Control of proper heating of meat-and-bone meal by ELISA-test

K. Hofmann

Institut für Chemie und Physik, Bundesanstalt für Fleischforschung (BAFF), Kulmbach, Germany

Introduction

The disastrous BSE epidemic amongst cattle („Mad cow Disease“) in England was caused by feeding with inadequately heat-treated meat meals. That is why compliance with and monitoring of the heating regulations now in place throughout Europe for all animal carcass disposal plants is particularly important. The actual effect of this treatment on the material in the sterilizer can be checked using the ELISA-species test for pork (supplier CORTECS DIAGNOSTICS, England). The content of material from pig should no be less than 10 percent.

The principle of „meat meal“ production

According to EU regulation (in effect since 1.4.1997) the material (animal bodies and meat disposals) has to be heated at least for 20 minutes at 133 °C under a pressure of 3 bar. Normally a so called pre-cooker is used (Fig. 1). The aim of this strong heat treatment is to kill all micro-organisms including the agents of BSE („Mad Cow Disease“).

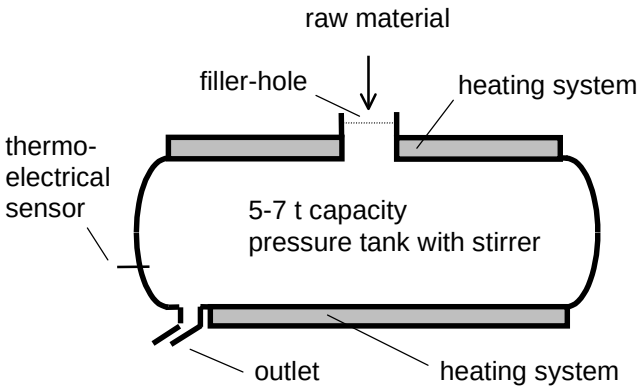

Fig. 1: Principle of „meat meal“ production in a sterilizer („pre-cooker“)

„Meat meal“ inspection

For the inspection of „meat meal“ production the physical data of heating, temperature, pressure and time have to be registrated (so called paper control). Furthermore bacteriological investigations have to be carried out. Recently also the effectivity of heating can be established by using the „ELISA-heating-test“ which was developed recently in our laboratory (HOFMANN, 1996, 1997). These test has already been used with success for the control of proper heating of meat meals by several commercial producers themselves and by the official service control as well. The reproducibility and reliability of the test has been confirmed by a interlaboratory trial organised in Germany with the participation of 15 laboratories (HOFMANN, 1998).

The principle of the ELISA-heating-test

In the case of proper heating with the heat-damaged meat antigens only a weak immunoreaction can be observed, whereas meat meals insufficiently heated give a strong positive ELISA-test reaction resulting a green colour. The influence of heat-treatment on the immune response in the microwave module for the ELISA-test is shown in Fig. 2 and 3.

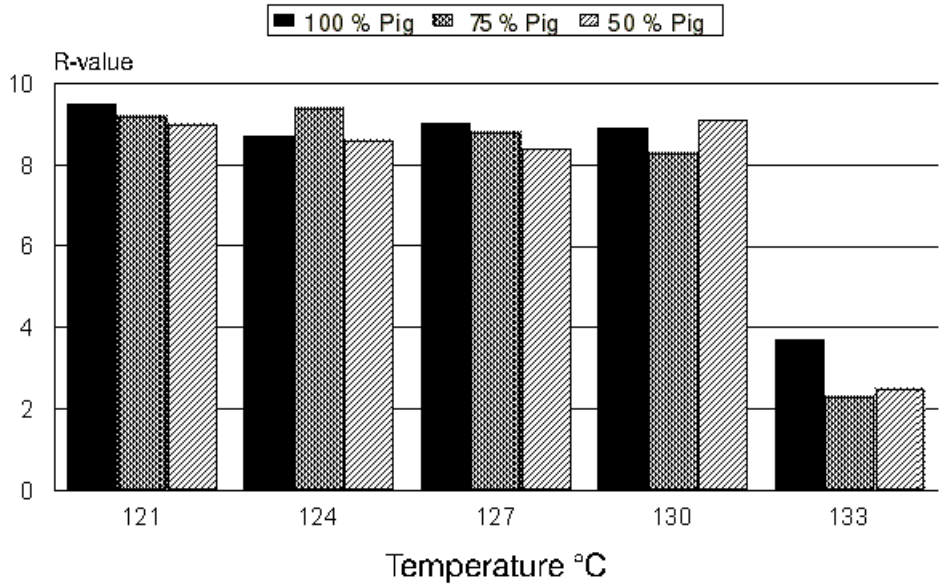

Fig. 2: Influence of heat treatment of meat on the ELISA-test. R-value: Measure of the immune reaction. All meat samples were heated for 20 min

