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Control of production costs and quality of meat products

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The unstability of chemical composition in raw materials of the meat industry influences both the quality of meat products and the costs of production. In the Hungarian Meat Research Institute a complex regulatory system was worked out.

The system called PRODUCONT attains the required quality and profitable production mainly through controlling production formulas. Development and application of the formulas is executed in several phases. In the meantime, it gives the possibility to keep the specific features and organoleptic characteristics of the product, controlling its chemical composition, taking the daily raw material supply and trade orders into consideration.

The established new system alignments with the composition of raw materials and their standard deviation. The lesser the standard deviation the more effective is the quality and expenditure control. So it is very important to decrease standard deviation by technological methods. First of all, in the Meat Plant of Szombathely, the modernization of raw material preparation, and the establishment of a new meat classification system - ensuring more precise quality - were executed /1/. The application of a rapid analyzer and a great volume blender is under preparation, too /2/. By introducing standardization, a stable composition and small deviation can be ensured in the meat lots. Until it is realised, the raw materials are characterized by the calculation of running average deriving from the results of regular control and several analyses.

Sampling from the raw materials is also a special question. A new sampling method providing results through known standard deviation and planned precision has been worked out.

In table 1. sample masses belonging to requested standard deviation are shown according to the approximate fat content and particle size of the raw material. Table 1. was achieved by recalculation of analytical results of a great number of meat sample units with different particle size. /3/

For calculating production formulas, a mathematical model was set up. In reality, it is a system of equations in which the relations of the quantity and composition of raw material are related with the prescribed composition of the final product by the help of conditional equations. Beside them, there is a target function taking raw material price into account /Fig.1./.

The standard deviations in the composition of the respective raw materials are also presented in the system of equations.

Through the calculations we obtain what actual composition is needed for assuring the prescribed chemical composition of the final product on a given level of statistical probability.

The comfortable application of the model is supported by a program composed on microcomputer. It is possible to take max.20 kinds of raw material simultaneously into account. Several variations of formulas are calculated on individual products. They are accepted after experimental production and organoleptic test. They are not standard formulas, after all. The regular control of raw materials makes it possible to test the prevailing set of formulas because of actual raw material quality and eventual price changes periodically. By the help of an aimingly composed computer program it can be selected which formulas deviated from an acceptable interval of composition and costs because of changes in the raw material composition. In this case they are corrected by the help of the above mentioned calculating program. The periodical change of the formulas follows the raw material composition and assures steady final product quality. After such "re-optimations" no experimental productions are needed. So the variations in the formulas give controlled composition, organoleptic quality and least possible raw material costs. From these variations those formulas must be daily selected which give the minimal production costs, at the disposable raw material stock and actual trade orders.

This latter problem is also solved by a mathematical model. The selection of formula can be executed by the help of an algorithm "back-track" with microcomputer - and fairly good speed and efficiency. The program examines a great number of production combinations and the products are enlisted in a special preference order on the matrixes. The program may require reserve or additional amounts of raw materials. In this case it always denotes the level of the additional financial result. The operator of the program may give permission of using additional raw material with knowledge of the factory and market conditions. This assures great flexibility in the use of the program. The calculating, testing, formula-selecting programs together with other additional ones furnish a system of programs. /Fig.2./.

In the meat plants of Szombathely and Gyöngyös, teams were organized for the application of this production control system. In these places beside the daily functions the production and final product control data are regularly analyzed. So e.g. if organoleptic objections are found repeatedly in the case of a given formula the team may cancel it from the system.

During the last years, beside a stable quality level, a considerable economy of raw materials was registered.

