yeast (Jones, & Pierce, 1964). Tyrosine is absorbed only during the latter stages of fermentation, because of competition for the permease sites in the yeast cell wall (Jones & Pierce, 1964), so the excess present in the syrup should not effect the yeast metabolism. Lysine could block the transport of several amino acids, as it is preferentially absorbed by the yeast permease system (Jones & Pierce, 1964). Consequently the excess of lysine might affect the quality of the beer if a major percentage of the wort was derived from the wheat syrup. However, small-scale brewing trials have shown that the use of a wheat-based syrup to replace 30% of a malt wort produced beers that could not be distinguished organoleptically from the all-malt wort control beers.

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The Reaction of Malonaldehyde with Wheat Flour Proteins

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Recent studies on lipid-protein interaction in dry systems (Roubal & Tappel, 1966; Roubal, 1970) have demonstrated that the free radicals derived from oxidizing lipids are the dominant cause of reactions leading to protein polymerization and amino acid destruction. However, there is some evidence that the difunctional aldehydes malonaldehyde and glutaraldehyde, products of the oxidation of polyunsaturated fatty acids, are able to react with proteins (Menzel, 1967; Ewart, 1968) and amino acids (Buttkus, 1968) directly. This communication confirms previous findings and demonstrates the reaction mechanism of malonaldehyde-protein in wheat flour systems.

Malonaldehyde was prepared from 1,1,3,3-tetraethoxypropane (Kwon & Watts, 1963) and allowed to react with wheat flour gliadin under the conditions described by Ewart (1968) for gliadin-glutaraldehyde reaction. The modified protein was hydrolysed with 6M-hydrochloric acid for 18h at 105°C, and amino acid analyses were carried out as described by Ewart (1967). Results demonstrate that the treatment of gliadin with malonaldehyde results in the destruction of all the detectable tyrosine, in contrast with other workers, who have reported losses of lysine and tyrosine (Ewart, 1968), of cysteine and methionine (Buttkus, 1968) and of methionine (Tannenbaum, Barth & Le Roux, 1969).

Glycerol tri[U-¹⁴C]linolenate was synthesized (Daubert & Baldwin, 1944) via the acyl chloride (Wood, Jackson, Baldwin & Longenecker, 1944) and stored with a mixture of wheat flour proteins for 35 days at 30°C (80% relative humidity). Portions of the mixture were withdrawn at intervals, exhaustively defatted and fractionated by polyacrylamide discontinuous gel electrophoresis. The developed gels were sliced into 1mm sections and the radioactivities counted. During storage significant amounts of radioactivity became associated with the more mobile proteins. After storage the mixture was slurried with water and the more volatile components, containing 70% of the residual radioactivity, were isolated by steam-distillation. All of the radioactivity in this isolate was associated with a compound whose properties were identical with those of malonaldehyde. A sample of [U-¹⁴C]-malonaldehyde was prepared from [U-¹⁴C]linolenic acid and dispersed with unlabelled aldehyde on to a similar protein mixture. Subsequent isolation and counting of radioactivity showed the pattern of radioactivity-protein combination to be identical with that observed in stored glycerol tri-linolenate-protein mixtures.

This evidence supports the view that the aldehydes released from oxidizing lipids combine directly with proteins.

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The Isolation of Plant Root Protoplasts and their Use in the Separation of Subcellular Components

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Power & Cocking (1968) described a method for the isolation of large numbers of protoplasts from fully expanded tobacco leaves. This method has been adapted for use on roots, either for the production of intact protoplasts or for the release of