

Extraction of Hazelnut Oil and its Application in Food Product Development

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Abstract: *In the hazelnut oil production, it is very important to find an appropriate method to recover the oil from kernels/ endosperm. Many researchers have shown that techniques such as microwave-assisted extraction, ultrasound-assisted extraction, pressurized liquid extraction, and supercritical fluid extraction developed for extraction of valuable components from plants and seed materials have been successfully used to effectively reduce the major short-comings of the traditional method. These include shorter extraction time, increase in yield of extracted components, decrease in solvent consumption, and improvement of the quality of extracts. This research presents a detailed description of the principles and mechanisms of the various extraction techniques for better understanding and summarizes the potential of these techniques in the extraction of oil from the hazelnut seed. A comparison of the performance of four methods of extraction i.e (a) solvent extraction by using n-hexane method b) solvents extraction by using acetone as an organic solvents and (c) water distillation method and d) cold press method are detailed here. If the amount of recoverable oil from solvent extraction of the mashes is large and produce good quality, then hazelnut oil can be sold in the marketplace and use in various food product development. Hazelnut oil is widely used in pharmaceutical Industry and can also replace in normal cooking oil due to its rich in vitamin E and has peculiar taste and aroma.*

Keywords: Hazelnut oil extraction, solvent extraction with hexane, solvent extraction with acetone, water distillation, application in green chilli pickle

1. Introduction

Hazelnut (*Corylus avellana* L.) is an important crop with a global production exceeding 800,000 metric tons accounting for an economical value of more than \$800 million. The attractive and typical aroma of roasted hazelnuts has been intensively investigated and is widely used in food production in raw, roasted, salted, paste and in oil form. Hazelnuts are common in Europe, particularly in Britain, and in Asia including Turkey and Bhutan since 2009 (Mountain Hazelnut).

Hazelnut has a high nutritional value, containing, generally 65% oil, 14% protein, and 16% carbohydrates. More than 90% of its oil consists of unsaturated fatty acids, especially oleic (80%) and linoleic (6-12%) acids. Two main types of processes for obtaining the hazelnut oil are physical and chemical. The physical process involves the use of mechanical power to remove oil from material, such as hydraulic pressing, cold press method and screw pressing method. Extraction is a process based on chemical characteristics of solute and solvent. Conventional solvent extraction produces low-quality oil that requires extensive purification operations while screw pressing does not require the use of organic solvent and can retain bioactive compounds such as essential fatty acids phenolics, flavonoids and tocopherols in the oils, as well as the possibility of using cake free of toxic solvents in other processes. Unfortunately, the main disadvantage of this process is low oil extraction yield. But nowadays, foods. (Gajendiran et al. 2016). Spices for flavoring purposes.

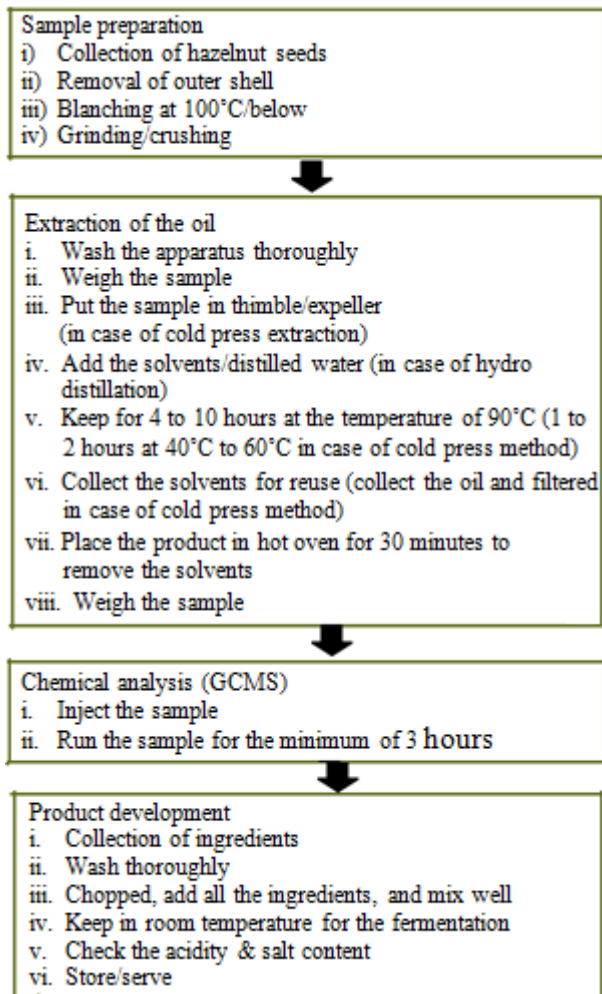
2. Material and Methods

The present investigation was carried out in the Department of Agricultural Engineering under the Maharashtra Institute of Technology based in Aurangabad and MGM college of Food Technology at Gandheli in Aurangabad.

