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Manufacturing of Bioactive Peptides from Tomato Seeds to Isolate from *Lactobacillus Plantarum* Fermentation and Improvement of Antioxidant Activity



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Abstract

The aim at the current study was to estimate the appropriateness at using protein-rich isolates from tomato seed like source of nutrition for the growth of lactic acid bacteria. Tomato seeds to contain rich source of proteins which has high nutritional value of the application of food technology. In this study, scientist examined the use of *Lactobacillus plantarum* strain to get high peptide values in fermentation process by using tomato seed meal separate as the substrate. Tomato seed meal has property of antioxidant activity which is very benefit of human against disease. The most advance techniques were used in this process like Gel filtration chromatography, HPLC analysis and FTIR analysis and PCR reaction. The result shows that *Lactobacillus plantarum* degraded and convert the tomato seeds into bioactive peptide which has ability to improve the antioxidant activity from isolating protein.

Keywords : Tomato seed isolate; *Lactobacillus plantarum* fermentation; Bioactive peptides; Antioxidant activity; FTIR.

Abbreviations : FTIR: Fourier Transform Infrared; AOAC: Association of Official Analytical Chemists; SDS-PAGE: Sodium Dodecyl Sulphate-Polyacrylamide Gel Electrophoresis; HPLC: High Performance Liquid Chromatography; DPPH: 1-diphenyl-2-picryl-hydrazyl free radical, ABTS: Azino-bis (3-ethylbenzthiazoline-6-sulfonic acid)

Introduction

Fruits, vegetables and other food processing produce a high rate of raw materials and waste materials like liquid which may be cause of the environmental pollution problems with loss of nutrients and valuable biomass [1]. At the present time, there is an ever-increasing demand of food engineers to reduce the rate of pollution problems and convert waste material into a useful by-product for other food industries. The other fact is that we all know health and nutrition are linked with each other. Food nutrients are able to activate the positive desirable physiological effect on the body which is benefit of human health [2].

The best example are tomato pomace, the unrefined material waste product of which, lingering after the juice mining process, consists of skins, seeds, and cores [1,3]. Fresh tomato has about 1% to 5% pomace which includes 60% of seeds and 40% of peel. Seed contains rich source of protein which is beneficial to health and the other 40% are raw material [1,3]. Tomato seeds contain high lipid contents such as linoleic acid and lycopene and in protein. Tomato seeds proteins have the mixture of compounds like globulin, albumin, prolamine,

and gluteline components which have high nutritional values. Thus, these studies show that tomato seed proteins have high nutritional value which is benefit of human consumption. In addition, scientist has been reported that bioactive peptides derivatives from vegetable samples and it has antioxidant property including the soybean and chickpea seeds. But, the tomato protein seed has high nutritional values and also exhibit antioxidant property [1] (Figure 1).

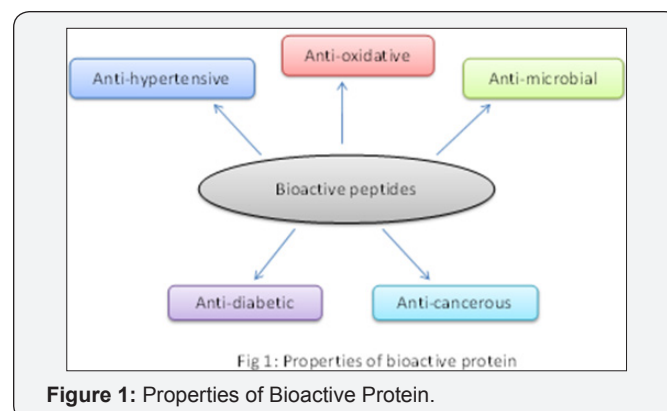
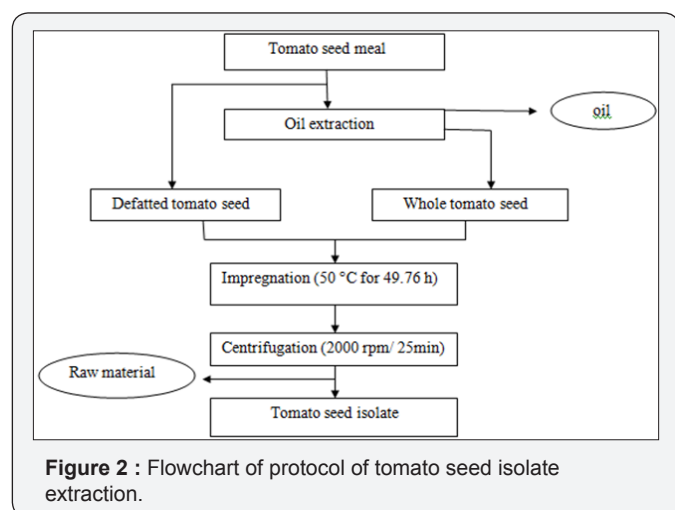