Figure 1.

mathematical model for calculation of formulas

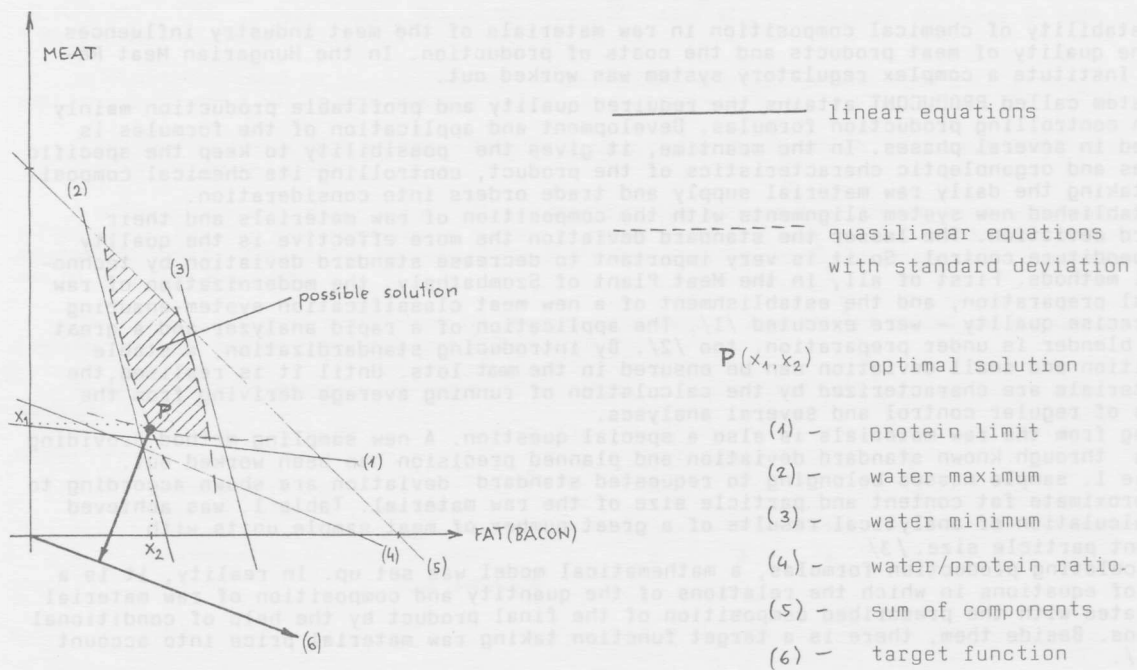


Figure 2. system of programs and organisation

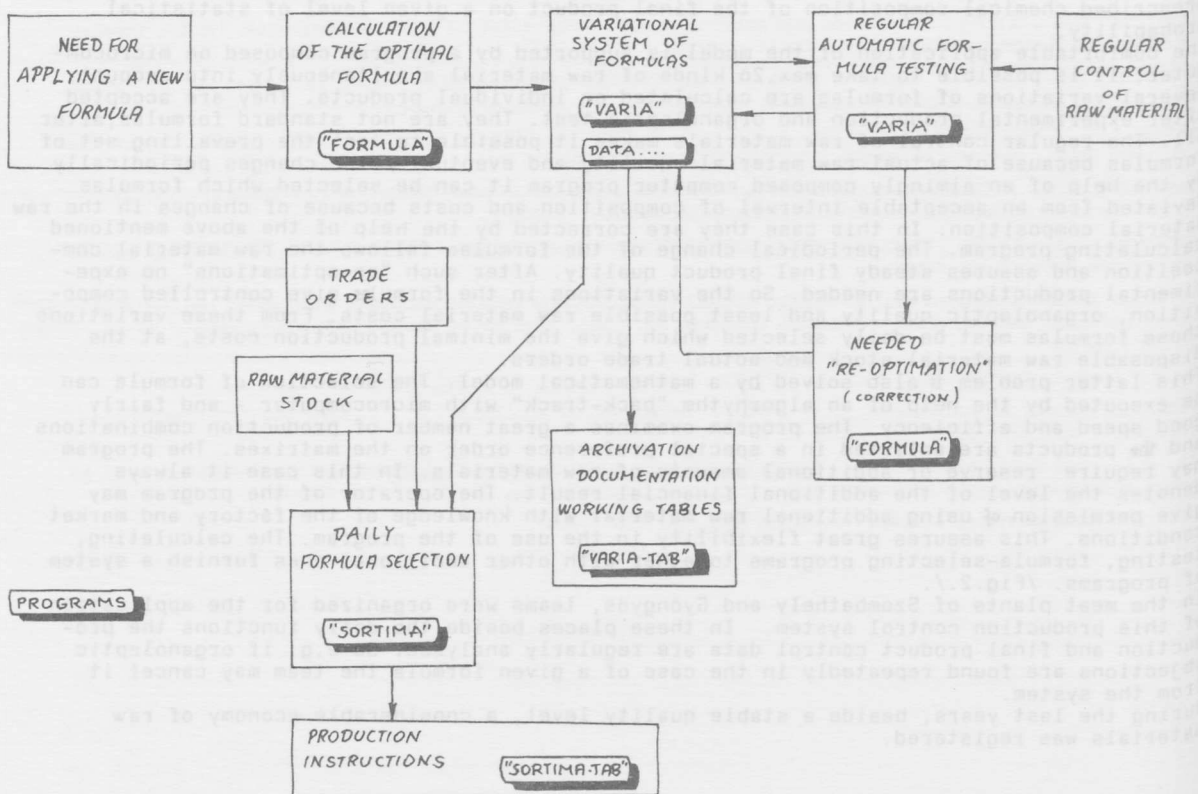


Table 1. Sample mass and standard deviation

permissible standard deviation	approximate fat content	particle size of meat /mm/						/g/
		2	3	5	13	20	40	
s = 0.8	cca. 10 %	150	150	350	490	830	1090	
	cca. 40 %	300	580	580	3300	3300	4560	
s = 1.2	10	70	70	160	220	370	490	
	40	130	260	260	1470	1470	2030	
s = 2.0	10	20	20	60	80	130	180	
	40	50	90	90	530	530	730	

LITERATURE

1/ LEHEL, K.: Húsipar, 31 /1982/, 4, p.164
 2/ DÓCZI, I., et al.: Húsipar, 32 /1883/, 4, p.145.
 3/ SCHÖBERL, E., et al.: /sampling from raw meat/ Die Nahrung - FOOD, 30 /1986/ in press

INTRODUCTION

There has been a considerable production of frozen minced beef loaves worldwide with any product Colour problems have been experienced for these products, the surface becoming brownish during storage due to oxidation of the myoglobin to the brownish metmyoglobin. As the appearance of meat is very important to the consumer it is necessary for the manufacturer to know which factors determine the colour stability of the product.

Temperature, light and packaging film are some of the main external factors of significance. Previous studies in this field have been concerned with the effect of temperature (Mehrad et al., 1962; Kowal et al., 1972; Tomberg, 1974; Tomberg, 1975; Lantz, 1979; Hunt