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Supercritical Fluid Extraction of Oil from Freshwater Edible Crab (*Barytelphusa Cunicularis*).

Mohammad Moaviyah Moghal[1, 3], Vidya Pradhan[2]*, and Vishal Ladniya[3].

[1]Department of Zoology, Dr. Rafiq Zakaria Campus, Maulana Azad College, Aurangabad, Maharashtra, India.
[2]Department of Zoology, Dr. Rafiq Zakaria College for Women, Naukhanda, Aurangabad, Maharashtra, India.
[3]Post Graduate and Research Center, Maulana Azad College, Aurangabad, Maharashtra, India.

ABSTRACT

In the present study Supercritical Fluid Extraction (SFE) method is used in order to extract oil from Freshwater Edible Crab (*Barytelphusa Cunicularis*). Carbon dioxide gas is used as a supercritical fluid and Hexane is used as a modifier. Extraction is performed at different temperatures (25^{o} C to 45^{o} C) and pressures (10 Mpa to 30 Mpa). Oil is extracted at constant flow rates. The flow rate of carbon dioxide gas is kept constant 1 ml/min and flow rate of modifier (Hexane) is also kept constant 0.5 ml/min. Outcomes are discussed in details.

Keywords: Supercritical Fluid Extraction, SFC CO_2, Hexane, *Barytelphusa Cunicularis*

Corresponding author

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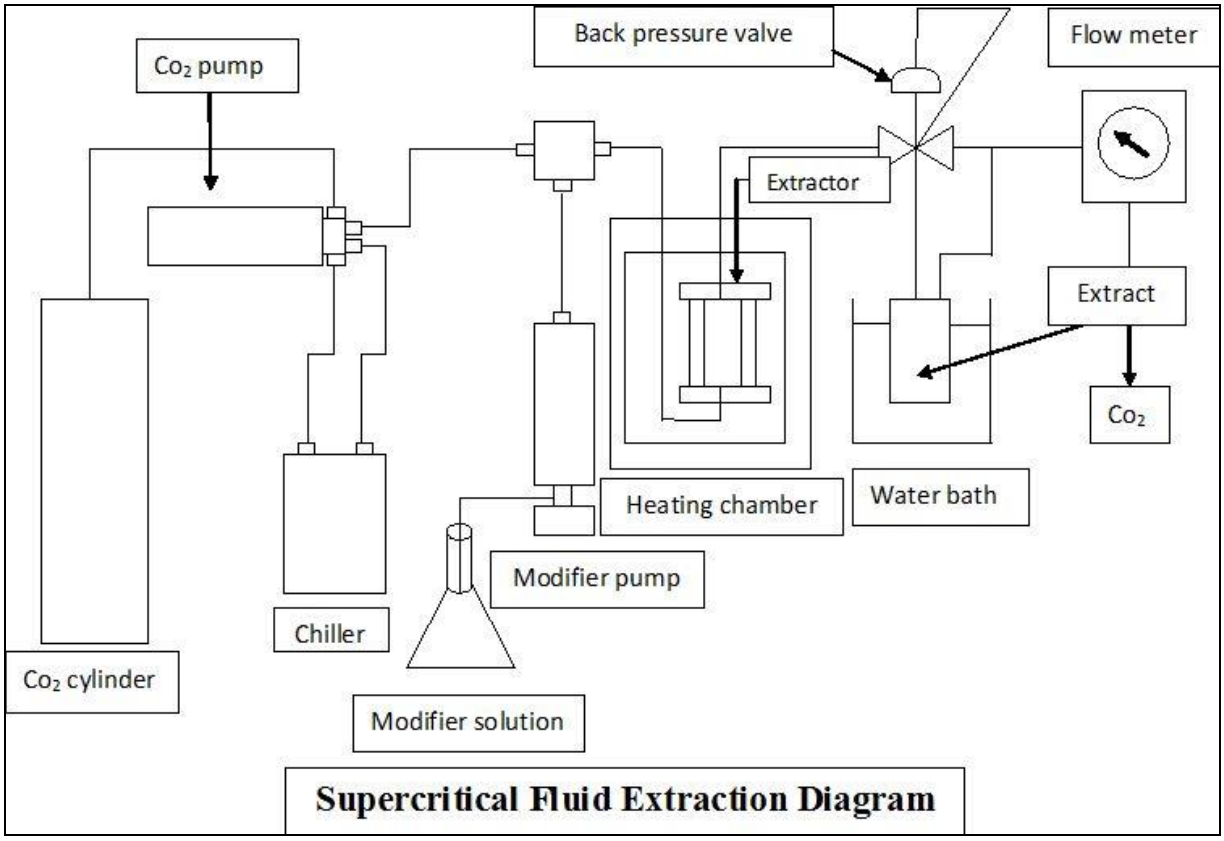
INTRODUCTION

