

The Brassicaceae plant family contains high concentrations of glucosinolates, which can be hydrolyzed by myrosinase yielding products having an anticarcinogenic activity. The pressure and temperature stabilities of endogenous broccoli myrosinase, as well as of the synthetic isothiocyanates sulforaphane and phenylethyl isothiocyanate, were studied in broccoli juice on a kinetic basis. At atmospheric pressure, kinetics of thermal (45-60 degrees C) myrosinase inactivation could be described by a consecutive step model. In contrast, only one phase of myrosinase inactivation was observed at elevated pressure (100-600 MPa) combined with temperatures from 10 up to 60 degrees C, indicating inactivation according to first-order kinetics. An antagonistic effect of pressure (up to 200 MPa) on thermal inactivation (50 degrees C and above) of myrosinase was observed indicating that pressure retarded the thermal inactivation. The kinetic parameters of myrosinase inactivation were described as inactivation rate constants (k values), activation energy (E_a values), and activation volume (V_a values). On the basis of the kinetic data, a mathematical model describing the pressure and temperature dependence of myrosinase inactivation rate constants was constructed. The stability of isothiocyanates was studied at atmospheric pressure in the temperature range from 60 to 90 degrees C and at elevated pressures in the combined pressure-temperature range from 600 to 800 MPa and from 30 to 60 degrees C. It was found that isothiocyanates were relatively thermolabile and pressure stable. The kinetics of HP/T isothiocyanate degradation could be adequately described by a first-order kinetic model. The obtained kinetic information can be used for process evaluation and optimization to increase the health effect of Brassicaceae.