

Impact of Leaf Juice Storage Time on the Yield and Quality of Leaf Protein Concentrate (LPC) from Pea (*Pisum Sativum* L.)

Madhekar R. D.

Associate Professor & Head, Department of Botany, S. B. E. S. College of Science,
Chhatrapati Sambhajanagar-431001 (Maharashtra), India

Abstract: Green Crop Fractionation (GCF) produces Leaf Protein Concentrate (LPC), but rapid autolysis and microbial activity after maceration can reduce nutrient recovery. This study examined how storage time (0–33 hours) affects the chemical composition of pea (*Pisum sativum* L.) leaf juice and its LPC yield. Significant declines were observed in juice dry matter, nitrogen, and water-soluble reducing sugars, leading to a marked reduction in LPC yield (4.82 to 2.94 g/100 ml) and nutritive value. While DPJ dry matter also decreased, its nitrogen content increased, indicating reduced nitrogen incorporation into LPC. Results demonstrate that pea leaf juice deteriorates rapidly, and storage beyond 3 hours severely diminishes LPC recovery and quality. Immediate processing is therefore essential for efficient GCF.

Keywords: Green Crop Fractionation (GCF), Leaf Protein Concentrate (LPC), Pea (*Pisum Sativum* L.)

1. Introduction

Green crop fractionation (GCF) is a process in which green plant foliage is macerated and then pressed to extract leaf juice. This juice is subsequently heated to 95°C to produce a leaf protein concentrate (LPC), which serves as a rich source of protein, minerals, and vitamins for human, animal, and poultry nutrition. The remaining liquid after the LPC has been separated from the heated juice is referred to as deproteinised juice (DPJ).

As soon as the foliage is macerated to a pulp, autolysis begins [1], [2]. This involves breakdown of proteins and other nutrients in the plant leading to further deterioration. Therefore the delay between making the pulp and its pressing should be avoided to attain maximum recovery of proteins in the LPC [3]. Similarly, the leaf juice or extract obtained due to the pressing of the pulp is also very labile and its chemical composition changes rapidly [4]. Proteolytic activity and microbial growth deteriorate leaf juice due to fermentation resulting in decrease in true protein content [5], [6], [7]. Present investigation was carried out to find out the impact of leaf juice storage time on yield and quality of leaf protein concentrate (LPC) from Pea (*Pisum sativum* L.).

2. Methodology for Extraction and Analysis of Pea Leaf Extract

2.1 Harvesting and processing

Pea (*Pisum sativum* L.) foliage was collected at the pre-flowering stage. The harvested leaves were thoroughly washed with water and macerated into a pulp [8]. The resulting pulp was then pressed to extract the juice, which was collected for further analysis.

2.2 Storage and Sampling

The extracted juice samples were stored in conical flasks sealed with cotton plugs for different durations 0, 3, 6, 9, 24, 27, 30, and 33 hours.

2.3 Analysis

The Dry Matter (DM) content of the juice was determined by drying samples in an oven at 95°C until a constant weight was achieved. Nitrogen (N) content was measured using the micro-Kjeldahl method [9], while Water Soluble Reducing Sugars (WSRS) were estimated using Folin-Wu tubes [10].

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

Stored juice samples were used to prepare Leaf Protein Concentrate (LPC) through heat coagulation. The LPC was oven-dried to determine the yield, expressed as LPC-DM per 100 ml of juice. Similarly, the remaining liquid, termed Deproteinised Juice (DPJ), was oven-dried to calculate DPJ-DM per 100 ml of juice. Both LPC and DPJ dry samples were analyzed for their N and WSRS contents using the same methods described above.

2.5 Statistical Analysis

All data were statistically analyzed to compute Standard Deviation (SD), Standard Error (SE), and Critical Difference (CD) [11], [12], [13].

3. Result and Discussion

Pea is also a common vegetable crop of this region and pods of these plants are often used as a source of vegetable. A sharp and gradual decline in DM, N and soluble sugars was observed in the leaf juice of pea due to its storage up to 33 hours. The % DM decreased from 9.88 to 6.14 %, N content in LPC-DM from 8.13 to 6.64 %, while WSRS content from

4.48 to 2.41 %. Thus great loss in the DM as well as protein along with WSRS was experienced during storage of pea leaf juice. As a result of this, yield of LPC-DM/100 ml of juice decreased from 4.82 to 2.94 g with simultaneous decrease in nitrogen and sugar content in the LPC-DM from 10.54 to 8.96 % and from 0.48 to 0.25 % respectively. The DPJ-DM also decreased gradually from 5.05 to 3.19 g/100 ml. The nitrogen content in DPJ-DM, however, increased from 0.99 to 2.66 % indicating its decreased recovery in the LPC. The sugar content in the DPJ fluctuated between 2.10 and 2.98 %. The overall results thus indicated that Pea leaf juice was highly susceptible to catabolism and got deteriorated fast.

4. Conclusions

With the storage of leaf juice samples from pea, 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 pea leaf juice for more than 3 hours alter 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. Similar results were observed in safflower and fenugreek. [14], [15].

Table 1: Effect of storage on chemical composition of pea 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	9.88	8.13	4.84	4.82	10.54	0.48	5.05	0.99	2.10
3	8.46	7.96	8.28	4.63	10.54	0.48	3.82	1.37	2.57
6	7.96	7.96	4.10	4.63	10.45	0.47	3.33	1.72	2.91
9	7.68	7.88	3.22	4.53	10.29	0.45	3.14	1.85	2.98
24	7.42	7.55	3.06	4.16	9.79	0.43	3.26	1.91	2.76
27	7.36	7.22	3.00	4.02	9.54	0.38	3.33	2.42	2.68
30	7.02	6.97	2.77	3.96	9.29	0.31	3.06	2.70	2.90
33	6.14	6.64	2.41	2.94	8.96	0.25	3.19	2.66	2.60
Mean	7.74	7.54	3.38	4.21	9.92	0.406	3.52	1.95	2.68
S. D.	1.10	0.55	1.14	0.60	0.63	0.08	0.65	0.60	0.27
S. E.	0.38	0.19	0.40	0.21	0.22	0.02	0.23	0.21	0.09
C.D. (p=0.05)	0.92	0.46	0.95	0.50	0.52	0.07	0.54	0.49	0.21

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