Supercritical fluid extraction method becoming popular day by day and it is also being used and endorsed at a laboratory and pilot scale to produce high value, natural bioactives from biologically based raw materials [1-2].There is no doubt that Supercritical fluid extraction method is superior than the conventional techniques, like microwave assisted extraction, soxhlet extraction, steam distillation and organic solvent extraction. In conventional extraction methods toxic solvent are used, these solvent are not good for human health and environment. Furthermore in conventional extraction methods, extraction is carried out at higher temperature which is not good for extract; high temperature is harmful for heat sensitive compounds present in the extract. On the other hand in supercritical fluid extraction method, process of extraction can be performed at lower temperatures (at room temperature) which protects extracts from thermal degradation, non-toxic and volatile solvent, such as carbon dioxide is used for the extraction of edible and essential oils, which guards extracts from thermal solvent contamination[3-5]. There are number of benefits of supercritical fluid extraction method such as short extraction time, probability of selective extraction, and no residual solvent in the final extracts [6].



MATERIALS AND METHODS

The crabs (*Barytelphusa Cunicularis*) are purchased from local market, at Aurangabad District (Maharashtra) India. The crab meat is dried in oven for 8 hours at 50 o C. After proper drying, the dried crab meat is subjected to supercritical fluid extraction process in order to obtain crab oil. Extraction is performed using SFC (L-tex, Japan) instrument. Carbon dioxide gas is used as supercritical fluid; CO2 is injected in the system with constant flow rate 1 ml/min. SFE process is performed at different temperatures ranging from 25 o C to 45 o C and different pressures ranging from 10 Mpa to 30 Mpa. Hexane is used as a modifier (co-solvent), and it is pumped in the system with constant flow rate 0.5 ml/min.

Other modifiers (co-solvents) such as Methanol, Chloroform, Methanol/Chloroform (1:1), Ethanol, Chloroform/Ethanol (1:1) are also tested.

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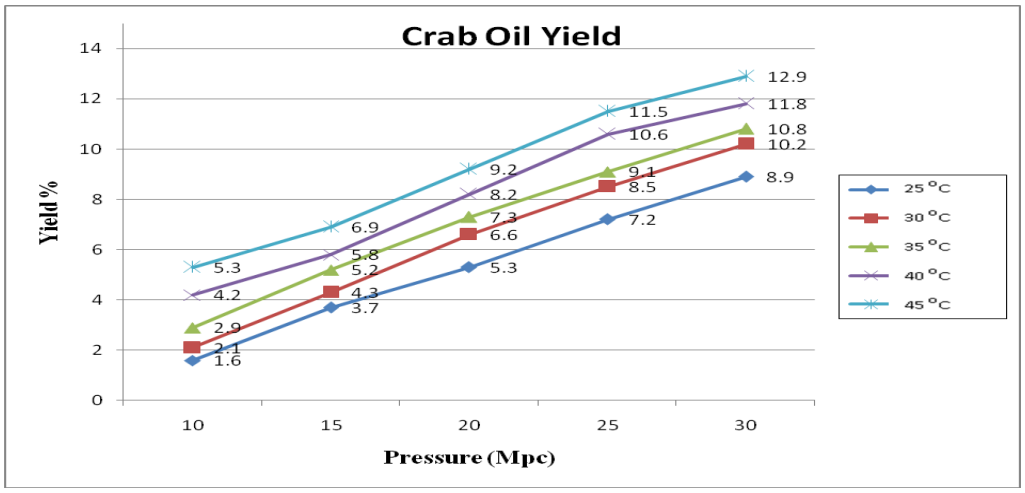
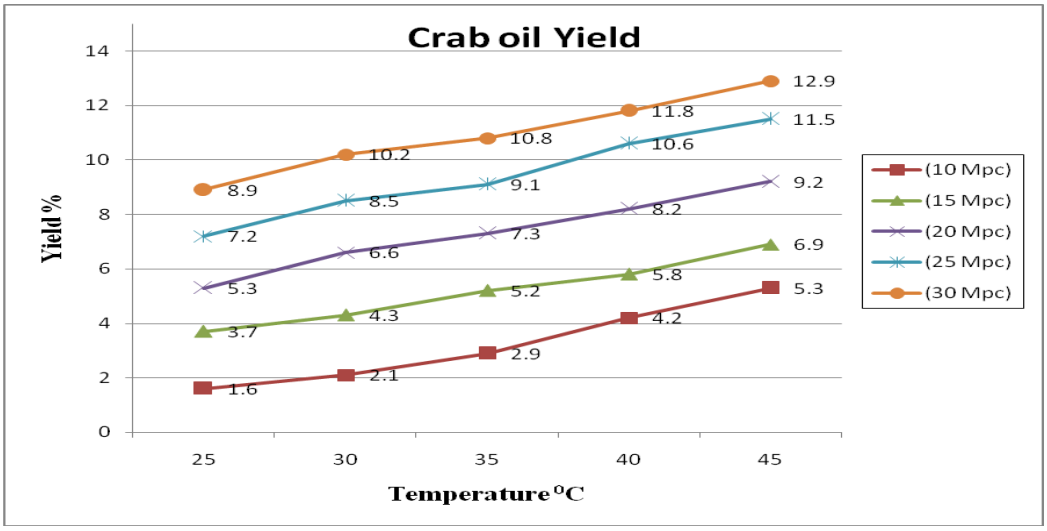
RESULTS

