RESEARCH ARTICLE

STORAGE INDUCED CHANGES IN CHEMICAL COMPOSITION OF SAFFLOWER *(CARTHAMUS TINCTORIUS)* LEAF EXTRACT OBTAINED THROUGH GREEN CROP FRACTIONATION

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Abstract:

This study investigated the impact of storage on safflower leaf extracts, focusing on changes in chemical composition over 33 hours at room temperature. The parameters analyzed included - Dry Matter (DM) content, Nitrogen (N) content and Water-Soluble Reducing Sugars (WSRS). The study also examined the effects on Leaf Protein Concentrate (LPC) and Deproteinised Juice (DPJ). The results indicated significant changes during storage, suggesting Proteolysis (breakdown of proteins) and Fermentation of sugars. These changes affected both the quality and quantity of the Leaf Protein Concentrate (LPC).

Keyword: Green Crop Fractionation (GCF), Leaf Protein Concentrate (LPC), Deproteinised Juice (DPJ), Safflower *(Carthamus tinctorius)*.

Introduction:

Green crop fractionation (GCF) involves maceration of green foliage which is subsequently pressed for the release of leaf Juice. The leaf juice is later on heated at 95^0 C to prepare leaf protein concentrate (LPC) for human, animal, poultry nutrition as a source of protein, minerals and vitamins. The portion left behind after isolation of LPC from heated juice is called as deproteinised juice (DPJ).

Leaf juice is highly labile, with its chemical composition changing rapidly. Pirie (1978) observed that proteolytic activity and microbial growth deteriorate leaf juice due to fermentation resulting in decrease in true protein content. Reddy and Mungikar (1988) observed breakdown and depletion of true protein, appearance of ammonia, fermentative loss of sugars, formation of lactic acid, decrease in pH and loss in dry matter. Similarly, storage of leaf extracts from lucerne resulted in the reduction of pH, dry matter and chlorophyll as well as β-carotene content (Shahane and Mungikar, 1987).

Safflower *(Carthamus tinctorius)*, a multipurpose crop that has been grown for centuries in India for its flowers, used as a dye source and for medicinal purposes (Patel *et al.,* 1989), and for its

seeds, which yield quality oil. It is an herbaceous annual or winter annual plant with bright yellow flowers. In Maharashtra state of India, it is also grown for culinary purpose as a leafy vegetable. Safflower leaves are dense in fibres, minerals, vitamins and antioxidants (Lee *et al*., 2008; Abdallah *et al.,* 2013; Hiramatsu *et al.,* 2009).

During the present investigation, studies were undertaken on changes in chemical composition of Safflower leaf extract which was stored up to 33 h at room temperature. The changes in dry matter (DM), nitrogen (N) and water soluble reducing sugars (WSRS) in the juice, stored for different hours, and in the samples of LPC and DPJ obtained from them were studied.

Methodology for Extraction and Analysis of Safflower Leaf Extract

Harvesting and Processing

Safflower green foliage was harvested at the pre-flowering stage. The foliage was washed with water and macerated to a pulp using the method of Davys and Pirie (1969). The resulting pulp was pressed, and the released juice was collected.

Storage and Sampling

Juice samples were stored for 0, 3, 6, 9, 24, 27, 30, and 33 hours in conical flasks plugged with cotton.

Analysis

Dry Matter (DM) content was determined by drying juice samples in an oven at 95°C till constant weight. Nitrogen (N) content was determined using the micro-Kjeldhal method (Bailey, 1967). Water Soluble Reducing Sugars (WSRS) was determined using Folin-Wu tubes (Oser, 1979).

Preparation of Leaf Protein Concentrate (LPC) and Deproteinised Juice (DPJ)

A sample of stored juice was employed for the preparation of leaf protein concentrate (LPC) by heat coagulation. The LPC was dried in an oven to record the yield of LPC-DM/100 ml juice. Similarly, the deproteinised juice (DPJ) was also dried in oven to determine the amount of DPJ-DM /100 ml of juice. The dry LPC and DPJ samples were used for the determination of N and WSRS contents as above.

Statistical Analysis

Data were analyzed for standard deviation (SD), standard error (SE), and critical difference (CD) following Panes and Sukhatme (1978) and Mungikar (1997, 2003).

Results and Discussion:

Though the safflower is oil seed crop, its young leaves are used as vegetable. Tables 1 and Fig. 1 give an account on changes associated with the storage of safflower leaf juice samples. The juice of the safflower showed significant decrease in % DM, N and WSRS content after 33 hours of storage. The yield of LPC decreased from 3.16 g/100 ml to 2.69 g/100 ml. The % N in LPC-DM declined from 9.87 to 8.21 and WSRS content from 0.45 to 0.13 %. The DPJ-DM yield remained within 2.60 to 3.50 g/100 ml up to 33 hours. While % N in DPJ-DM significantly increased from 1.35 to 2.96 after 33 hours. The WSRS content in DPJ-DM decreased significantly from 3.19 to 1.16 % (Table 1, Fig. 1). Thus, from the results obtained, it is clear that due to the storage of leaf juice deterioration takes place affecting the quality and quantity of LPC.

Table 1: Effect of storage on chemical composition of safflower juice obtained during green crop fractionation

Time of Storage (hours)	Juice			Leaf Protein Concentrate (LPC)-Dry matter (DM)			Deproteinised Leaf Juice (DPJ)- Dry matter (DM)		
	% DM	% N	% WSRS	Yield / 100ml	% N	% WSRS	Yield / 100ml	% N	% WSRS
0	6.22	6.88	5.99	3.16	9.87	0.45	3.05	1.35	3.19
3	5.92	6.64	6.18	3.05	9.71	0.36	2.86	1.48	3.43
6	5.88	6.64	6.15	3.02	9.62	0.33	2.85	1.49	3.31
9	5.86	6.39	6.10	2.95	9.29	0.26	2.90	1.63	4.75
24	5.74	5.97	5.84	2.90	8.88	0.25	2.83	2.14	2.48
27	5.74	5.89	5.46	2.89	8.63	0.20	2.84	2.18	2.21
30	5.72	5.39	5.17	2.80	8.38	0.16	2.91	2.24	0.95
33	5.56	5.14	4.92	2.69	8.21	0.13	2.60	2.96	1.16
Mean	5.83	6.12	5.72	2.93	9.07	0.26	2.85	1.93	2.71
S. D.	0.19	0.62	0.48	0.15	0.63	0.10	0.12	0.54	1.19
S. E.	0.06	0.22	0.17	0.05	0.22	0.03	0.04	0.19	0.42
C.D. (p=0.05)	0.16	0.52	0.40	0.12	0.53	0.08	0.09	0.45	0.99

Conclusion:

With the storage of leaf juice samples from safflower, the dry matter (DM), nitrogen (N) in DM and water-soluble reducing sugar (WSRS) decreased. The decrease in these contents affected the yield of LPC and DPJ dry matter (DM) as well as their nitrogen and sugar content. On an average, a decline in the yield of LPC-DM per unit volume of the juice was experienced with decreased nitrogen and sugar content in it. Thus, storage of the juice resulted in low recovery of nitrogen in the LPC coupled with its low yield.

It can be thus concluded that storage of the safflower leaf juice for more than 3 hours alters its chemical composition leading to low recovery of LPC of poor nutritive value, hence leaf juice should be immediately used for the preparation of LPC to make the process of GCF efficient.

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