Figure 1: Properties of Bioactive Protein.

Bioactive proteins are defined as protein hydrolysates the mixture of amino acid which commonly contain 10-20 amino acids joined with peptide bonds and have positive effect on the body functions. These physiological activities such as anti-hypertensive, anti-oxidative, antimicrobial, anti-diabetic and anti-cancerous depends upon amino acid composition, structure and in some parent protein molecules often have inactive bioactive proteins and can be produced by hydrolysis of different protein by using different techniques like

- Proteolysis by enzymes from plants
- Microbial fermentation of proteins by proteolytic microbes
- Proteolysis by gastrointestinal enzymes.

In the past researches, microbial fermentation was used to releasing bioactive components in dairy product such as milk, meat, etc. microbial fermentation was the oldest technique which is widely used for preservation and food processing. However, Starter bacterial strain was used in fermentation process, lactic acid bacteria which has safest and have been used in beverage process or food process [2,4] (Figure 2).



Lactobacillus plantarum a particular proteases, can hydrolyze the certain proteins and making multiple copies of different oligopeptides. At the present time, scientist has investigation into the new bioactive peptides that may be affecting the human physiological activities [3]. By using, bacterial hydrolysis of tomato seeds protein to convert the peptide hydrosylates into bioactive peptide through fermentation of defatted tomato seed waste material or raw material by *Bacillus subtilis*. But this fermentation has some drawbacks so scientist can be used fermentation based on hydrolysis protein of tomato seed by *Lactobacillus plantarum*. This method is simple and inexpensive to making bioactive peptides from tomato seed and also improved its antioxidant property. Next step was extracted protein analyzed by chromatographic techniques such as gel filtration, HPLC and

identified by Fourier transform infrared (FTIR) spectroscopy [1-5].

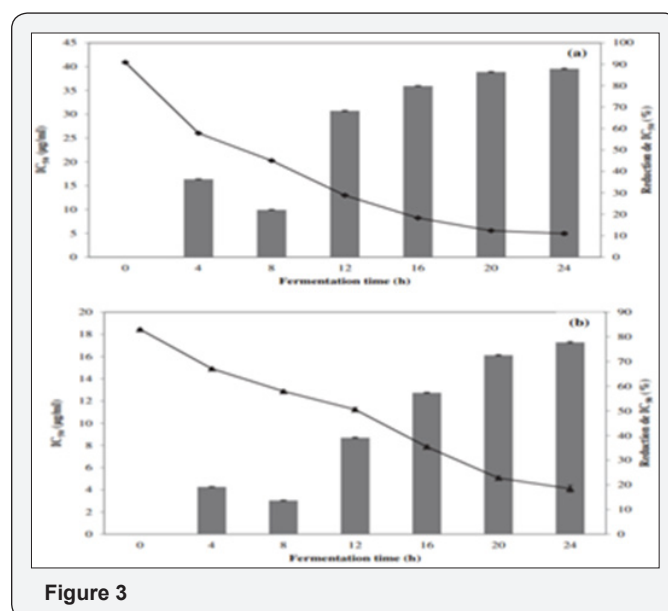
Methods

Fermentation by *Lactobacillus plantarum* was used to convert protein hydrosylates into bioactive peptides. Association of Official Analytical Chemists (AOAC) method is used to determine the crude protein concentration by the estimation of nitrogen. Gel filtration is used to analyze the aromatic polymers or high molecular weight protein in the tomato seed meal. SDS-PAGE (sodium dodecyl sulphate-polyacrylamide gel electrophoresis) was used to monitor the tomato seeds to isolate. Identification of free amino acid from tomato seed meal was evaluated by high performance liquid chromatography (HPLC) and Fourier transform infrared (FTIR) spectroscopy.

