

Far infrared assisted biotransformation and its effect on total phenolics and antioxidant activity in black soybean seed

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실험목적 (Objectives)

Aglycone isoflavones are more potent in their biological activities than their corresponding glycosides. The objective of this research was to explore the suitable temperature and time to find optimum conversion of daidzein, genistein (aglycones isoflavones) using far infrared irradiation (FIR) as a thermal source on black soybean.

재료 및 방법 (Materials and Methods)

1. Estimation of total polyphenol and total flavonoid content.
2. Antioxidant assay
3. HPLC quantification of aglycone isoflavones

실험결과 (Results)

The increase in temperature with increase in exposure time in FIR caused gradual increase in diadzein and genistein production. The maximum increase in aglycone isoflavone (sum of diadzein and genistein) content was achieved in 30 min of exposure with 341 mg/g at 196°C which was 9.89 and 5.08 fold higher than that of the control for genistein and diadzein respectively. The TP contents also altered with increase in temperature and exposure time. The maximum increment of TP was 1385.31 mgTAE/100g dw at 196°C which was 2.87 fold higher than the control. In antioxidant assay, the DPPH free radical inhibition was increased with temperature and time, and the maximum inhibition was observed in 30 min of exposure at 196°C with 69.17%. However, the metal chelating property was decreased with increasing temperature. Overall, this research demonstrated that FIR treatment alters the phenolic and antioxidant activity in soybean in temperature and time dependent manner. And also, the FIR can be used as a convenient tool for biochemical conversion of isoflavonoid glycosides in soybean.

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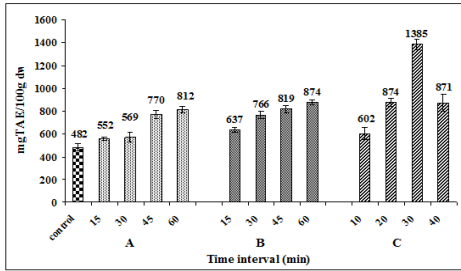


Fig. 1. Total polyphenol content of FIR treated and untreated (control) soybean sample expressed in tannic acid equivalent (TAE) in mg/100g dw. All values are expressed in average (n=3). The letter A, B and C represent temperature at 143, 166 and 196°C in different time intervals respectively.

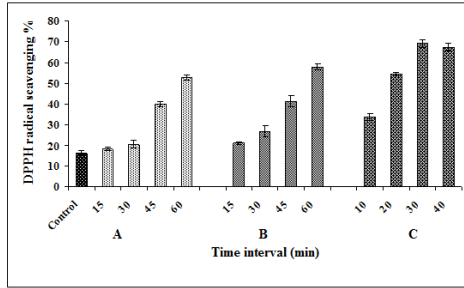


Fig. 2. DPPH free radical scavenging activity of FIR treated and untreated soybean sample expressed in percentage. The samples were used at the concentration of 2 mg/mL for comparison. Absorbance was taken at 517 nm. All values are expressed in average (n=3). The letter A, B and C represent temperature at 143, 166 and 196°C in different time intervals respectively.

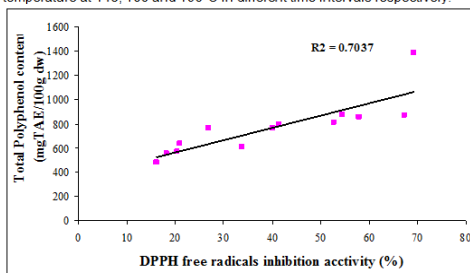


Fig. 3. Linear correlation plot of the total phenolic (TP) content and DPPH free radical scavenging activity (%).

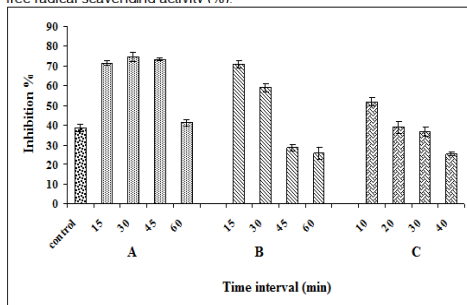


Fig. 4. Metal chelating property of FIR treated and untreated (control) soybean sample expressed in percentage. The samples were compared at the concentration of 0.5 mg/mL. Absorbance was taken at 562 nm. All values are expressed in average (n=3). The letter A, B and C represent temperature at 143, 166 and 196°C in different time intervals respectively.

Table 1. HPLC quantification of daidzin, genistin, daidzein and genistein content in FIR treated at 143, 166 and 196°C in different time intervals and untreated (control) soybean seed sample. The average values were expressed in mg/100g dw. The letters D, G, De and Ge represents daidzin, genistin, daidzein and genistein respectively.

Temp (°C)	Samples	Daidzin (D)	Genistin (G)	Daidzein (De)	Genistein (Ge)	Total (De+Ge)	Total (D+G+De+Ge)
Control		78.487	76.503	23.584	20.629	44.213	199.203
143	15min	89.145	118.346	23.631	21.378	42.009	252.500
	30min	89.526	101.256	49.590	38.691	68.370	279.063
	45min	100.603	96.836	53.109	72.119	125.228	322.667
	60min	88.216	73.687	80.047	116.560	196.607	358.510
166	15min	87.570	101.637	27.633	48.894	76.527	265.734
	30min	88.133	99.039	75.810	113.517	189.327	376.499
	45min	93.490	86.426	77.272	124.298	201.570	381.486
	60min	81.860	72.605	89.591	131.442	221.033	375.498
196	10min	112.031	106.432	25.291	41.932	67.223	285.706
	20min	106.621	93.581	55.784	145.774	201.558	401.759
	30min	40.645	28.007	119.968	204.094	324.062	392.713
	40min	14.185	11.920	144.969	171.101	316.070	342.175

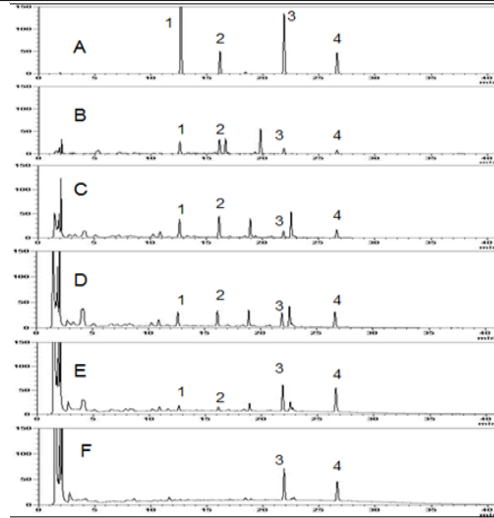
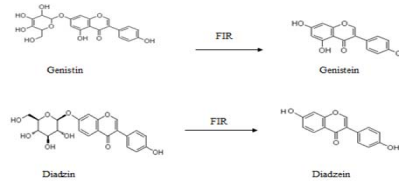


Fig. 5. HPLC chromatogram of daidzein, genistin, daidzein and genistein content in FIR treated and untreated soybean seed sample. 'A' denotes the peaks of the external standard used. 1, 2, 3 and 4 represents daidzin, genistin, daidzein and genistein respectively. 'B' represents untreated (control) and C, D, E and F represent FIR treated samples at 196°C for 10, 20, 30 and 40 min respectively.



Scheme 1. Biochemical transformation of glycoside isoflavone (genistin and diadzin) to aglycone isoflavones (genistein and daidzein) using far infrared irradiation (FIR).