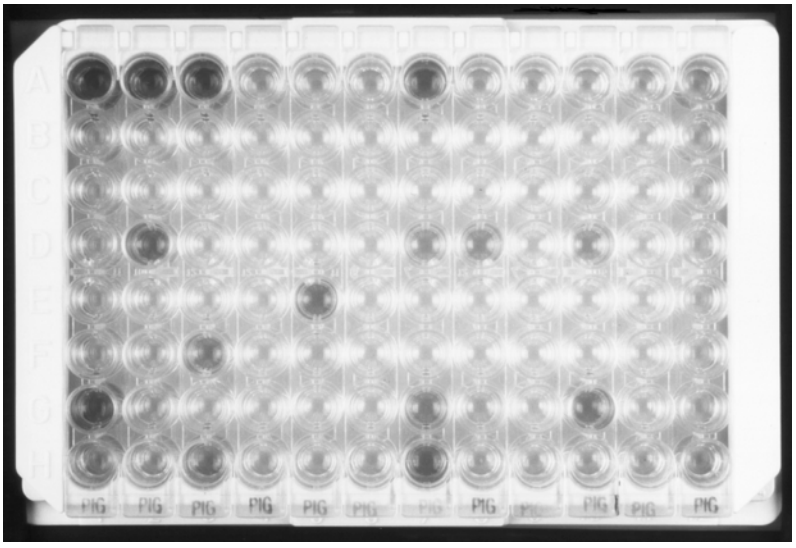

Fig. 3: Microwave module to carry out the ELISA-test. The development of a green colour (in the Figure: grey) means insufficient heating

The procedure

The sample preparation and the ELISA test were already described in earlier papers (HOFMANN at al 1996, HOFMANN 1996-1998) and shall be summarised shortly in the following:

6,25 g of the dry material is weighed into a 250 ml Erlenmeyer flask an then blended with 18,75 g of distilled water to compensate for water withdrawal. The soaking time allowed is 15 minutes. Then 100 ml physiological salt solution (0,9 % NaCl) is added, and the mixture is heated in a simmering water-bath for 15 minutes under stirring or shaking.

Having cooled down to ambient room temperature, the mixture is passed through a 15 cm diameter flute filter. A slight turbidity of the extract is of no concern (don't repeat the filtering process!). In the next step a pipette is used to fill the undiluted filtrate to the test strip cavities of the microwave module. Afterwards, the ELISA test is performed as described in the supplier's instruction and in those of the German dealer (TRANSIA, Ober-Mörlen). In the latter also the calculations and tolerance limits for evaluating the results (Fig. 4) are presented.