et al., 1982; Mosevitch et al., 1981; Tomberg and Berglund, 1979; Lantz, 1974; Lantz, 1975; Berthel and Singh-Sorenson, 1981) and packaging film (Tomberg, 1979; Lantz, 1974; Lantz, 1975; Hunt et al., 1982; Lantz, 1979).

However, most of these studies have dealt with frozen steaks. The present study was undertaken to establish the effect of light and temperature on the colour stability of frozen minced beef.

MATERIALS AND METHODS

Samples

Minced beef was produced at six different commercial processing plants. The meat loaves (frozen loaves) were manually ground then mixed with about 20% hydrated soy protein (1 part soy protein to 3 parts water). Then the mixture was ground again. The fat content of the final product was approximately 25%.

The minced beef was packed in retail-sized 4 lb polyethylene (PE) chubs, and was then placed in vacuum (about 75 in. Hg). At one plant (No. 2) the chubs were frozen before being placed in the cartons. At the other plants the chubs were frozen in the cartons. At all plants the freezing process was done freezing (air temperature about -20°C).

A few days after production, the samples were transported to the laboratory.

Packaging materials

All plants used approximately the same type of PE chubs.

The oxygen-permeability of the PE chubs was approximately 200 cc/h/25 in./cm., measured at 23°C. The material transmitted about 70% of the light of wavelengths greater than 340 nm.

Figure 1.



Figure 2.

