Int. J. Chem. Sci. : 3 (1), 2005, 47–52

THE EFFECT OF pH VARIATION ON THE SOLUBILITY OF SEED PROTEINS OF SOME NEW VARIETIES OF CULTIVATED SEEDS

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ABSTRACT

The protein solubilization at different pH ranging from 0.5 to 13.5 were studied on some new varieties of cultivated seeds, i.e. Arachis hypogaea JGN–3, Brassica compestries VARUNA, Carthamus tinctorius JSF–1, Glycine max–JS–90–41, Helianthus annus KBSH–1. All the five samples were found to show the characteristic curves. Maximum solubility of protein was achieved at pH 13.5 and above 11.5.

Key words: Solubility of seed proteins, pH, Cultivated seeds.

INTRODUCTION

The solubility behaviour of proteins is of extreme importance from the practical standpoint, purification and fractionation of proteins demands considerable knowledge of solubility properties of the proteins. The albumins and globulins in legumes account for more than 80 per cent of the total proteins. Legume proteins are difficult to solubilize due to two factors i.e. globular nature of proteins and hydrophobicity of globular proteins[1, 2].

The importance of the isoelectric point in protein fractions lies in its wide variation from protein to protein. The isoelectric precipitation of protein depends upon two factors, firstly all protein exhibit minimum solubility in solutions of constant ionic strength at their isoelectric points and secondly at low concentrations of the electrolyte or in the absence of electrolyte. Some proteins are sufficiently insoluble to form a precipitate. This property has been useful as a means of crystallising proteins[3, 4].

Present study aims to examine solubility behaviour of seed proteins of cultivated seeds at different pH that may help in further understanding of functional properties of seed proteins and is necessary for their successful extraction and purification in large quantities so that these could be used as additives in the cereal diets of food product commonly marketed as supplementary proteins to enrich their nutritive value. The cultivated seeds under consideration therefore, were studied for their protein solubility in considerable wide pH range (0.5 to 13.5).

The seeds under investigation were procured from Department of Plant Breeding and Genetics in Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur.

EXPERIMENTAL

In the present investigation, all the seeds were analysed for their protein content and protein solubilization with pH variation in the powdered form, because size of seed powder has been shown to influence the nitrogenous extraction[5, 6]. The seed were sun dried and powdered to 60 mesh[7].

The effect of pH variation of the extractant on the protein solubilization were studied by varying pH of water, ranging from 0.5 to 13.5, brought by the addition of hydrochloric acid or sodium hydroxide solution. One gram of the seed powder was suspended in 20 mL of extractant of desired pH. The contents were shaken in electrical shaker for about 2 hours at room temperature and centrifuged for 20 minutes at 2000 rpm in a centrifuge. The nitrogen solubilized was determined in suspernatant so obtained by ''micro Kjeldahl'' method by using KEL–PLUS–DISTYL–EM.

RESULTS AND DISCUSSION

The protein content of Arachis hypogaea JGN–3, Brassica compestries VARUNA, Carthamus tinctorius JSF–1, Glycine max JS–90–41 and Helianthus annus KBSH–1 was found to be 23.89%, 23.25%, 30.47%, 40.42% and 11.48%, respectively[8].

The results of protein solubility are represented graphically and in tabular form (Figure 1–5 and Table 1, respectively).

