Volume 13, No 2 | International Journal of Radiation Research, April 2015

Proximate analysis of different groups of irradiated alginic acid

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► ***Short report***

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Revised: April 2014
Accepted: May 2014

Int. J. Radiat. Res., April 2015; 13(2): 187-190

DOI: 10.7508/ijrr.2015.02.010

ABSTRACT

***Background*:** Seaweeds contain significant quantities of lipids, protein, vitamins and minerals. Aquavac Ergosan contains 1% alginic acid extracted from two brown seaweeds, Laminaria digitata and Ascophyllum nodosum. Both in vivo and *in-vitro* researches have mainly been focused on the effect of Ergosan on fish growth, survival rate, reproductive performance and innate immunity in blood and epidermal mucus. Despite numerous studies on the effects of Ergosan on immune system of aquatic animals and evaluation of seaweeds in proximate analysis, there is no data available on proximate analysis of irradiated Ergosan extract (alginic acid). Therefore, the aim of this study was to assess the effect of on different groups of irradiated alginic acid (10, 20, 30, 40 and 50 KGy) for analyzing proximate composition. ***Materials and Methods*:** Alginic acid was prepared from the sonicated Ergosan extract. The Alginic acid extracted from Ergosan was irradiated with a gamma cell. The protein and lipid content and Moisture and ash were recorded. ***Results*:** Statistical analysis showed no significant differences among all of groups in terms of protein, lipid, ash and moisture. ***Conclusion*:** Radiation processing is a very convenient tool for imparting desirable effects in polymeric materials. The polysaccharide degradation by gamma or ultraviolet irradiation is free of initiators. High energy radiation technique can be effectively used to decrease the molecular weight of different polysaccharides such as alginate and Chitosan. Based on the results of this study, gamma irradiation of alginic acid as natural polysaccharide had no effect on crude protein, crude lipid, moisture and ash.

Keywords: *Gamma ray, alginic acid, proximate analysis.*

INTRODUCTION

Outbreaks of infectious diseases have been cause of a significant economic loss in the aquatic farming industry [(1)]. Many studies have evaluated the effects of different immunostimulants on aquatic animals. Ergosan, an algine based immunostimlant, has been shown to enhanced the body weight and also increased survival rate of juvenile shrimp which were experimentally infected with *Vibrio harveyii* and WSSV [(2)] and also this product enhanced lysozyme production in plasma and growth performance in Huso huso juvenile [(3)]. Despite numerous studies on the effects of alginic acid on immune system of aquatic animals, there is no data available on proximate analysis of irradiated alginic acid. This research reported herein was conducted to evaluate the total crud protein, crud lipid, moisture and ash of alginic acid after being exposed to different doses of gamma irradiation.

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[DOI: 10.7508/ijrr.2015.02.010]

MATERIALS AND METHODS

Preparation of alginic acid

Preparation of alginic acid was performed as previously described by Heidarieh *et al.* (2012) Ergosan (Schering Plough Aquaculture, UK) is composed of 0.002% unspecified plant extract, 1% alginic acid from Laminaria digitata, and 98.998% algal based carrier. Ergosan (Supplied in powdered form) was suspended in sterile 0.15 M phosphate buffered saline (pH 7.2) to reach the appropriate concentration and then sonicated on ice for 30 min [4]. Alginic acid was precipitated from the Ergosan sonicated suspended through addition of 2.5 volume of 96% ethanol and heat at 40˚C; the dried precipitate was then milled to the mesh size of 53– 125 µm [5].

Gamma irradiation

The Alginic acid extracted from Ergosan was irradiated with a gamma cell instrument model PX-30– IssIedovapel (Russia) at a dose rate of 0.22 Gy/sec in, Agricultural, Research School, Nuclear Science and Technology Research Institute, Karaj, Iran. The applied dose levels were 10, 20, 30, 40 and 50 kGy. Dosimetry was performed with Fricke reference standard dosimetry system and after irradiation process the samples were stored at 4˚C for further experiments.

