The Effect of Amino Acids on the Activity of Synergists and Antioxidants in Two Vegetable Oils

M.M. AHMAD, S. EL-HAKIM[1] and **A. ADEL Y. SHEHATA**[2], Food Science Department,
College of Agriculture, Hammam Al-Alil, Mosul, Iraq

The objectives of the present work were to examine the prospects of replacing phenolic antioxidants partially or completely by certain amino acids or their mixtures with ordinary synergists. The seven selected amino acids (methionine, proline, lysine, cysteine, arginine, tryptophan and glutamic acids) were found to be relatively effective as antioxidants (M.M. Ahmad et al., previous work, to be published). Laboratory prepared crude safflower oil and freshly prepared commercial vegetable oil composed of 50% sunflower and 50% cottonseed oil (Bint oil) were used as substrates. The latter commercial oil had ca. 10% more of oleic acid, whereas the former had ca. 10% more of linoleic acid. The two oils had comparable natural tocopherol contents with Bint oil having about twice as much copper and iron and five times as high a peroxide value as the safflower oil. The antioxidative activity of any substance or mixture was tested by both the active oxygen method (AOM) at 97.8 C and by a storage stability test (oven heating of samples at 45 ± 1 C) for both tests to reach a peroxide value of 100 meq/kg of oil. Control samples without any added material, with each amino acid alone (at 0.02%), with each synergist alone (at 0.02%), or with each phenolic antioxidant alone (at 0.02%) were all made. In all the mixture experiments, a particular amino acid replaced 50% of the initial synergist or antioxidant concentration.

Synergism between amino acids and ordinary synergists has occurred in safflower oil with the mixtures: ascorbic acid (AA) + methionine and citric acid (CA) + cysteine. In both mixtures, AOM and storage stability values have increased higher than with each individual component (controls). In Bint oil, synergism occurred differently with the mixtures: ascorbyl palmitate (AP) with lysine, tryptophan; AA mildly with methionine, proline, tryptophan; and CA with proline.

Replacement of half the concentrations of tertiary butylhydroquinone (TBHQ), hydroquinone (HQ) and propyl gallate (PG) each with each of the seven amino acids resulted in mixtures which were less effective (in safflower oil) compared with the phenolic antioxidant controls. However, the mixtures of HQ and PG with certain amino acids, particularly with methionine and lysine, achieved stability values closer to those of the antioxidant controls. This indicated some degree of synergism in these mixtures. Besides, butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) alone and in their mixtures with the amino acids achieved stability values comparable to most of the amino acid controls.

In Bint oil, phenolic antioxidants behaved differently with apparent synergism occurring with the mixtures: TBHQ with methionine, lysine, cysteine, arginine and tryptophan; HQ with the seven amino acids; and BHT with lysine. With PG, strong synergism was noted with most of the amino acids by the AOM values alone thus stressing the importance of using more than one stability test in similar experiments.

In conclusion, the present work indicated that several amino acids, when added alone at 0.02% level, were as effective as BHA and BHT. Furthermore, it has provided some evidence that replacement of a portion of concentration of some phenolic antioxidants (like HQ and PG) with certain amino acids (like methionine and lysine) would enhance the antioxidative activity of the mixture or cause it to decrease only to a small extent.

[1]Current address: Food Science Department, College of Agriculture, Abou-Gharib, Baghdad, Iraq.

[2]Current address: Food Science Department, College of Agriculture, Alexandria, Egypt.