NEWS AND REVIEWS

OBJECTIVE MEASUREMENT OF FRENCH FRY COLOR

W. M. Iritani and Larry Weller

The processing of frozen french fries is becoming increasingly more important in the expanding potato industry of the Northwest. In Washington, approximately 54% of a 1,500,000 ton crop was processed into frozen fries in 1973.

One of the principal problems confronting processors every season is the accumulation of reducing sugars in tubers which causes darkening upon frying of the slices. The determination of reducing sugar content can be time consuming. Therefore, evaluation of the processability of a lot is usually determined by frying and subjectively rating the fries into different color classes according to USDA color standards for frozen french fried potatoes (1). Subjective methods of color evaluation have limitations which are obvious. Critical evaluation of color requires standardized lighting and viewing conditions of which many people are not aware. Generally, training and experience are required for proper color or texture evaluation. The trend is for processors to contract the purchase of potatoes on the basis of quality factors such as bruise free, percent U.S. No. 1's, and specific gravity. It is entirely conceivable that within the near future the amount of reducing sugars or fry-ability in terms of color will be another basis on which potatoes are purchased for processing.

This report suggests the use of the Photovolt reflection meter for color evaluation of french fried potatoes both in research and by the potato industry. The chip industry has been using standardized procedures for objective potato chip color determinations for many years (2, 4).

Objective determination of french fry color requires the following items:

A model 670 Photovolt reflection meter with a green tri-stimulus filter. Photovolt Corp., N. Y.

A restaurant type “Keen Kut Shoe Stringer” which has cutting heads available to produce slices from \( \frac{1}{8}'' \) to \( \frac{5}{8}'' \) squares. Shaver Specialty Co., 6121 So. Western Ave., Los Angeles 47, California.

Alternate blades of the cutter were removed so that double width fries could be cut which is necessary for complete coverage of the opening of the sensing portion of the Photovolt which is approximately 2 cm (\( \frac{3}{4}'' \)) in diameter.

A minimum of 12 to 15 tubers is recommended as representative of a lot of potatoes. A single double width slice from the center longitudinal portion of each tuber was used. The center slices generally show the greatest treatment differences in respect to fry color of stem and bud halves of the tuber.

After slicing, the strips were carefully rinsed in cold water, blotted with a paper towel and fried in vegetable oil at 375 F. for 3½ minutes. They were taken out and readings were made at four locations on each longitudinal slice. The Photovolt was standardized each time of use with a white porcelain plate of known reflectance.

1Horticulturist and Senior Experimental Aide II, respectively, Washington State University, Pullman, Washington 99163. Received for publication April 30, 1974.
Results

The fry color begins to change as soon as removed from the fryer. Fig. 1 shows Photovolt readings of six groups of 12 fries each which were read within 3, 5, and 7 minutes and after 10 and 30 minutes. The readings were taken at four equal quarter portions of each fry. The results indicate a distinct darkening of the fry color between 3 and 10 minutes after removal from the fryer after which the color change seems to have stabilized. Readings should probably be made within 3 minutes after removal from the fryer. This agrees with recommendations made for texture determinations stated in the USDA Grade Standards for Frozen French Fried Potatoes (1).

French fries were placed into subjective color classes by three graders and Photovolt readings made within 3 minutes after removal from the fryer. Fig. 2 shows the regression line obtained and the expression of the line. Each point is an average of 30 readings. Conversion of Photovolt to color class can easily be made.

Fig. 3 shows relationship of Photovolt readings to percent reducing sugar in the stem and bud portion of tubers stored at three temperatures. Although, high correlation coefficients have been reported between reducing sugar content and fry color (3, 5), at a specific Photovolt reading considerable variation in reducing sugar content can occur. This should be recognized when fry color is used for evaluating processing quality.