5-P83

MICRO-MEAT PRODUCT MODELS: TOOLS TO STUDY MEAT AND NON-MEAT PROTEIN FUNCTIONALITY

Randolph P. Happe[a], Stef. J. Koppelman[a], Riek Vlooswijk[a], Gerrit Wijngaards[a] and Alard A. van Dijk[b]

a. TNO Nutrition and Food Research Institute, Zeist, The Netherlands

b. DSM Gist-Brocades, Food Specialties Division, Delft, The Netherlands

Keywords: cooked ham, sausage, meat protein, protein, model, functionality

Background:

The performance of (non-meat) protein ingredients in meat products is usually judged by performing application tests, being an inevitable step in the track of development and testing of new protein ingredients. Such application tests are time consuming and quite expensive as well. Furthermore, these tests require relatively large amounts of the ingredient to be tested.

Micro-meat product models (small-scale tests) are valuable tools functioning complementary to application tests in the track of developing novel ingredients for meat products. They will proof especially beneficial if many protein ingredients are to be tested, or if only small amounts of an ingredient are available for evaluation. On basis of the outcome of such small-scale screening test a deliberate decision can be made if it is worth the effort of evaluating a particular ingredient (e.g. a enzymatically modified vegetable protein) in application tests.

Objectives:

The objective of our studies was to develop micro-meat models for cooked hams and for cooked emulsified sausages which can predict the performance of novel protein ingredients in specific meat products. The most important specifications which are aimed for are: the models have to be reliable and must mimic a particular type of meat product and the tests should be easy to carry out in laboratory environments, preferably on a short time-scale. Furthermore, models of a scale of 50 grams or smaller are desirable.

Methods:

The recipes of the models for cooked hams and cooked emulsified sausages were intensively investigated. We varied meat source and type, the amount of added water, processing aids (e.g. polyphosphate), and processing steps. Either a meat extract, meat batter or ground meat was used as starting material in the models.

In the case of sausage models, various vegetable oils (e.g. palm oil, soy oil) and fats of animals sources (e.g. minced pork fat, beef fat) were added. The emulsification step was carried out by means of an Ultra Turrax or a Sorvall Omni Mixer Homogenizer. The emulsification step was optimized such that meat and fat were thoroughly mixed, that the fat was maximally emulsified, and that a minimal amount of air bubbles was introduced into the system. The production of heat was kept as low as possible.

After cooking, testing and evaluation of the products prepared in the models was mainly performed by means of a Lloyd load instrument in combination with the *Texture Profile Analysis* (TPA) software for data collection and mathematical processing. The meat products were therefore cut into identically sized slices. The tests were carried out in either a destructive mode (large-deformation) or a less-destructive mode (25 % deformation). They reveal information on hardness ("firmness"), fracture force and/or elastic properties. The back-extrusion test (method of Harper et al., 1978) was used if very small scale products had to be tested (1-5 g). If it was of interest, estimates were made of the cooking loss (separated fat or water) (Hall, 1996).

The models were validated by comparison with the respective real meat products, either with or without added non-meat protein ingredients. In a series of experiments we substituted part of the intrinsic meat proteins by commercially available protein ingredients (e.g. soy, milk proteins, plasma protein) in order to identify the behavior of the models.

Results and Discussion:

The models were optimized and ultimately, on basis of a meat extract, a scale of 30 grams appeared to be conceivable. Figure 1 displays the hardness (i.e. the "firmness") of the micro-sausage model in relation to the reduction to the amount of meat protein (by substituting it with brine, also referred to as 'negative control'). This figure learns that the model is sensitive for a decrease in the contribution of meat protein, as is reflected by a decrease in the hardness of the model product. The same holds for real products. The model for cooked hams displayed a comparable graph (not shown). In a normal test case, up to 40% of the meat protein was substituted by the protein ingredient to be tested. This almost exclusively led to a decrease of the hardness. If a protein ingredient has no contribution at all to the hardness, a reduction will be seen down to the level of the negative control.

As an example the hardness of the sausage model and of that of real sausages is listed in table 1, in addition to findings of a panel and penetrometer results. The results indicated that the hardness is a good reporter for the firmness of a product: the hardness of a product can predict how the panel will experience the product in terms of firmness. Furthermore, it was found that the hardness as measured by means of TPA of the model correlated well with that of the real sausages. A correlation of $R^2 = 0.92$ was found in the described experiment (graph not shown). The error within a single experiment was usually lower than 7%.

The results confirm that we have developed adequate, functional models. The hardness of a model product as determined by TPA is a measure for the firmness of the respective real product. Thus, by means of testing a novel protein ingredient in the model it is possible to predict the effect of this ingredient on the quality (especially firmness) of a final meat product.

Conclusions:

Here we presented the development of models for two types of meat products: cooked hams and cooked emulsified sausages. The behavior of the models correlated well with the respective real products.

Using these models, the required amount of a to be evaluated non-meat protein ingredient can be decreased to sub-gram scale. The fast processing procedure and rapid testing method leads to a significant gain in time.

Literature:

[1] Harper, J.P., Suter, D.A., Dill, C.W. and Jones, E.R. (1978), J. Food Sci. 43, 1204-1209.
[2] Hall, G.W., ed. (1996), Methods of testing protein functionality, Blackie Academic & Professional, London

Acknowledgments: This work was in part financed by the Dutch Ministry of Economical Affairs.

Data:

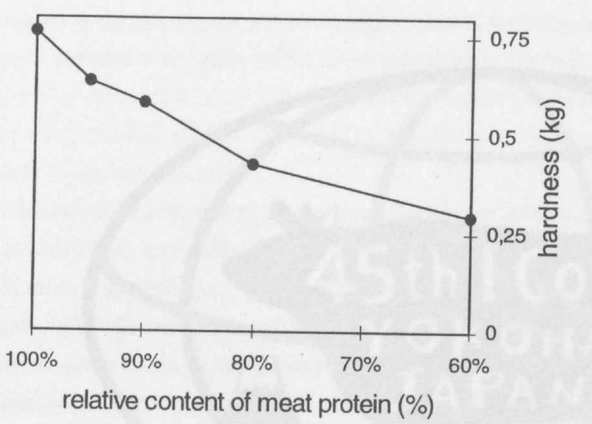

Figure 1. *Hardness of the micro-sausage model at decreasing meat protein content, using Texture Profile Analysis. TPA conditions: deformation: 25% (2-fold); plunger speed: 100 mm/min; plunger diameter: 2.5 cm.*

	Panel test: consistency	*Penetration* (mm)	*Hardness* (kg)	*Hardness* (kg)
	Sausage	Sausage	Sausage	***Model***
Control	firm	12.9	1.2	1.24
Control - 20% MP	weak	17.3	0.94	0.71
Control - 40% MP	soft	21.6	0.68	0.54
+ 20% SPI	less firm	12.8	1.15	1.29
+ 40% SPI	less firm	14.5	1.17	1.22

Table 1. *Texture Profile Analysis data, penetrometer results, and results from a panel test obtained with real sausage products in comparison to the micro-sausage model. TPA conditions: deformation: 25% (2-fold); plunger speed: 100 mm/min; plunger diameter: 2.5 cm. MP: Meat protein; SPI: Soy Protein Isolate.*

NOTES