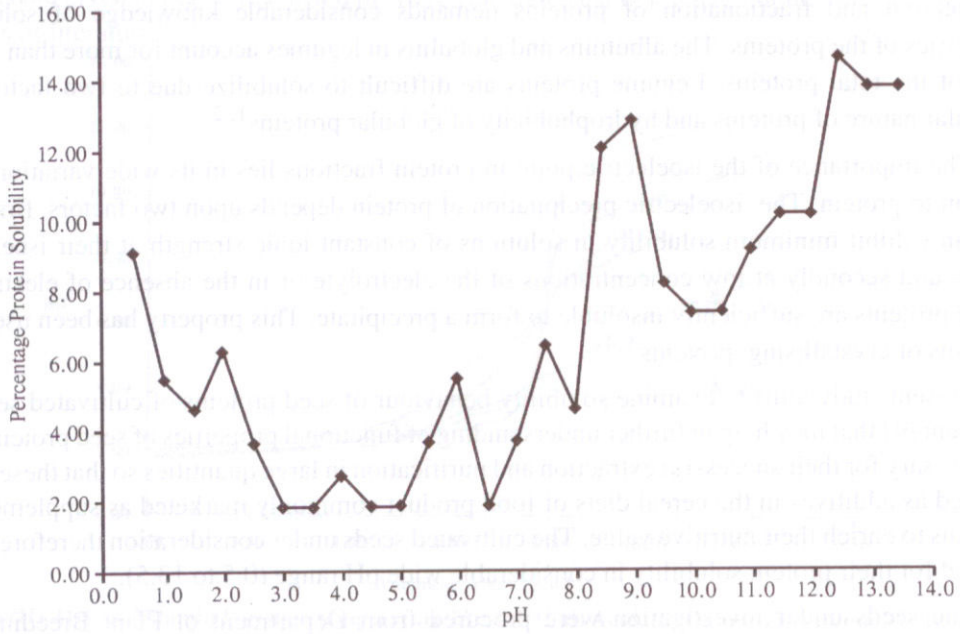

Fig.1. Effect of pH variation Vs. Solubility of seed proteins of *Arachis hypogaea* JGN–3

Table 1. The effect of pH variation on the solubility of seed proteins of five new varieties of cultivated seeds

pH	Percentage of protein solubilized				
	Arachis hypogaea JGN–3	*Brassica compestries* VARUNA	*Carthamus tinctorius* JSF–1	*Glycine max*–JS–90–41	*Helianthus annus* KBSH–1
0.5	9.12	11.26	5.74	8.65	15.24
1.0	5.48	8.43	3.57	3.78	11.41
1.5	4.56	8.43	2.85	3.24	9.49
2.0	6.27	7.31	4.26	2.69	7.62
2.5	3.64	2.82	2.15	1.61	7.62
3.0	1.82	3.76	3.57	2.69	7.62
3.5	1.82	3.76	1.43	2.69	7.62
4.0	2.74	2.82	2.15	4.32	7.62
4.5	1.82	3.76	2.15	4.32	5.71
5.0	1.82	3.76	1.43	3.78	5.71
5.5	3.64	3.76	2.85	3.78	7.62
6.0	5.48	3.76	2.15	4.32	7.62
6.5	1.82	3.76	2.15	4.32	5.71
7.0	3.64	4.68	2.15	4.84	5.71
7.5	6.40	5.63	2.15	8.16	18.98
8.0	4.56	5.63	5.74	4.84	11.41
8.5	12.01	6.58	7.15	9.17	11.41
9.0	12.80	6.58	5.74	6.01	21.16
9.5	8.20	9.37	5.74	6.48	21.16
10.0	7.32	8.43	5.74	5.39	18.98
10.5	7.32	12.34	6.43	6.48	17.07
11.0	9.12	11.26	7.15	4.84	21.16
11.5	10.17	8.43	7.15	6.48	22.82
12.0	10.17	11.26	7.15	6.48	22.82
12.5	14.65	14.19	8.59	7.10	22.82
13.0	13.80	14.19	9.41	10.26	22.82
13.5	13.80	15.05	9.41	11.35	22.82

Each value is an average of three estimations.

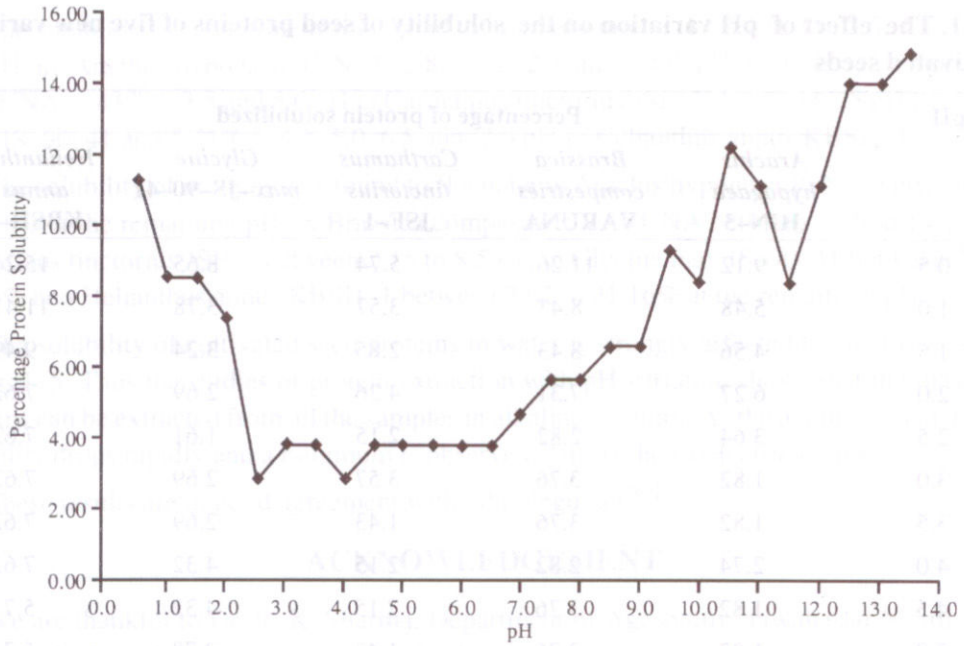

Fig.2. Effect of pH variation Vs. Solubility of seed proteins of *Brassica compestries* VARUNA