CO2 flow Rate = 1 ml/min Co-solvent (Hexane) Flow Rate = 0.5 ml/min

Pressure (MPa)	Yield % at Different Temperatures				
	25 oC	30 oC	35 oC	40 oC	45 oC
10	1.6	2.1	2.9	4.2	5.3
15	3.7	4.3	5.2	5.8	6.9
20	5.3	6.6	7.3	8.2	9.2
25	7.2	8.5	9.1	10.6	11.5
30	8.9	10.2	10.8	11.8	12.9



Temperature	Yield % at Different Pressures				
	10 MPa	15 MPa	20 MPa	25 MPa	30 MPa
25	1.6	3.7	5.3	7.2	8.9
30	2.1	4.3	6.6	8.5	10.2
35	2.9	5.2	7.3	9.1	10.8
40	4.2	5.8	8.2	10.6	11.8
45	5.3	6.9	9.2	11.5	12.9



DISCUSSION

Fred j. Eller and jerry W. King used supercritical fluid extraction instrument for extracting fat from ground beef. They used SFE/SFC grade Co2 for extraction. They performed supercritical fluid extraction at 9000psi. During extraction flow rate was kept at 2ml/min and temperature at 100oC [7].

Ki-Souk used supercritical fluid extraction instrument to detect pesticide in meat product. The meat samples were extracted by supercritical CO2, customized with methanol. supercritical fluid extraction was carried out by two different methods: static extraction with a pump less system designed in his laboratory and dynamic extraction using a commercial apparatus [8].

Ram Chandrasekar supercritical used fluid extraction method to extract crude fat from the meat. A food chopper, bowl cutter or food processor was used to prepare meat samples, sub sampling the meat, and mixing the meat with granular diatomaceous earth.Drying step is not necessary. Supercritical fluid extraction instrument is used to extract crude fat. Extracted material is collected on glass wool contained in collection vials. After removing moisture from the extracts, percent crude fat is determined by weight gain of the collection vial [9].

Yih-Dih Cheng used supercritical fluid extraction to extract components from black ant.Supercritical fluid extraction instrument with CO2 was used to extract desired component from black ant. The extraction time ranged from 7.5, 15, 30, 45 to 60 minutes for each extraction. The temperature was set at 35, 50, 65, 80 and 95°C for each run. The pressure was set at 3000, 4000, 5000, 6000 and 7000 psi for each extraction. Fifty microliter of each extract was dissolved in 1 ml of CHCl3 for chromatographic analysis [10].

Natalia mezzomo performed supercritical fluid extractions (SFE) in a dynamic extraction unit using 99.9% pure Co2 delivered at pressure up to 60 bars. A modifier pump, was joined to the extraction line in order to provide the modifier (pure organic solvent, mixture or vegetable oil at high-pressure) at pre-established flow rate, to mix with Co2 flow prior to the extraction vessel. The extraction method, consisted of placing a fixed mass inside the extractor cell to form the particles fixed bed, followed by the control of the process variables (tem- perature and pressure). The extraction was then carried out and the solute collected in flasks and weighed on an analytical [11].

Scott L. Taylor used supercritical fluid extraction method to extract Aflatoxin M1 from beef liver. Before extraction, 4 ml of a 20% citric acid solution was poured into a 150-ml beaker containing 20 gram of liver. This mixture was mixed well and allowed to set for 10 minutes, after that 15 gram of an extraction-enhancing agent was added to mixture and then placed in the extraction cell. SPE was performed in a vertically positioned extraction cell. Various pressures (5,000 to 10,000 psi), temperatures (80 to 150OC), quantity of CO2 (100 to 900 liters delivered at 5 liters/min) and organic modifiers (CHCl3, ACN:MeOH) were investigated for aflatoxin M1 extraction. The extracts were collected in flasks [12].

Byung soo chun defatted viscera of mackerel using supercritical fluid extraction instrument. The defatted powder of mackerel viscera was prepared using semi batch type of supercritical fluid extraction unit. The lipid extraction by supercritical fluid extraction instrument was performed at temperature of 45°C and pressure of 25 MPa. The total extraction time was 2.5 hours. The defatted powder was kept at −60°C until further analysis [13].