2.1 Procurement of Sample

The fresh hazelnut (*Corylus*) sample was imported from hazelnut farmland of Bhutan and organic solvents especially n-hexane (C₆H₁₄) and acetone(C₃H₆O) are used which are available in Food testing laboratory of Maharashtra Institute of Technology technologies such as supercritical fluid extraction (SFE) are more often applied in the extraction of fatty oils. All these mentioned extraction processes can be combined in commercial operations i.e. continuous mechanical pressing followed by supercritical CO₂ extraction by which is an environmentally friendly solvent. Eggers et al. (2010), studied process of fatty oil SFE from rapeseed and soybean and explained that the oil containing cell wall had to be disrupted They showed that the mechanical pre-deoiling remained the superior pre-treatment in the supercritical extraction of oilseeds. Extracts obtained using CO₂ as the extraction solvent are solvent-free without any trace of toxic extraction solvents, and are thereby highly valued

2.2 General procedures of the oil extraction & product development



based in Aurangabad and MGM college of food technology based in Gandeli Aurangabad. The ingredients for product development was bought from local market in Aurangabad (Green Chili, Ginger, garlic, Turmeric and Salt, red chili powder)

2.3 Proximate chemical analysis of the oil by GCMS

A typical GC-MS system performs the following functions: 1) separation of individual compounds in a mixture by gas chromatography, 2) transfer of separated components to the ionizing chamber, 3) ionization, 4) mass analysis, 5) detection of the ions by an electron multiplier and 6) data acquisition, processing, and display by a computer system (Mani et al., 2015). The GCMS result of hazelnut oil shown below

Table 1: Result of GC-MS

Peak	Name	Area %	Height %
1	Hexane, 2,4,4- trimethyl-	0.21	0.35
2	Hexane, 2,3-dimethyl	11.79	15.37
3	Hexane, 2,2,3-trimethyl	13.73	16.64
4	n-Hexane	21.07	23.17
5	Cyclohexane	29.54	19.84
6	Hexane, 3,3,4,4- tetramethyl	2.40	3.63
7	Pentane, 3-ethyl-3-methyl	5.52	7.90

2.3 Product formulation

The extracted oil from hazelnut sample was incorporated in green chili pickle processing. I used various methods to extract the hazelnut oil such as solvent extraction with hexane as a solvent, solvent extraction with acetone as a solvent, hydro distillation and cold press method in Department of Agricultural Engineering Laboratory under Maharashtra Institute of Technology and MGM college of Food Technology laboratory in Gandheli. Further oil treatment and chemical analysis has done in MIT campus particularly in Department of Agricultural Engineering.

Table 2: Quantities of the ingredients

Ingredients	Quantity
Fresh green chili	100gm
Ionized salt	1tps
Extracted hazelnut oil	150ml
Chopped garlic	100gm
Chopped ginger	100gm
Red chili powder	1tps (Coloring)
Vinegar	1tps

3. Result and Discussions

Table 3: Results of yield obtained

Methods of extraction	Sample (in gm)	Results (yield obtained in gm)
Solvent extraction with n-hexane	45	27.023
Solvent extraction with acetone	45	23.782
Hydro distillation	45	Nil (due to high fat content in sample)
Cold press method	45	24.939

Oil extraction with hexane as solvent is highly preferable for the commercial purposes and for the product development cold press method is best method since solvents is health hazardous for the human consumptions.

3.1 Sensory evaluation by hedonic scale

Table 3: Rating of the product

Taste	8
Appearance	7.3
Odor	8
Total acceptability	8

4. Conclusion

I concluded that the efficiency of oil extraction depends on the method adopted and the material sources. Best method of oil extraction is Solvent extraction with hexane as a solvent (due to easy oil recovery) and best method of chemical analysis of the oil is Gas chromatography & Mass Spectrometry (due to its ability to separate mixture). The new product developed (green chili pickle) has good acceptability with rating of 8 in hedonic scale method. Thus hazelnut oil is consumable by all the ages and can be used in various applications.

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