Inverse Methods to Estimate Anthocyanin Degradation Kinetic Parameters in Cherry Pomace During Non-Isothermal Heating

Ibrahim Greiby[1], Dharmendra K. Mishra[1], Kirk Dolan[1,2]

[1]Department of Biosystems & Agricultural Engineering, Michigan State University, East Lansing, MI 48824

[2]Department of Food Science & Human Nutrition, Michigan State University, East Lansing, MI 48824

Phone: 517-355-8474 ext 178

Fax: (517) 353-8963

Abstract

Tart cherry pomace is the by-product of cherry juice production. This by-product has high amounts of anthocyanins (ACY), which have health benefits and is used as a natural colorant. The retention of ACY in the pomace was investigated for two retort temperatures 105 and 126.7 °C. Tart cherry pomace was equilibrated to 25%, 41%, and 70% moisture content (MC) wet basis and heated in sealed 54 × 73 mm cans at 126.7 °C in a steam retort for 25, 40, 60 and 90 minutes and at 105 °C for 100 and 125 minutes. ACY retention of 70% pomace decreased with heating time and ranged from 76 % to 10 % for 25 and 90 min heating, respectively at 126.7 °C, and ranged from 60 % to 40 % for 100 and 125 min heating, respectively at 105 °C. Previously estimated thermal properties were used in Comsol software for temperature prediction in the pomace. Time-temperature data were used to estimate the kinetic parameters of the pomace simultaneously by two inverse methods: ordinary least squares and the sequential method. Scaled sensitivity coefficients were used to determine which steam temperatures to use to best estimate the parameters. ACY degradation followed a first-order reaction. The rate constant and activation energy for 70% pomace were k $_{115.8\ °C}$ = 0.0129 ± 0.0013 min^{-1} and 75.7 ± 10.7 kJ/mol, respectively. The model fit well as shown by RMSE of approximately 9*% of initial ACY concentration (about 65 mg/kg db) and relative error of all parameters estimated was less than 24% for all moisture contents.

Keywords: Anthocyanins ; Kinetic parameters ; Cherry pomace ; moisture content