

## Protein and Amino Acid Composition of Sea Buckthorn Seeds (*Hippophae rhamnoides mongolica* Rouse)

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### Abstract

The wild sea buckthorn (*Hippophae rhamnoides* L.) is distributed in Mongolia along the basin of rivers and lakes, which disposed between high mountains in western and northern parts of the country. The wild sea buckthorn is a cold tolerant unique plant with beneficial value of medicinal and cosmetic products. About 7.2% of wild sea buckthorn berries belongs to seeds and the protein in seeds composed 37.79%, while the protein in shells equal to 15.25%. Best extraction of proteins was successful at value of pH=1-3 or pH=10-12. The soluble protein content of the whole proteins in seeds was 37.4% at the value of pH=1 and 63.85% at pH=12, while the shell proteins were 16.2% and 22.8%, respectively. The total content of essential amino acids is composed about 43.32-45.04% of whole protein. Therefore, it can be conclude that the sea buckthorn seeds are valuable resource containing respectable amount of valuable proteins. On the other hand, seeds are undamageable during technological procedure and, therefore further processing as raw material is advisable.

**Key words:** Sea buckthorn, seed, proteins, amino acids, *Hippophae rhamnoides*

### Introduction

The wild sea buckthorn (*Hippophae rhamnoides mongolica* Rouse) is distributed in Mongolia along the basin of rivers and lakes, which disposed between high mountains of western and northern parts of the country (Tsendeehuu, 1996). Sea buckthorn have beneficial value for medicine and cosmetic products (Li & Wang, 1998; Jamyansan, 1973). This is a cold tolerant, hardy plant species, useful for reclamation and farmstead protection. Therefore, the sea buckthorn has been domesticated in various regions of the world (Li & Schröder, 1996). The main products produced from sea buckthorn are oil, juice and different additives to candies, jellies, cosmetics and shampoos (Beveridge *et al.*, 1999; Oomah *et al.*, 1999).

General technology of processing the sea buckthorn berries are similar in many countries, and in Mongolia, we produce only oil and juice. Our general technology is depicted in Figure 1. However, we have not yet produced seed oil and paints for the food from shell.

There are a number of publications on biochemical characteristics of the sea buckthorn,

especially its oil yield, fatty acid composition and biological activities (Jamyansan, 1973; Zhang *et al.*, 1989; Tong *et al.*, 1989; Ma *et al.*, 1989; Badgaa, 1966). The soft part of sea buckthorn berries contained approximately 0.26% of nitrogen, and 38-60% of this nitrogen belong to the proteins. This fact confirms that the sea buckthorn is a plant with high amount of proteins in its fruits and berries than other plant species. Seeds of the sea buckthorn composed 5-7% of berries, and contain about 30% of proteins. Therefore, the sea buckthorn seeds can be considered as the unique protein source (Zhang *et al.*, 1989; Badgaa, 1966; Solonenko, 1983).

In the present work we summarized the general content of proteins, pH-dependence for extraction of proteins, and amino acids composition of seeds and shells of the wild sea buckthorn, collected from the basin of Selenge river in northern Mongolia.

### Material and Methods

Berries, which used for this study, were obtained in September, 1998 from shrubs of wild sea buckthorn growing in valley of Selenge river, northern Mongolia. After cleaning from damaged

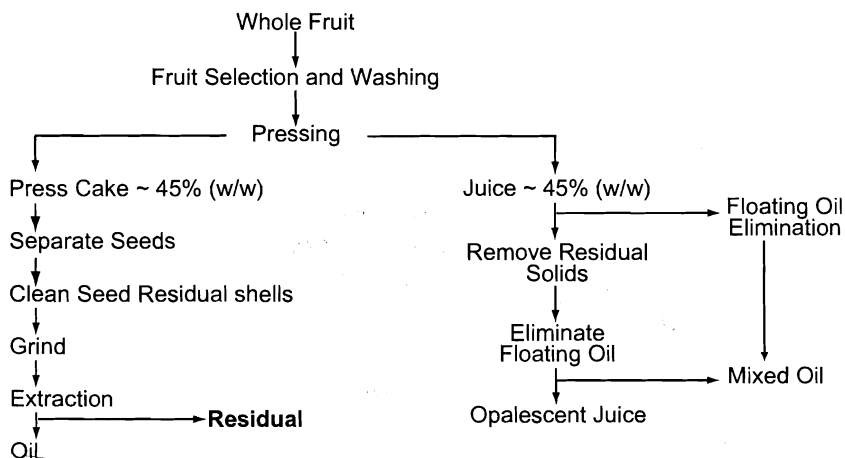


Fig. 1. General scheme for processing of sea buckthorn berries in our laboratory  
 Only in laboratory

parts, leaves and other debris, the fruits were pressed using vertical hand press. The press cake was repressed and separated the seeds by hand and then shells were dried in the place avoiding direct sunlight. Before extracting the protein, the oils in the sample was removed by hexane. The protein was extracted in three times from powdered seeds and shells using 0.9% NaCl with the different values of pH. Protein content was determined by the nitrogen content. Amino acid composition was established using amino acid analyzer AAA-881.

