Combined chicken fat dry fractionation and texturization to improve poultry meat products processing

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Abstract: This paper presents chicken fat gelation process based on a calcium-induced gelation of an emulsion composed of sodium alginate, water, and chicken fat. Effects of formulation parameter and and a previous dry fractionation operation on the gel texture and colour are discussed. Results show that both parameters had a significant effect on gel properties, with a predominant effect of alginate on texture and fat unsaturation on colour properties. The texturized fat can be used in the manufacturing of delicatessens products in order to improve pure poultry delicatessen products. The two variables studied must be optimized in relation to product specifications.
Keywords : Fractionation, texturization, alginate, chicken fat, poultry delicatessen products

Introduction

Traditional meat products manufacturing requires suitable fat tissues like pork bard. The development of pure poultry delicatessen products is limited because of the poor technological properties of poultry fat tissues. In an attempt to improve these properties, a first process of dry fractionation of chicken fat has been developed (Arnaud *et al.*, 2004). The first fraction obtained from this process is called olein and is an oil more unsaturated than the initial fat, and with good sensory properties. It can thus be used as a frying or salad oil. The second fraction, stearin, is more saturated than the initial fat, solid at room temperature and can be used as lard replacer in meat products processing. However, it is not suitable for products needing a structured fat, like sausages and dry fermented sausages. This paper presents chicken fat gelation process used to produce a pork bard substitute. Effects of formulation parameter and a previous dry fractionation operation on the gel texture and colour are discussed.

Materials and methods

Fat texturization was realised by calcium-induced gelation of an emulsion composed of sodium alginate (0.5 to 2%) dissolved in water, sodium pyrophosphate (0.3%) and chicken fat (40%).

An experimental design based on a Doehlert uniform shell design (Doelhert, 1970) was used to quantify the impact of fat unsaturation (stearin, olein ratio) and alginate concentration on gel properties. A second order poynomial model was used (eq. 1) to describe the response variables Y_i (gel firmness and colour) as a function of the factor variables X_i.

$$Y_i = a_0 + \sum_{i=1}^{n} a_i X_i + \sum_{i=1}^{n} a_{ii} X_i^2 + \sum_{i=1}^{n} \sum_{j=1}^{n} a_{ij} X_i X_j$$

where X_1 is the fat unsaturation, X_2 is the alginates concentration, a_0 is the polynomial constant, a_i , a_{ii} and $a_{ij\ (i \neq j)}$ are the linear, quadratic and interaction effects of the factors respectively. Multiple linear regression coefficients were calculated using Statgraphics software (Manugistics, Rockville, USA). Regression and coefficient validity were verified by statistical test (R^2 correlation coefficients, variance analysis , Fisher test).

Gel firmness at ambiant temperature was measured with a texture analyser TAXT 2i (Stable micro systems, Surrey, Angleterre). To this purpose, a cylindical probe of 5 mm diameter was used. The gel was compressed at a speed of 1 $mm.sec^{-1}$ to a distance of 10 mm. The compression force, reported as firmness, was recorded as the results.

The colour of samples was measured using a chromameter (CR200, Minolta Camera Co., Osaka, Japan) to obtain the L, a, b parameters.

Results

From table I, one can conclude that both process parameters has significant effects on gel firmness and colour (b value). The firmness of texturized fat varies with fat unsaturation and alginate concentration, the latter variable having a predominant effect. Gel colour is mainly influenced by fat unsaturation. The gel is whiter when stearin is used. This can be explained by the concentration of fat pigments in the liquid fraction during dry fractionation.

Table I : Effects of fat unsaturation and alginates concentration on gel texture and colour

coefficient	Firmness (N)	b*
a_0	0.67	8.03
a_1	0.14 *	-0.95 **
a_2	0.22 **	0.69 **
a_{11}	-0.04 -	-0.14 -
a_{22}	-0.24 *	-0.31 -
a_{12}	0.03 -	-0.53 -
R^2	0.97	0.98

Indices 1 et 2 referred to fat unsaturation and alginate concentration respectively

**, * coefficient significant at $p<0,01$, $p<0,05$, respectively

- not significant

Texturized fat can be used in the manufacturing of delicatessen products in order to replace bork fat tissues. For its use as a coating , the optimum alginate concentration is 0.8%.

Conclusion

Results presented in this paper show that fat unsaturation and alginate concentration influence gel properties. Depending on the texturized fat uses, these process parameters must be optimized. It would be interesting to evaluate its technological properties as an ingredient in sausage and dry-fermented sausage formulations. However, texturized fat has a higher water content (55%) than pork fat tissues (11%) and the water added during the gelation process cannot be reduced as it is necessary to obtain an emulsion capable of gel formation. So, an additional drying operation of the gel is envisaged.

References

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