Proximate Analyses

Proximate composition analyses of the samples were done in triplicate for protein, moisture, lipid and ash contents. The crude protein was determined by the Kjeldahl procedure [6]. Moisture was determined by oven drying at 105ºC to constant weight [7]. Total lipid was extracted from the irradiated samples using Bligh and Dyer (1959) method [8]. The lipid content was gravimetrically determined. Ash was determined gravimetrically in a muffle furnace by heating at 550 ºC constant weight [7].

Statistical analysis

All data are presented as means ± SEM of three replicates treatments. Statistical analysis of data was carried out using one-way ANOVA and tukey multiple range tests using SPSS for windows software, version 17. Differences in treatment means were considered significant at $P<0.05$.

RESULTS

The results of proximate analysis of different groups of irradiated alginic acid, 10, 20, 30, 40 and 50 KGy treatments, are shown in table 1.

While crude protein, crud lipid, moisture and ash of 10 KGy group were 8.57, 12.51, 2.40 and 20.94%, those values in 20 KGy group were 8.13, 12.01, 2.24 and 22.51%, and in 30 KGy group 8.43, 12.54, 2.49 and 21.01%; in 40 KGy group were 8.21, 12.11, 2.19 and 21.82% and also in 50 KGy group were 8.21, 12.03, 2.22 and 21.37%, respectively.

Statistical analysis showed no significant differences among all of groups in terms of protein, lipid, ash and moisture.

Table1. The results of proximate analysis of different groups of irradiated alginic acid.

Proximate chemical analysis				
Treatments (Dose KGy)	**Crude protein**	**Crude lipid**	**Moisture**	**Ash**
10	8.57±0.06	12.51±0.09	2.40±0.30	20.94±0.13
20	8.13±0.20	12.01±0.83	2.24±0.52	22.51±1.67
30	8.43±0.30	12.54±0.83	2.49±0.51	21.01±0.55
40	8.21±0.24	12.11±0.69	2.19±0.37	21.82±1.02
50	8.21±0.19	12.03±0.48	2.22±0.53	21.37±0.86

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[DOI: 10.7508/ijrr.2015.02.010]

DISCUSSION

In recent years, natural polymers are being explored for many new applications because of their easy availability, biocompatibility and biodegradability [9]. Ergosan contains 1% alginic acid extracted from two brown sea weeds, *Laminaria digitata* and *Ascophyllum nodosum* [2].

Radiation processing is a very convenient tool for imparting desirable effects in polymeric materials [9]. Also, the polysaccharide degradation by gamma or ultraviolet irradiation is free of initiators. Therefore, irradiation is simpler and more environmentally friendly than acidic hydrolysis or enzymatic treatment [9]. High energy radiation technique can be effectively used to decrease the molecular weight of different polysaccharides such as alginate and Chitosan [10, 11].

In study by Choi *et al.* (2009) and Heidarieh et al. (2012) gamma irradiation decreased the average molecular weights of polysaccharides, and UV spectra of irradiated polysaccharides increased in the numbers of carboxyl and carbonyl groups and double bonds [4, 12].

Results of the present study indicated, there is no significant difference between all of groups (irradiated alginic acid) in terms of protein, lipid, ash and moisture; while the same result was achieved in the study of gamma irradiation effects on proximate analysis of chestnuts. The obtained results were showed that the irradiation treatment did not affect the nutritional and chemical quality of chestnut fruits [13]. No change in the chemical composition of irradiated alginic acid is in agreement with our previous works [6], in which no effect of electron beam irradiation on chemical composition of cereals and legume seeds was found. Conversely, EB irradiation significantly elevated crude protein, crude carbohydrates and IVPD of Mucuna pruriens seeds [14].

The present investigation is almost related to earlier study; here the proximate composition is not varied within and between the different groups of irradiated alginic acid.

According to the results obtained in this present investigation, the protein, lipid, ash and moisture level was optimum in irradiated alginic acid.