1,1-diphenyl-2-picryl-hydrazyl free radical (DPPH•) scavenging and 2, 2'-azino-bis(3-ethylbenzthiazoline-6-sulfonic acid) (ABTS) was used to measure the antioxidant activity.

Results

In this experiment, result showed that after 24hrs of fermentation, isolated to extract from the radical scavenging activity was increased by 87%. During fermentation, the rapidly increase in antioxidant activity is quality of the making of different bioactive peptides (Figure 3).



After 24h fermentation, decrease to 18.44% and 68.99% were detected, correspondingly in crude and soluble protein content [3](Figure 4).

Gel filtration chromatography result showed the depolymerization of high molecular weight of the polymer and decrease to low molecular weight of monomer. The

total number of amino acid decrease especially aspartic and glutamic acid is showed in HPLC analysis [3]

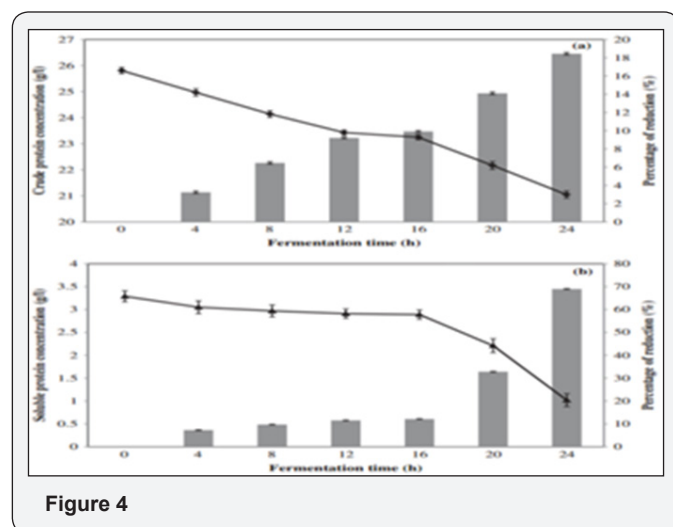


Figure 4

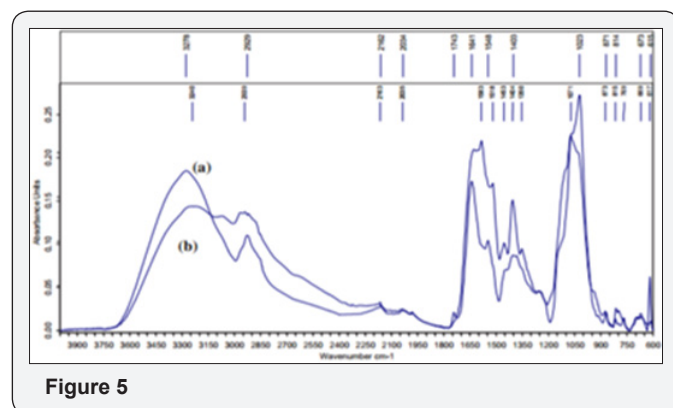


Figure 5

After 24h fermentation, benefit of production of new aromatic and amide compounds was observed in FTIR [3] (Figure 5).

Conclusion

From the above discussion, bioactive protein is isolating from potato seeds were converted into antioxidant property after 24h *Lactobacillus plantarum* fermentation. *Lactobacillus plantarum* is non toxic to human consumption and give efficient result. Tomato seed protein has high value of nutritional factors and used for food preservatives [4,5].

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