Development and Validation of a Predictive Statistical Model to
Optimize Accelerated Solvent Extraction of Isoflavones from
Edamame Soybean [Glycine max (L.) Merrill]

A Thesis
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Abstract

Three experiments were conducted to develop and validate predictive statistical models for isoflavone extraction from edamame soybean [Glycine max (L.) Merrill]. Soybean line NUTRIVEG Soy6407 was chosen to be the experimental sample material. The first set of extractions tested five factors; solvents, temperatures, pressures, extraction time per cycle and number of extraction cycles. Least squares means for six observed isoflavones (daidzin, glycitin, genistin, malonyl daidzin, malonyl glycitin and malonyl genistin) were used to evaluate trends for the effect of changes in each treatment factor. Pressures had no significant differences for any of the isoflavone extractions. Therefore, 500psi (the lowest pressure setting on the ASE instrument sufficient to maintain solvents in a liquid state when temperatures were raised above the boiling point), was used for all subsequent experiments.

A second set of experiments was done to develop predictive regression models. Temperature had a significant effect on glycitin extraction, and extraction time had a significant effect on daidzin extraction. There were differences among solvents for malonyl daidzin, malonyl glycitin, malonyl genistin and total isoflavone content. Temperature and extraction time interacted with solvent, and the interaction was significant for daidzin, genistin and malonyl glycitin extraction. The final models predicted the quantity of extract for daidzin, glycitin, genistin, malonyl daidzin, malonyl glycitin and malonyl genistin respectively at 43.22, 53.57, 44.36, 672.13, 344.14 and 443.30 µg per
gram of dry weight edamame. Model validation was accomplished on a third set of extractions by calculating the means of percent absolute differences between true values and the predicted values in order to understand the accuracy of the model. Two organic solvents, 60% methanol and 80% methanol, were determined to have the most consistent extractions. The means of percent absolute differences were approximately 20% or less, and evidence led to the conclusion that the models for these two solvents were reliable.
To the Graduate Council:

I am submitting herewith a thesis written by Yu-Ting Hung entitled “Development and validation of a predictive Statistical Model to Optimize Accelerated Solvent Extraction of Isoflavones from Edamame Soybean [Glycine max (L.) Merrill].” I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Plant Sciences.

Carl E. Sams, Major Professor

We have read this thesis and recommend its acceptance:

Vincent R. Pantalone

Arnold M. Saxton

Dean A. Kopsell

Accepted for the Council:

Carolyn R. Hodges
Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)