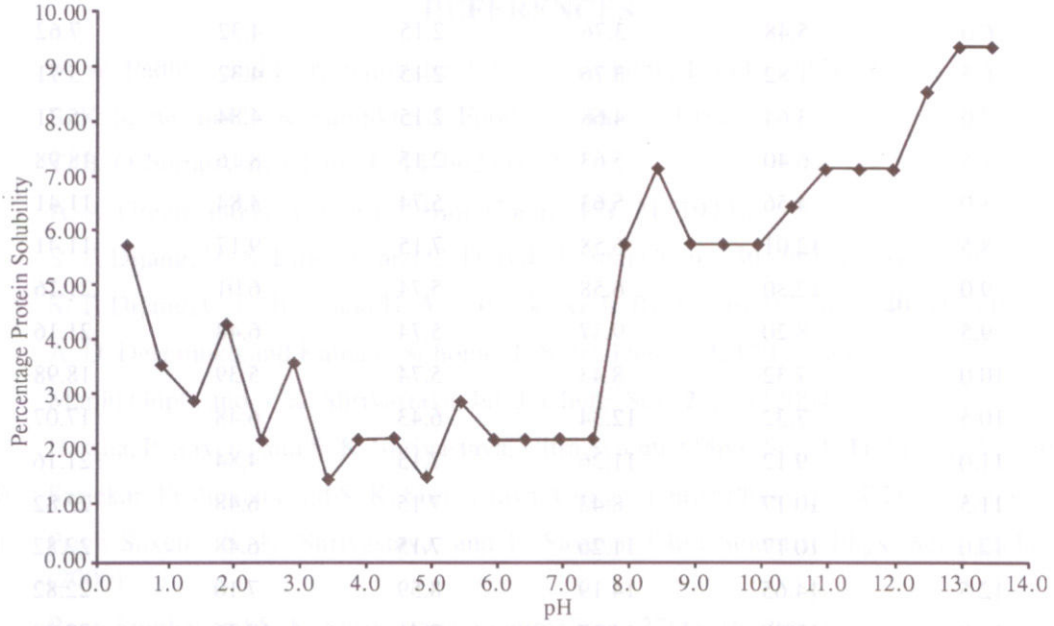

Fig.3. Effect of pH variation Vs. Solubility of seed proteins of *Carthmaus tinctorius* JSF–1

The solubility of seed protein was found to be maximum i.e. 14.65% at 12.5 pH in Arachis hypogaea JGN–3, 15.05% at 13.5 pH in Brassica Compestries VARUNA, 9.41% at 13.0 and

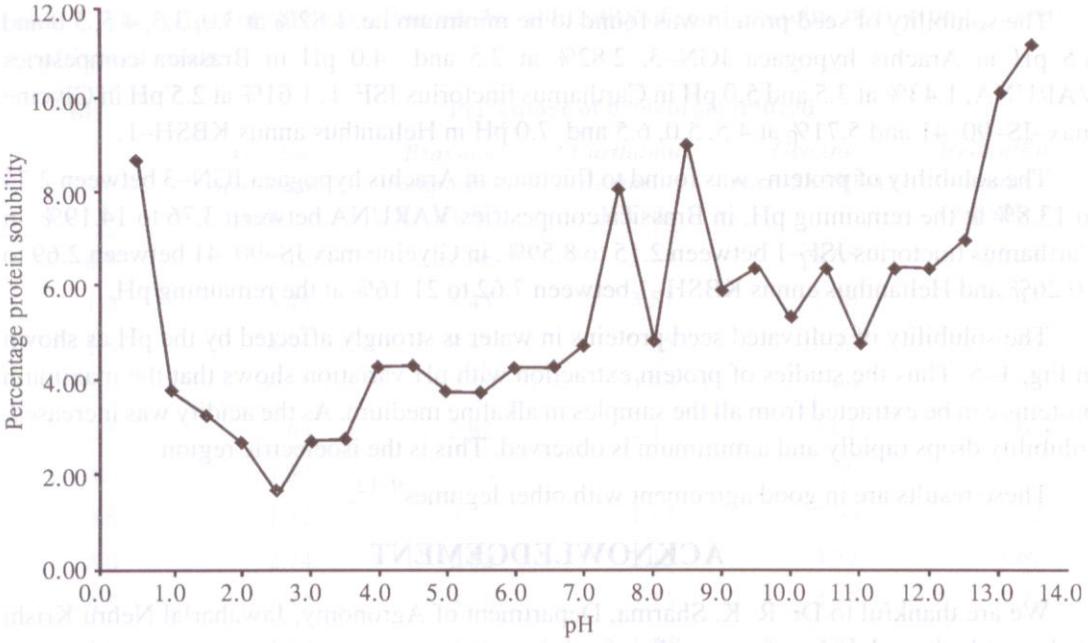

Fig.4. Effect of pH variation Vs. Solubility of seed proteins of *Glycine max*–JS–90–41

