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STUDY REGARDING THE WATER INFLUENCE FOR THE SOYMILK LIPOXYGENASE

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Abstract

In the termical treatments, more proteins, aminoacids, vitamins from soy are destroid. For this reason the technological must search more and competitive recipes-that keep the nutritional potential. This work paper show the variation for the lipoxygenase content- a very important parameter - in the case of changed soymilk – from different waters.
***Keywords**: soymilk, lipoxygenase, different waters*

Introduction

In the soy coexist thermic stable compounds (saponins, tannins, estrogens and phytats) and thermic labile (vitamins, former inhibitors for proteases) (Evans, 1996). These labile thermic compounds, can be destroit to heat, the process being dependent on a series of factors (duration of thermic treatments, temperature of process, size particles, humidity) (Frankel, 1991; Ciobanu, 2002).

The redox processes what can be produced during the soymilk making are influenced by more oxidoreductases enzyme: glutathione peroxidase, lactate dehydrogenase and specialy, lypoxigenases (Florea, 2001; Leonte, 1998). Lipoxygenase (linoleic acid oxygen oxido-reductase, EC 1.13.11.12) catalyzes the oxidation of some unsaturated fatty acids to their corresponding monohydroperoxides (Belitz, 1999).

Lipoxygenase is a metal-bound protein with an Fe-atom in its active center. The enzyme is activated by its product and during activation, Fe^{2+} is oxidized to Fe^{3+} (Keshun, 1999).

Generally, in the soymilk exist two types of lipoxygenases. The enzyme that peroxidizes only free fatty acids is a type I lipoxygenase. It give rise to an optically active hydroperoxide with a cis-, trans-diene system. This type I lipoxygenase forms preferentially either 9- and 13-hydroperoxides from free linoleic acid as the substrate (Nielsen, 1996).

Type II lipoxygenase acts more like a catalyst of autoxidation with a much lower specificity for linoleic acid. It produces both 9- and 13-hydroperoxides in equal amounts and some other products, such as ketodiene fatty acids (Grosch, 1987).

The both types I and II lipoxygenases can be responsable for the "beanny" taste and for this reason she are undesirable in the soymilk (Grosch, 1982).

Experimental

For sample preparation the following recipe was used: 150g soybean seed/water (the average weight for 10 soybean seed are 1.6g); after 36 hours, decanted and filtered the liquid (Savescu, 2004). For the experiments eight variants were made:

- V1- variant with standard water and soybean seeds;
- V2- variant with standard water and soybean flour;
- V3- variant with deionisated water and soybean seeds;
- V4- variant with deionisated water and soybean flour;
- V5- variant with soybean seeds and ionic natural water (from natural source A);
- V6- variant with soybean flour and ionic natural water (from natural source A);
- V7- variant with soybean seeds and ionic natural water (from natural source B);
- V8- variant with soybean flour and ionic natural water (from natural source B).

The used water for produced the soymilk (for V1 and V2) was clean water, indoor, colorless, with 10 germane degrees, without ferruginous, sulphoxidant, and sulphoreducteur bacteria.

Before the UV spectroscopy, the sample was centrifugate (4480round/min at 15 min time), filtered through cellulose surface. For UV spectroscopy was used a digital spectrophotometer UNICAM2 with 1 mm band and thermostat system.

The deionisated water was obtain using the drinking water and an E-PURE Three Holder Water Purification System (Savescu, 2005).

This system have a cationic and anionic resine filters and the solved ionisated solids and ionisated gases can be easy eliminated.