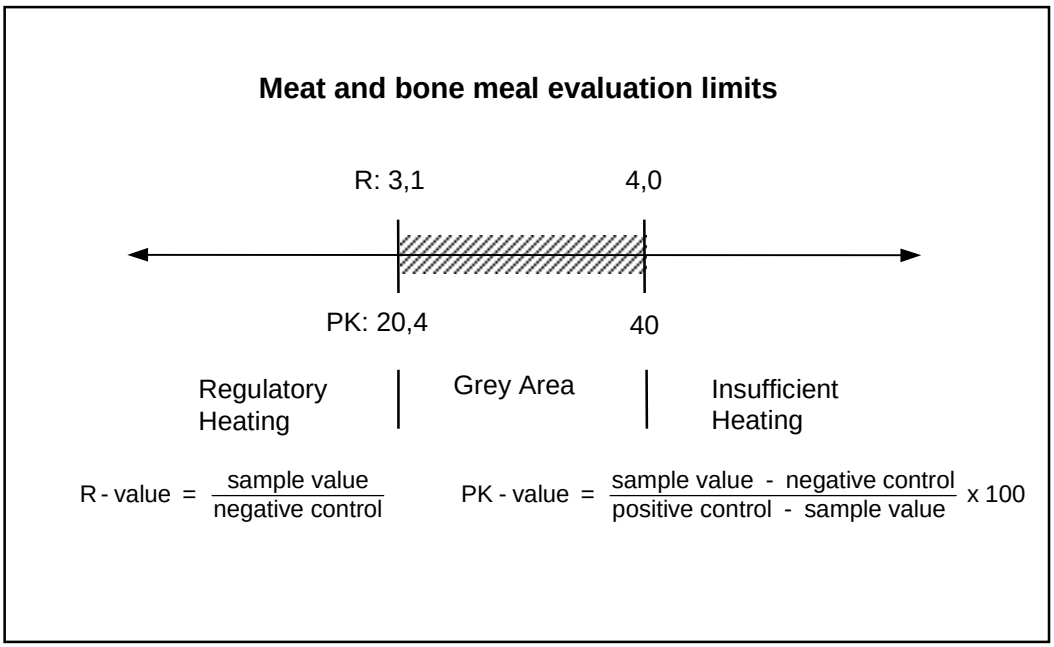

Fig. 4: Calculation of the measures (R- and PK value) and the limits to evaluate the heating status of meat-and bone meal

Evaluation

The limits for the „Thermal-Evaluation-Test" (ELISA-TEST) are the result of numerous examinations of meat-and-bone meal products from different producers and of model samples specifically prepared for this purpose. For the evaluation of the results both values, R- and PK-values (see Fig. 4), are used.

A meat-and-bone meal product may be regarded as sufficiently (regularly) heated if both indicator limits are below their assigned maxima, i.e. R < 3,1 and PK < 20,4. On the other hand values of

R > 4 and PK > 40 indicate that the product has not undergone sufficient heat treatment. Between the two limits there is a range („Grey Area, see Fig. 4) in where it is not possible to make a decision as to whether the feed has been sufficiently or insufficiently heated.

A value of R = 2,5 which is based on experience with animal feeds heated to higher temperatures (UNGLAUB, 1997) cannot be accepted as a general limit value. According to general experience, even with an animal feed manufactured at the minimum stipulated (20 min at 133 °C, 3 bar), the R-value can be over 2.5.

Summary

In order to increase the safety of proper heating of meat-and-bone meals being important to minimise the BSE problem a test procedure, based on the immune reaction of meat antigens, has been developed. The test is based on an ELISA-species test for heated meat (CORTECS DIAGNOSTICS). The antigens of meat become inactivated under the heating conditions prescribed for „animal meals“ (20 min at 133 °C, 3 bar). As in most countries the raw material for the animal meal production consists of material form swine, the ELISA-test for pig is used. Limits of the evaluation have been determined by way of investigations carried out on meat-and-bone meals and on model samples specifically tailored for the purpose of this exercise. The ELISA-test provides a valuable tool for verifying the effectivity of heat-treatment of the final product. Therefore this method can be used for both the official control as well as for monitoring the sterilisation process in the producers own interest.

Literature

HOFMANN, K.: Proof of proper heating at meat-and-bone meals. Fleischwirtsch. 76 (10), 1037-1039 (1996)

HOFMANN, K., K. FISCHER, E. MÜLLER u. V. KEMPER: Experiments to demonstrate the effectiveness of heat treatments applied to canned meat and meat-and- bone meals. Fleischwirtsch. 76 (9), 920-923 (1996)

HOFMANN, K.: Safe controls for renewed confidence: the ELISA meat & bone meal test. Fleischerei 48 (11), III-VI (1997)

HOFMANN, K.: Futtermittel-Komponente „Tiermehl“ im Erhitzungstest-Ringversuch/The Feed Component “Meat Meal“ in a Heating Test Ring Experiment. Kraftfutter/Feed Magazine 81 (6), 251-255 (1998)

UNGLAUB, W.: Produktnahe Überprüfung rechtskonformer Sterilisation bei der Tiermehlherstellung. Fleischwirtschaft 77 (11), 994-996 (1997)