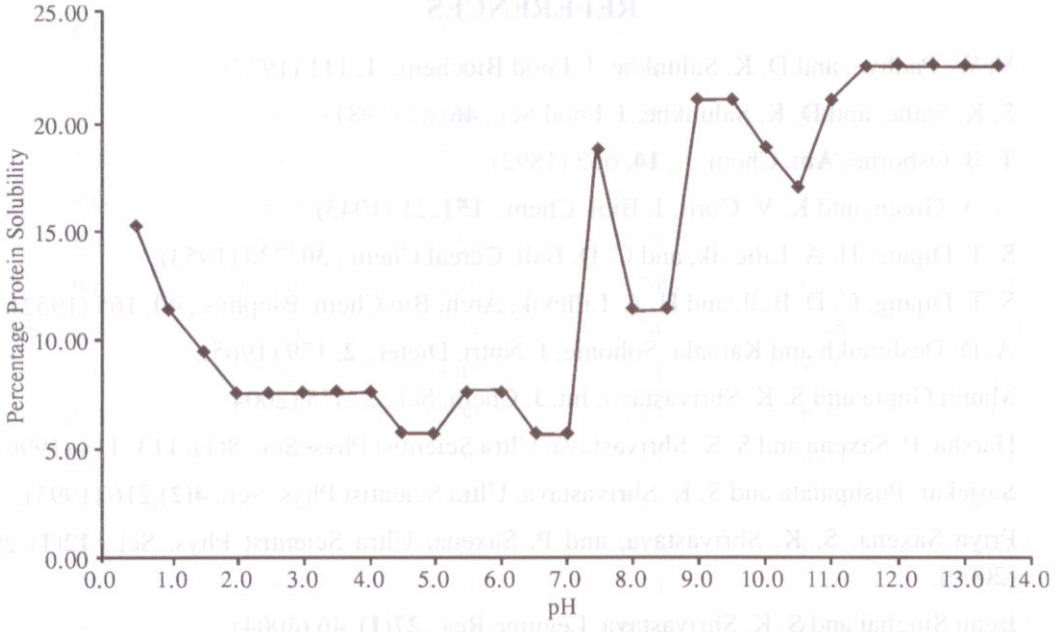

Fig.3. Effect of pH variation Vs. Solubility of seed proteins of *Helianthus annus* KBSH–1

13.5 pH in Carthamus tinctorius JSF–1, 11.35% at 13.5 pH in Glycine max–JS–90–41 and 22.82% at 11.5, 12.0, 12.5, 13.0 and 13.5 pH in Helianthus annus KBSH–1.

The solubility of seed protein was found to be minimum i.e. 1.82% at 3.0, 3.5, 4.5, 5.0 and 6.5 pH in Arachis hypogaea JGN–3, 2.82% at 2.5 and 4.0 pH in Brassica compestries VARUNA, 1.43% at 3.5 and 5.0 pH in Carthamus tinctorius JSF–1, 1.61% at 2.5 pH in Glycine max–JS–90–41 and 5.71% at 4.5, 5.0, 6.5 and 7.0 pH in Helianthus annus KBSH–1.

The solubility of proteins was found to fluctuate in Arachis hypogaea JGN–3 between 2.74 to 13.8% at the remaining pH, in Brassica compestries VARUNA between 3.76 to 14.19%, in Carthamus tinctorius JSF–1 between 2.15 to 8.59%, in Glycine max JS–90–41 between 2.69 to 10.26% and Helianthus annus KBSH–1 between 7.62 to 21.16% at the remaining pH.

The solubility of cultivated seed proteins in water is strongly affected by the pH as shown in Fig. 1–5. Thus the studies of protein extraction with pH variation shows that the maximum proteins can be extracted from all the samples in alkaline medium. As the acidity was increased, solubility drops rapidly and a minimum is observed. This is the isoelectric region.

These results are in good agreement with other legumes[9–12].

ACKNOWLEDGEMENT

We are thankful to Dr. R. K. Sharma, Department of Agronomy, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur for providing facilities.

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Accepted : 25.11.04