Table 1. The chemical composition for the used water

Ions	Water from natural source A (mg/kg)	Water from natural source B (mg/kg)	Standard water for milk industry (mg/kg)
Cl^-	53.25	39.5	30
Br^-	1	0.6	0.8
NO_3^-	1.2	0.9	10
NO_2^-	0.036	0.033	0.15
SO_4^{2-}	196.3	180.2	198
HCO_3^-	341.6	273.5	256
CO_3^-	36	22	28
PO_4^{3-}	3.4	0.1	0.3
Na^+	150.8	134.5	131
K^+	3.5	2.5	2.8
NH_4^+	0.8	1.4	trace
Ca^{2+}	62.8	39.5	50
Mg^{2+}	20	28.8	0.03
Fe^{2+}	1	0.7	0.2
H_2SO_3	19.3	30.6	trace
HBO_2	3.8	5.5	trace
Total N	0.7	0.8	0.8
CCOCr	2.3	1.9	2.3
H_2S	2.9	3.2	1.8
Minerals	861.3	777.2	550

Results and discussions

The obtained UV spectra are depicted in figures 1 – 4. From figure analisys, for the soymilk from deionisated waters it can observe that the I type Lipoxygenase (LPox 1) registred at 234nm (point for maximum of absorption for LPox1) (Evanghelista, 1997). 3.602 units-for V3 (with soybean seeds) and 2.920 units - for V4 (with soybean flour).

The II type Lipoxygenase (LPox2), with her charactersitic point of maximum absorption at 280nm (Evanghelista, 1997), shows -at this point - 1.464 units for V3 and just 0.727 units-for V4.