Kai Chang used supercritical CO2 fluid extraction technique for extracting oil from selected animal tissue and plant seeds. Supercritical fluid extractions were performed at pressures of 30 MPa and temperatures of 45ºC, extracted for 3-5hours in dynamic mode. The supercritical CO2 flow rate was set at 30 ml/min. Preparation of Plant sample: Seeds powder (100g-200g) was well mixed and then placed into the extraction vessel. The oil was extracted from the plant using supercritical fluid extraction instrument with CO2 under above conditions. Preparation of Animal sample: Fresh fat tissues with diatomaceous earth of animals were placed into the extraction vessel. The oil was extracted from these animal fat tissues using supercritical fluid extraction instrument with CO2 under above conditions [14].

Saadat Parhizkar used supercritical fluid extraction instrument to extract oil from black cumin seeds. Extraction of essential oil from the seed of N .sativa was extracted using the supercritical fluid extraction instrument. N. sativa seed powder was measured to 150 gram with digital scale balance before putting into the extraction vessel. The oil extract was obtained at 60 MPa and 40°C using supercritical fluid extraction instrument. supercritical fluid extraction flow rate was set at 20 ml/min using a variable flow restrictor. The yellowish brown color yield was collected within three hours and its value was 26 percent which was stored at

-20°C before use. The collected pressure and temperature were 0.1 MPa and 25°C, respectively. The extraction was performed with pure carbon dioxide [15].

CONCLUSION

Supercritical fluid extraction is an ideal, swift, uncomplicated and cheap to run method. Quantitative recovery of the target analytes without loss or degradation is easily possible with SFE; this extraction technology gives extract (sample) that is without delay ready for analysis without additional concentration or class fractionation steps; further more SFE does not produce additional laboratory wastes. In a few words, it can be said that supercritical fluid extraction technique is more advanced, superior and better than conventional extraction techniques.

The present study reveals that among all tested modifiers only Hexane is suitable as a modifier for crab oil extraction and other modifiers such as Methanol, Chloroform, Methanol/Chloroform (1:1), Ethanol, Chloroform/Ethanol (1:1) are not suitable for crab oil extraction. Best conditions for crab oil extraction are: CO2 flow rate = 1ml/min, modifier (Hexane) flow rate = 0.5 ml/min, Pressure = 30 Mpc and Temperature = 45o C. We observed that as temperature and/or pressure increased, the percentage of yield of extract also increased.

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REFERENCES

[1] Owen Catchpole, Stephen Tallon, Peter Dyer, Fernando Montanes,Teresa Moreno, Erika Vagi, Wayne Eltringham and Jagan Billakanti. American J Biochem Biotechnol 2012;8(4):263-287.
[2] Ola Basaar, Adel Al Saeedi, Samreen Fatema, Mohd Mohsin, Mazahar Farooqui. J Med Chem Drug Disc 2015 (Special issue):285-289.
[3] I Papamichail, V Louli, K Magoulas. J Supercrit Fluids 2006;18:213–226.
[4] Jian Bo Xiao, Jing Wen Chen, Ming Xu. Electronic J Biotechnol 2007;10(1):141-148.
[5] Kutta G, Pluhár Zs. Sárosi Sz. Int J Horticult Sci 2007;13(2):79–82.
[6] Young Hae Choi,Inkyum Kim, Kee Dong Yoon, So Jin Lee, Chul Young Kim, Ki-Pung Yoo, Young-Hee, Choijinwoong Kim. Chromatographia 2002;55:617-620.
[7] Fred J. Eller and Jerry W. King. J Agr Food Chem 1998;46(9):3657-3661.
[8] Ki-Souk Nam and Jerry W. King. J Agr Food Chem 1994:1469-1474.
[9] Eller FJ, King JW. J Agr Food Chem 2001;9(10):4609-14.
[10] Yih-Dih Cheng, Chiung-Hui Tseng, Hui-Po Wang and Chi-Chow Liao. J Food Drug Anal 2001;9(2):72-78.
[11] Natalia Mezzomo, Daniela A. Oliveira, Sandra R. S. Ferreira. Food Nutr Sci 2013;4(8):211-218.
[12] Scott L Taylob, Jerry W King, Judith I Greer, and John L Richard. J Food Prot 1997;60(6):698-700.
[13] Byung-Soo Chun, Hideki Kishimura, Sitthipong Nalinanon, Sappasith Klomklao,and Soottawat Benjakul. J Amino Acids 2011.
[14] Kai Chang, Lili Jiang, Fengguo Du,, Zhiguang Gao, and Guangren Sun. Chem Biol 2012;49(20):100-104.
[15] Saadat Parhizkar, Latiffah A Latiff and Sabariah Abd Rahman. Scientific Research And Essays 2011;6(34):6817-6820.