

THE UNIVERSITY OF MANITOBA

PHENOLIC COMPOUNDS FOUND IN CANOLA:
CONVERSION TO LIGNAN
AND
EFFECTS ON GLOBULAR PROTEIN PROPERTIES

By

Maria I. Rubino

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Submitted to the Faculty of Graduate Studies
in Partial Fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

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permission.**

To my parents: Elbio, Aida, Rita and Frank.

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ABSTRACT

Phenolic compounds in plant materials represent an area of concern, because products obtained from plant seeds containing phenolic compounds have low sensory characteristics and nutritional value. Sinapic acid and sinapine are the preponderant compounds found in canola, and knowledge of their behaviour is important if increased usage of canola protein is to be realized. The goals of this work were to elucidate the changes in the phenolic compounds under different conditions of pH and to examine how the phenolic compounds and their by-products bind to the protein and affect protein functionality.

Changes in phenolics were followed using U.V. spectroscopy, high performance liquid chromatography (HPLC) and nuclear magnetic resonance (NMR) spectroscopy. Binding of purified phenolic compounds and associated by-products to bovine serum albumin (BSA) and canola protein as a function of pH and salt concentration, was evaluated using equilibrium dialysis in conjunction with HPLC analysis. Gelation properties of proteins at similar levels of phenolics and by-products were evaluated with dynamic rheology.

It has been shown that sinapic acid readily converts to a lignan, thomasidioc acid, when exposed to alkaline aqueous buffer; this identification was confirmed by comparison with a synthesized authentic sample of thomasidioic acid. This conversion is complete at pH 8.5 but there is only partial conversion at pH 7. The reaction can be completely controlled

by the elimination of oxygen, or partially controlled by the inclusion of ascorbic acid.

It was found that sinapic acid and sinapine interact with the proteins mainly through electrostatic interaction, whereas the thomasidioic acid and sinapine by-products react through hydrophobic interactions. The ligand involved in binding was pH dependent. Furthermore, there was more binding to the canola protein. In general the presence of either ligand reduced the three dimensional network as well as the elasticity of the gel. This reduction was greatest when binding was greatest.

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