5.7; Salt[5] 4; Mustard[3] 2.4; Garlic[4] 4.5; Black pepper[4] 3; Lemon juice[1] 4		

Ingredients used in the production of carrageenan (G1) and agar-agar (G2). Subscripts number: [1] Hacendado, Valencia, Spain; [2] Tadissimo, Barcelona, Spains, [3] Lopez Matencio - Especias y Condimentos, Murcia, Spain; [4] Ducros, Sabadell, Spain and [5] Aliada, Madrid, Spain.

III. RESULTS AND DISCUSSION

In Table 2 is showed that pH, in both gels, increased with time but any important colour variation is described during the storage period. As regards the T (transparency) a slight decrease is observed in carrageenan gel G2 by time, from day 0 to up, which can be related with the differences in the jellification process between both hydrocolloids. Carrageenan is needed of cations to become gel, concretely kappa carrageenan needs K+ ions to jelly, which could alter visual stability matrix, since the formation of ionic complexes along time could prevent the passage of light and provide opacity to the matrix Galus et al. [4].

Table 2. Average± SD for pH, colour coordinates and transparency (T) in both types of gels at 0,14 28 days.

Gels		pH	L*	a*	b*	Transparency (T)
Agar	**0**	3.59 ± 0.04^{x}	34.70 ± 1.40^{x}	8.45 ± 1.17^{x}	14.68 ± 2.68^{x}	0.01 ± 0.00^{x}
Carrageenan		3.43 ± 0.02^{X}	36.31 ± 1.41^{X}	9.72 ± 0.53^{x}	16.70 ± 1.73^{X}	0.18 ± 0.03^{Z}
P value		**	NS	*	NS	***
Agar	**14**	3.64 ± 0.04^{xy}	32.65 ± 2.01^{x}	8.82 ± 1.37^{x}	14.41 ± 3.17^{x}	0.01 ± 0.01^{x}
Carrageenan		3.53 ± 0.04^{Y}	35.18 ± 0.9^{X}	9.87 ± 0.57^{X}	15.50 ± 1.54^{X}	0.01 ± 0.01^{X}
P value		*	*	NS	NS	NS
Agar	**28**	3.70 ± 0.04^{y}	32.53 ± 3.09^{x}	8.25 ± 0.89^{x}	13.77 ± 1.39^{x}	0.02 ± 0.03^{x}
Carrageenan		3.65 ± 0.02^{Z}	35.16 ± 0.62^{X}	10.33 ± 0.61^{X}	16.26 ± 1.00^{X}	0.05 ± 0.03^{Y}
P value		NS	NS	***	**	**

x,y,z : Time effect in agar gel. **X, Y, Z**: Time effect in carrageenan gel. Significant values p-value <0,05. *(p<0,05), **(p<0,01), ***(p<0,001); **NS**: Not significant (p>0,05).

No changes were observed for textural parameters in any attributes except in Hardness (grams) that was lower for the agar agar (G1) than for carrageenan gel (G2). Both gums are pH-dependent with higher ionic strength within the pH range 6-8 for G1 and 8-11 for G2 but, in gels from the present study, pH values are <4, since spices have modified this parameter. The carrageenan gels also showed less adhesiveness than agar gels. Banerjee [5] found that agar agar gels promoted a lower degree of hardness since its bonds had a lower maximum tension and then lower resistance to compression.

Table 3. Average± SD for textural properties in both types of gels at 0,14 and 28 days.

Gels		Adhesivity (millijoules)	Hardness (grams)	Deformation (millimeters)	Hardness C2 (grams)	Elasticity (millimeters)
Agar	**0**	0.33 ± 0.20^{xy}	169.5 ± 81.84^{x}	4.44 ± 1.02^{x}	305.33 ± 123.25^{x}	3.54 ± 0.06^{x}
Carrageenan		0.10 ± 0.09^{X}	1270.5 ± 47.97^{X}	4.99 ± 0.01^{X}	1203.5 ± 85.46^{X}	4.36 ± 0.18^{X}
P value		*	***	NS	***	***
Agar	**14**	0.45 ± 0.16^{y}	275.33 ± 103.46^{xy}	4.36 ± 0.66^{x}	232.0 ± 85.42^{xy}	3.35 ± 0.51^{x}
Carrageenan		0.15 ± 0.10^{X}	1189.00 ± 76.40^{X}	4.99 ± 0.01^{X}	1160.17 ± 74.8^{X}	4.42 ± 0.1^{X}
P value		**	***	*	***	***
Agar	**28**	0.13 ± 0.08^{x}	387.50 ± 206.73^{x}	4.42 ± 0.62^{x}	305.33 ± 123.2^{y}	3.54 ± 0.6^{x}
Carrageenan		0.22 ± 0.24^{X}	1236.68 ± 63.21^{X}	4.96 ± 0.08^{X}	1203.5 ± 85.46^{X}	4.36 ± 0.17^{X}
P value		NS	***	NS	***	*

x,y,z : Time effect in agar gel. **X, Y, Z**: Time effect in carrageenan gel. Significant values p-value <0,05. *(p<0,05),**(p<0,01), ***(p<0,001); **NS**: Not significant (p>0,05)

IV. CONCLUSION

The two edible gels had good physical-chemical and mechanical properties providing stability to vehicle spices incorporation into entire pork. The lower hardness and elasticity in agar agar gel could be interesting to improve the sensory texture of pork with a low percentage of intramuscular fat and thus a greater hardness. Summary both developed gels could contribute to diminish or even eliminate this sensory defect in order to revalorize boar-tainted pork.

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