ACKNOWLEDGEMENTS

The authors are grateful for the financial support provided by Agricultural Research School (NARS-NSTRI), Karaj, Iran.

REFERENCES

1. Lightner DV (1996) A handbook of shrimp pathology and diagnostic procedures for disease of cultured Penaeid shrimp. World Aquaculture Society.
2. Heidarieh M, Afsharnasab M, Soltani M, Dashtyannasab A, Rajabifar S, Sheikhzadeh N, Tamimi AH (2010) Effects of Ergosan and Vibromax to Prevent Vibriosis and WSSV in Litopeaneus vannamei. *Journal of Fisheries and Aquatic Science,* ***5:*** *120-125.*
3. Heidarieh M, Soltani M, Tamimi AH, Toluei MH (2011) Comparative effect of raw fiber (Vitacel) and alginic acid (Ergosan) on growth performance, immunocompetent cell population and plasma lysozyme content of giant sturgeon (Huso huso). *Turkish Journal of Fisheries and Aquatic Science,* ***11:*** *445–450.*
4. Heidarieh M, Borzouei A, Rajabifar S, Ziaie F, Shafiei S (2012) Effects of gamma irradiation on antioxidant activity of Ergosan. *Iranian Journal of Radiation Research,* ***9(4):*** *245-249.*
5. Heidarieh M, Daryalal F, Mirvaghefi AR, Rajabifar S, Diallo A, Sadeghi M, Zeiai F, Moodi S, Maadi E, Sheikhzadeh N, Heidarieh H, Hedayati M (2014c) Preparation and anatomical distribution study of 67Ga-alginic acid nanoparticles for SPECT purposes in rainbow trout (Oncorhynchus mykiss). *Nukleonika,* ***59(4):*** *153-159.*
6. Shawrang P, Sadeghi AA, Behgar M, Zareshahi H, Shahhoseini G (2011) Study of chemical compositions, anti-nutritional contents and digestibility of electron beam irradiated sorghum grains. *Food Chemistry,* ***125:*** *376–379.*
7. AOAC (1995) Official Methods of Analysis, 16th ed. Association of Official Analytical Chemists, Arlington, VA, USA.
8. Bligh EG, Dyer WJ (1959) A rapid method of total lipid extraction and purification. *Canadian journal of biochemistry and physiology,* ***37:*** *911-917.*
9. International atomic energy agency (2004) Radiation processing of polysaccharides. ISSN, 1011–4289.
10. Jumel K, Harding SE, Mitchell JR (1996) Effect of gamma irradiation on the macromolecular integrity of guar gum. *Carbohydrate research,* ***282:*** *223-236.*
11. Kume T and Takehisa M (1983) Effect of gamma–irradiation

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[DOI: 10.7508/ijrr.2015.02.010]

on sodium alginate and carrageenan powder. *Agricultural and biological chemistry,* ***47(4):*** *889-890.*

12. Choi JI, Kim HJ, Kim JH, Byun MW, Soo B, Hyun Ahn D, Hwang YJ, Kim DJ, Kim GH, Lee JW (2009) Application of gamma irradiation for the enhanced physiological properties of polysaccharides from seaweeds. *Applied Radiation and Isotopes,* ***67(7-8):*** *1277-81.*
13. Fernandes A, Barreira JC, Antonio AL, Bento A, Luisa Botelho M, Ferreira IC (2011) Assessing the effects of gamma irradiation and storage time in energetic value and in major individual nutrients of chestnuts. *Food Chemistry and Toxicology,* ***49(9):*** *2429-32.*
14. Bhat R, Sridhar KS, Young CC, Bhagwath AA, Ganesh S (2008) Composition and functional properties of raw and electron beam-irradiated Mucuna pruriens seeds. *International Journal of Food Science and Technology,* ***43:*** *1338–1351.*

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[DOI: 10.7508/ijrr.2015.02.010]