S8P19.WP

ANTIOXIDANT ACTIVITY OF OILSEED FLOURS AND THEIR EXTRACTS IN MEAT MODEL SYSTEMS

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[Ed note: Folio 76 incorrectly labelled S8P20.WP]

INTRODUCTION

Lipid oxidation is a major cause of quality deterioration and development of off-flavours in muscle foods. In addition, possible mutagenic, teratogenic and carcinogenic activity of oxidized lipids and their products is of concern to consumers and processors alike (Artman, 1969; Perkins, 1976). Although use of synthetic antioxidants and preservatives is commonplace, testing of natural antioxidants for use in meat and meat products is of interest. Natural ingredients such as rosemary, sage and other spices have been extensively studied in recent years (Barbut *et al.*, 1985; Al-Jalay *et al.*, 1987; Shahidi, 1988; Mendiolea *et al.*, 1990; Stoick *et al.*, 1991). Furthermore, some protein binders and their extracts have also been found to improve the keeping quality of meat products (Rhee *et al.*, 1981; Ziprin *et al.*, 1981; Pratt *et al.*, 1981).

Ground mustard and canola seeds may be used as spices or protein extenders in comminuted meat products. UFL Foods Inc. (Mississauga, ON) produces deheated ground mustard seed (DGMS) using an enzyme deactivation method. The pungency of mustard arising from enzyme-assisted decomposition of its glucosinolates and production of isothiocyanates is inhibited by application of a heat processing technique. In addition to its mild seasoning activity, DGMS may be considered as a functional protein extender in meat emulsion systems.

The present study was undertaken to examine the effects of application of DGMS and ground canola seed (GCS) on prevention of lipid oxidation in meat systems. The effects of aqueous and non-aqueous extracts of DGMS and GCS in meat model systems were also investigated.

MATERIALS AND METHODS

One day post-mortem pork loin samples were obtained from Newfoundland Farm Products Corp. (St. John's, NF). DGMS was obtained from UFL Foods Inc. (Mississauga, ON). Canola seeds were obtained from Can Amera (Saskatoon, SK). Other chemicals and reagents were purchased from Sigma Chemical Co. (St. Louis, MO).

Extracts of DGMS and GCS in water, methanol, and 85% methanol were obtained by extraction of a 6g sample with 100mL of each solvent at 80°C for 20 minutes. The content of total phenolics in each extract was determined using the Folin-Denis reagent as described by Rhee *et al.* (1979, 1981). The dried extracts were used in meat model system studies.

Meat model systems were prepared by homogenizing 80g of comminuted meat less the amount of protein extenders or their extracts with 20 mL of distilled water. Additives were dissolved or dispersed in the water and added to the meats. Homogenized meat model systems were cooked in a thermostated water bath at 85°C for approximately 40 minutes. After cooling, oxidative stability of samples was determined over a 3-week storage period at 4°C. The 2-thiobarbituric acid (TBA) test of Tarladgis *et al.* (1960) as modified by Shahidi *et al.* (1987) was used throughout this study.

RESULTS AND DISCUSSION

The percent inhibition of TBA reactive substances (TBARS) defined as 1- (TBARS of treated sample / TBARS of control) x 100 is shown in Figures 1 and 2 for mustard and canola seeds and their extracts, respectively. Generally, addition of 1-2% DGMS or GCS to meat was found to provide a suitable level of protection to the meat model systems investigated. Both of these ingredients inhibited lipid oxidation by >90% without imparting any adverse taste or colour effects to the meats. The antioxidant activity of both DGMS and GCS was found to be concentration dependent.

Extracts of DGMS and GCS also possessed good antioxidative effects. The antioxidant efficacy of these extracts depended on the nature of the extraction system employed. The 85% methanolic extracts exhibited a better antioxidant activity than their aqueous or methanolic extracts. The antioxidant activity of extracts tested paralleled their content of phenolic compounds as shown for DGMS extracts (Table 1). In case of GCS, the most active ingredient of the extracts was identified as 1-O-β-D-glucopyranosyl sinapate.

The DGMS was also effective in enhancing the cook yield of comminuted meats. At a 2% level of addition, it increased the cook yield of products by approximately 10% (Saleemi *et al.*, 1993). The effect of DGMS addition at 0.5% on the cook yield was equivalent to that of sodium tripolyphosphate (STPP) addition at 0.3-0.5%. In addition, it is expected that GCS will show a similar enhancement in the cook yield of products as that of DGMS.

These protein extenders did not impart any undesirable effect on the colour quality of treated meat samples. Although there was a slight yellow tint in the products, this was not considered as being detrimental to either cured or uncured meats (Saleemi *et al.*, 1993).

In conclusion, DGMS and GCS and their extracts were found to effectively prolong the shelf-life of meat products. The activity of the extracts paralleled their content of phenolics. Thus, 85% methanolic extracts were more effective than methanolic extracts which were in turn more effective than water extracts.

ACKNOWLEDGEMENT

We are grateful to the Natural Sciences and Engineering Research Council of Canada for financial support.

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Table 1. Content of phenolics in extract of deheated ground mustard seed (DGMS).

Solvent System	Phenolics, mg/100
Water	1079.0 ± 4.5
Methanol	1416.3 ± 6.8
85% Methanol	1557.4 ± 1.0