### Results and Discussion

About 7.2% of wild sea buckthorn berries belong to seeds and the protein in seeds composed 37.79%, while the protein in shells equal to 15.25% (Table 1). These results and the amount of the lysine, methionine and other essential amino acids indicated that sea buckthorn seeds and shells are usefull protein source (Table 2). The amounts of the soluble proteins in seeds and shells were different depending on the pH value of solvents. Extraction was carried out within pH=1-12, and the best extraction was achieved at value of pH=1-3 or pH=10-12 (Figure 2). In the figure is not labeled all values. The soluble proteins of seed whole proteins were 37.4% at pH=1 and 63.85% at pH=12, while the shell proteins were 16.2% and 22.8%, respectively. The amount of soluble protein at pH=4-8 was 5.5-6.5%, which connected with the iso-electric point of the proteins. It can be explained that the smaller amount of proteins in shells compared to that of seeds is because they were extracted by same way, where berry juice was obtained.

Table 1. Some characteristics of wild sea buckthorn

Contents	Amount (%)
Yield of seeds	7.2
Total proteins of seeds	37.79
Total proteins of shells	15.25

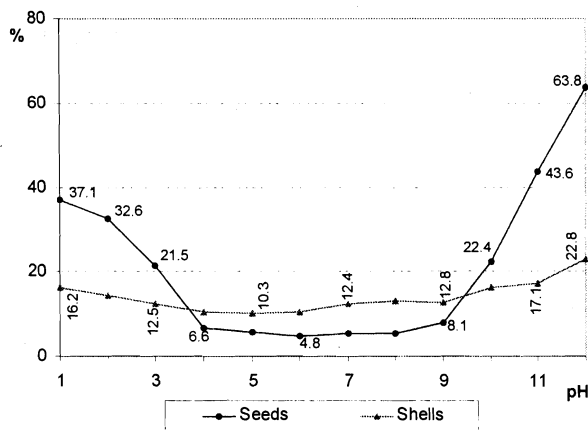


Fig. 2 pH-dependence of soluble proteins of sea buckthorn seeds and shells (% of total proteins)

In Table 2, summarized the composition of essential and nonessential amino acids if the extracts obtained in two different pH conditions, which compared to amino acid composition of the sea buckthorn whole proteins. In order to make to be better visible, the content of the table is converted into Figure 3. We have not observed significant differences between the amino acid contents of the sea buckthorn whole proteins and the proteins extracted at pH=1.5 and 11.5. The content of amino acids in seeds was similar with the results obtained by different authors

(Jamjansan, 1973; Zhang *et al.*, 1989), who studied the content of buckthorn berries protein. The total content of essential amino acids is varies between 43.32-45.04% of total protein. Therefore, it can be conclude that sea buckthorn seeds are valuable resource containing considerable amount of valuable proteins, which mainly composed from

essential amino acids and with best quality unsaturated fatty acids (personal communication) e.g. linoleic, linolic and oleic acids. On the other hand, seeds are not damaged during technological procedure and therefore further processing as a raw material is advisable.

Table 2. Amino acid composition of sea buckthorn seed proteins (%)

Full name	Abbreviation	In total protein	In extractable proteins	
			at pH 1.5	at pH 11.5
<i>Essential amino acids</i>				
Lysine	Lys	4.38	3.46	3.39
Histidine	His	2.47	2.55	2.34
Arginine	Arg	15.12	16.99	16.2
Threonine	Thr	2.43	2.37	2.64
Valine	Val	4.77	4.16	4.77
Methionine	Met	0.9	0.51	0.73
Isoleucine	Ile	4.01	3.27	3.77
Leucine	Leu	6.9	6.52	7.17
Phenylalanine	Phe	2.74	3.49	4.03
Sum		43.72	43.32	45.04
<i>Nonessential amino acids</i>				
Cysteine	Cys	0.91	1.1	0.54
Aspartic acid	Asp	10.92	11.39	10.51
Serine	Ser	4.86	5.34	5.54
Glutamic acid	Glu	22.51	24.08	23.68
Proline	Pro	5.87	5.04	5.1
Glycine	Gly	3.86	3.42	3.95
Alanine	Ala	3.87	3.56	4.07
Tyrosine	Tyr	2.47	2.73	2.57
Sum		55.27	56.66	55.96
Total		98.99	99.98	100.00

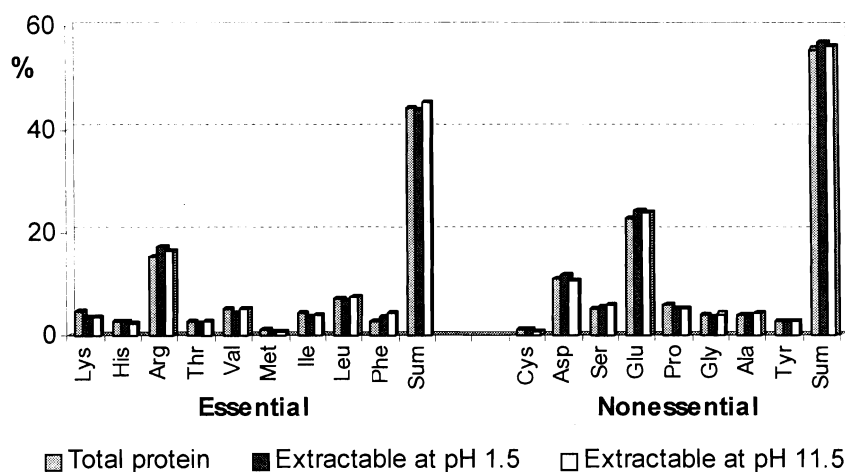


Fig. 3. Amino acid composition of sea buckthorn seed proteins

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