

**F.10. EFFECT OF EXTRACTION CONDITIONS ON THE CIELAB COLOR PARAMETERS OF ALFALFA (*MEDICAGO SATIVA* L.) PROTEIN CONCENTRATE**

**ALIONA GHENDOV-MOȘANU\*, IANA CIUGUREANU, ANGELA GUREV,  
VIORICA BULGARUDANA**

*Technical University of Moldova, 168 Stefan cel Mare Blvd., Chisinau, Republic of  
Moldova*

*email: aliona.mosanu@tpa.utm.md*

**Abstract.** The most important product derived from alfalfa (*Medicago sativa* L.) is alfalfa protein concentrate (APC), which contains 45–60% protein, along with essential amino acids, dietary fiber, unsaturated fatty acids, pigments, polyphenols, flavonoids, vitamins, and minerals. Since 1992, APC has been used as a food supplement in Mexico, Canada, and the United States, and in 2009 it received a positive opinion from the European Food Safety Authority. This study aimed

to investigate the effect of extraction conditions on the CIELab color parameters of APC. Eight APC samples were obtained: S1, S3, S5, and S7 by conventional extraction, and S2, S4, S6, and S8 by ultrasound-assisted extraction (UAE). The influence of extraction pH (5.6 for S1–S4 and 9.0 for S5–S8) and organic acid type used for isoelectric precipitation (lactic acid for S1, S2, S5, S6; citric acid for S3, S4, S7, S8) was evaluated. Color measurements were performed using a Chroma Meter CR-400 (Konica Minolta, Osaka, Japan). The following CIELab parameters were determined: lightness ( $L^*$ ), red–green ( $a^*$ ), yellow–blue ( $b^*$ ), greenness ( $-a^*/b^*$ ), and total color difference ( $\Delta E^*$ ). The paired  $t$ -tests were performed at a significance level of  $p \leq 0.05$ , to determine whether the differences observed between samples treated with organic acids with and without the application of UAE were statistically significant. Significant differences ( $p \leq 0.05$ ) in  $L^*$  (48.26–53.97) and  $a^*$  (–22.80 to –13.17) were observed among all samples, indicating a predominance of green pigmentation associated with chlorophylls. The  $b^*$  values ranged from 32.09 to 44.26 and differed significantly among most samples ( $p \leq 0.05$ ), except for S3–S4 ( $p = 0.41$ ), suggesting limited influence of extraction conditions on yellow coloration linked to carotenoids. No significant differences ( $p > 0.05$ ) in greenness ( $-a^*/b^*$ ) were observed for pairs S1–S3 and S2–S4, indicating that acid type and ultrasound application at pH 5.6 had minimal impact on this parameter. The  $\Delta E^*$  values indicated perceptible to pronounced color differences between selected sample pairs, with values of 4.31 (S1–S2), 5.60 (S3–S4), and 6.75 (S7–S8), while S5–S6 exhibited  $\Delta E^* > 12$ , corresponding to completely distinct coloration. These findings demonstrate that alkaline extraction conditions significantly influence the green coloration of APC, and that green pigments cannot be fully removed during isoelectric precipitation.

**Keywords:** alfalfa protein concentrate, CIELab color parameters, greenness, chlorophylls.

**Acknowledgments:** The authors would like to thank the National Project Stimulating Excellence in Research of National Agency for Research and Development of Moldova 25.80012.5107.21SE “Optimization of the extraction technology of protein concentrates from alfalfa (*Medicago sativa* L.) for the manufacture of new food products”, being implemented at the Technical University of Moldova.