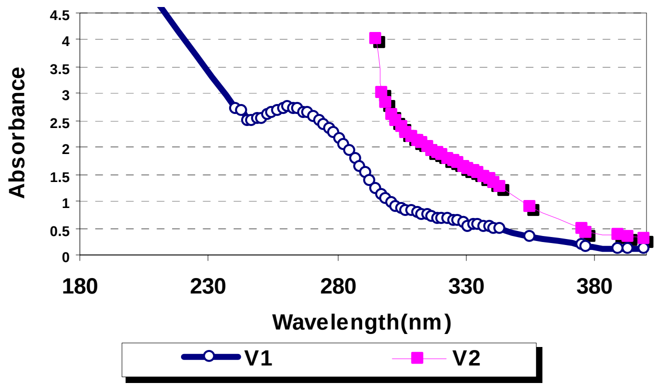

Fig. 1. UV spectra for V1 and V2 variants

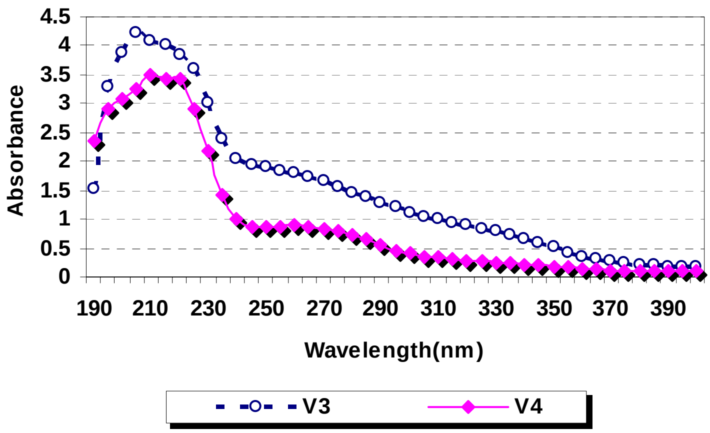

Fig. 2. UV spectra for V3 and V4 variants

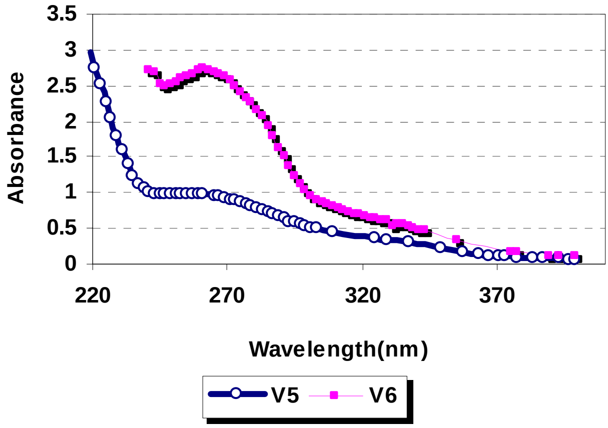

Fig. 3. UV spectra for V5 and V6 variants

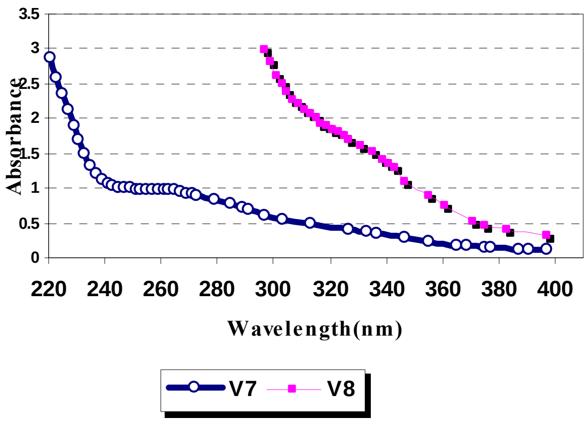

Fig. 4. UV spectra for V7 and V8 variants

For the variants that use the Standard Water for soymilk (V1 and V2), both lipoxygenase (LPox1 and LPox2) proved the great value (over 4 units) for absorption. For this case only LPox2-for V1 show the smallest value (2.209units for absorption at 280nm).

The experimental variants that use the soybean seeds for soymilk making, the diffusion vitesse is more slowly (for V5 and V7-that use ionisated water). In these cases it is posibil to inhibate the lipoxygenases from soybean with Fe^{2+} from ionisated waters (Evans, 1996; Florea, 2001; Frankel,1991).

The absorption at 280 nm (Grosch, 1982) show the greatest Lpox2 content for V3 (1.464 units), so different for V5 (0.797 units) .

Follow the results collate - for the variants that use the soybean seeds (V1, V3, V5, V7), the small Lpox1 and Lpox2 contents were showed V5-with water from natural source A (water enriched with Fe^{2+}-that force activation the active center for lipoxygenase) . For to compare, at 234nm (point of maximum absorbance for LPox1) , V5 has 1.302 absorbance units, V7 has 1.402 units, V3 has over 3.600units and V1 over 4.5 units. At 280 nm (point of maximum absorbance for Lpox2) V5 has registered 0.794 units, V7 has registered over 4.5 units, V3 has 1.464 units and V2 has 2.200 units of absorbance (Savescu, 2005).

More, the electrochemical potential E_H for V5 was more good toward V6 (the maximum of E_H for V5 was 5.2 V-at 270 minuts and the maximum of E_H for V5 was 3.2V -at 150 minuts from starter soymilk) (Savescu, 2005).

For the variants that use the soyflour for soymilk, the best variant was variant with deionisated water (V4 with 2.920 units of absorbance at 234 nm and 0.727 units of absorbance at 280nm).Farther variants were registered with bigger absorbance (over 4.6 units for V2 at 234 and 280nm, over 4.7 units at 234nm and 2.220 units at 280nm-for V6, 0.830 units at 234 nm and 3.254units at 280nm-for V8).

These show how act the surface of film for the soybean seeds again ionic migration. For an relative high content of Fe^{2+} and an mean chemical consumption of oxygen (CCOCr) - like as ionised water from A natural source - was establish a equilibrium with soy seeds membrane (Savescu, 2005).

When use the soyflour , the processes for membrane aren't present and the redox processes generated of lipoxygenases are more favorable for V4 variant (that use the deionisated water).

Conclusions

The soymilk that use the unionisated waters are more qualitatif superior toward the soymilk that use the standard waters; in soymilk that use the standard waters exist a great content of fatty acids, acids can be easy oxidized and the sensorial properties for the final soymilk can be worsen. For the variants than use the soybean seeds and waters from the A and B (natural ionisated)resources, V5 were the best variants follow the lipoxygenases studies; V5 has proved and the best sensorial properties and the best resistance again oxidise processes toward the V7. V5 was the best variant toward the variants that use the standard water (V1,V2) and toward the variants that use the deionisated waters (V3,V4). For the case that use the soyflour, V4 was the best variant (more good - like as finally soymilk physical,chemical and sensorial properties - toward V2, V6, V8). The negative efects of lipoxygenase from soybean can be removed through use the ionisated and deionisated waters- into new technology for soymilk yield.

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