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Brief Communication

MEASUREMENT OF PORK AND BEEF COLOUR BY COLOUR PHOTOGRAPHY AND SPECTROPHOTOMETRY*)

The current methods for measurement of meat colour have recently been commented upon (1, 2). This paper describes a method based upon spectrophotometric measurement of transparent colour photographs of meat.

Muscle specimens, 6 to 7 cm in diameter and about 3 cm thick, were cut from the inner thigh close to the pelvic bone of pigs and cows at the abattoir. Until they were photographed, after 2 or 3 hrs. at the latest, the specimens were kept in plastic bags at refrigerator temperature. Immediately before photographing, the specimen was cut into two flat halves in order to obtain a fresh surface exposed to air. The surface was tightly covered with a 2 mm thick plate of clear glass, which would eliminate reflecting spots.

The camera (Leica M 3 with the reflex housing Visoflex, focusing bellows, and the Hektor lens-head, focal length 135 mm, f/4.5) was attached to the top of a stand above the specimen. The distance object to lens was about the focal length, giving the size ratio 1:1 between the object and the picture. Exposure for 1/50 second was done in flash light, using a Cornet R aggregate with two bulbs in series situated 50 cm from the specimen. A straight line from the bulbs to the specimen should form an angle of 45° with the glass plate and the horizontal plane. The flash-light aggregate was connected with the electric main holding 220 v tension. After the lamp indicating full voltage of the aggregate had started to glow, 2 min. were allowed to elapse before exposure.

Agfacolor CT 18 reversal film, 24×36 mm, speed rating 50 ASA, was found to give a true reproduction of the meat colour as perceived by the eye, when used at lens aperture f/5.6. A freshly prepared magnesium-oxide layer on a glass plate was included in each set of specimens to give a reference blank. A red Gevacolor standard filter (Gevaert), with colour approaching that of bovine muscle, was photographed in order to test the continuity of the film and the developing procedure. The developed film was fitted into a specially made metal frame which kept it free from folding, and at right angle to the light beam in the cuvette house of a Zeiss PMQ 2 spectrophotometer. The light beam which is transmitted through the film and acts upon the photocell has a crosssection area of 1 cm^2.

Characteristic extinction curves of pork and beef (Fig. 1) have maxima at about 440 and 530 mμ and a minimum at about 490 mμ. The curve is continuously falling towards the red area.

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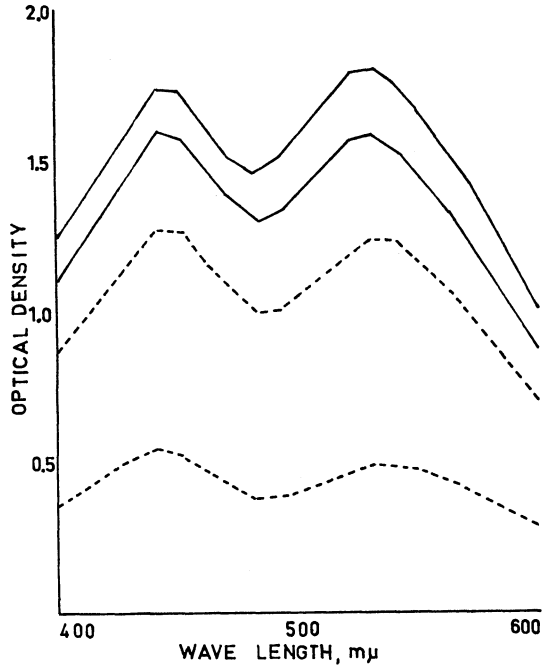

Figure 1. Optical density of beef (solid lines) and pork (broken lines): The upper curve represents dark and the lower curve light colour of the respective kind of meat.

The extinction curve of the red Gevacolor filter runs a similar course. It gave extinction values (mean ± s) of 1.458 ± 0.163 at 440 mμ, 1.294 ± 0.105 at 490 mμ, and 1.634 ± 0.101 at 530 mμ with 7 different films. The error associated with photography and spectrophotometric measurement of pork was determined by repeating the procedure twice with each of 10 specimens from as many animals, the interval between exposures of the same specimen being 2 min. Mean extinction values ± errors of single determinations were 0.769 ± 0.021 at 440 mμ, 0.583 ± 0.016 at 490 mμ, and 0.729 ± 0.021 at 530 mμ.

The results — extinction values ($\bar{x} \pm s$) — of examining a set of specimens from another 12 pigs and from 12 cows were:

Wave length, mμ	pork	beef
440	0.849 ± 0.300	1.695 ± 0.216
490	0.660 ± 0.263	1.331 ± 0.179
530	0.816 ± 0.330	1.630 ± 0.211

If curves of applied remission photometry to pork (3) are inverted, there is fairly good accordance with our curves from 430 mμ towards the red wavelength area.

The method described here has some advantages. The muscle surface can be photographed immediately after it has been cut free and, consequently, the environmental influence is kept at a minimum. Appropriate photographic equipment and procedure will produce colours in close agreement with those directly perceived by the eye. Strict standardization of the method, including the use of magnesium oxide and a colour filter as references, ensures good reproducibility.

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