



## Supercritical Fluid Extraction (SFE) Technique and its Application in Fisheries

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### Abstract

Supercritical fluids are of very much importance in the modern chemical technology among other extraction methods which are being used at preparative and analytical scale. The technique has potential to be used in variety of fields. An important aspect of supercritical fluids is that they are considered as the green technology and thus they are environmental friendly method for extraction. The Green extraction methods are the processes which helps in reducing energy consumption, further it allows the use of renewable natural substances, and alternative solvents. It also provides a secure high-quality product. They are mostly used in chemical industries as they provide excellent results because of their unique properties. Carbon dioxide (CO<sub>2</sub>) is among the most widely used supercritical fluids (SCF). The article covers about SFE method and its application in the field of fisheries.

**Keywords:** CO<sub>2</sub>, Fisheries, Green technology, Supercritical Fluid Extraction (SFE)

### Introduction

The method of Supercritical fluid extraction (SFE) is mainly used for separating one component (extractant) from another component (matrix) using special fluids commonly referred as supercritical fluids (SCF) as an extracting solvent agent. The process of extraction can be obtained through solid as well as liquids matrix. Further on a larger scale it can also be used for the removal of unwanted material from a product or for the collection of a desired product. SFE can also be used as preparatory step for samples which can further be used for analytical purposes. In this technique, the most commonly used supercritical fluids are Carbon dioxide (CO<sub>2</sub>). It may also be modified using other cosolvents such as methanol or ethanol.

The solvents used for this technique of SFE states about how intermediate the physical and chemical properties are similar to that of the liquid or gas that are responsible for increasing the extracting power of the solvent. Due to high-density characteristic of SCF it provides the better solvation power. The solubility of solutes in the SCF increases with temperature when pressure is kept constant. Currently there are variety of solvents being used as SCF,

however many of them are found to be in more reasonably acceptable conditions (Machado *et al.*, 2013). Also, many of them require special handling such as in the case of benzene, cyclohexane and ammonia, thus they are not easily accepted. The SCF used in this technique should also satisfy certain kinds of requirements such as should have low cost, be inert to the matrix, have good solubility of the desired solute which is to be extracted, easy separation from the product, not too high critical pressure, *etc.* At present carbon dioxide is being widely adopted as a SCF in different fields as it has low critical temperature which helps in the conservation of thermolabile substances. Thus, it helps in achieving the critical conditions more easily (Machado *et al.*, 2013).

Initially the technique of supercritical extraction was first used in Germany for tea and coffee decaffeination. Further its applications included scents extraction and uses in various pharmaceutical and cosmetic industries. Currently several countries including China, Italy, South Korea, United State *etc.* are dependent on supercritical extraction plants for obtaining pharmaceutical products. India utilizes for scents and spices extraction (Yepez *et al.*, 2002).

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### Application in Fisheries

Environmentally friendly method of supercritical fluid extraction (SFE) is mainly used for extracting fish oil from whole fish or from fish waste. They are further used for Extraction and purification of omega-3 fatty acids, extraction of pollutants from aquaculture, determination of PCBs (Polychlorinated Biphenyls) in fish tissues, *etc.*

The main disadvantage of the traditional techniques is that the high temperatures degrade the labile and heat-sensitive natural compounds present in the product thus deteriorating the quality of the product. Also, the toxic solvents which are used here further contaminate the end product. The traditional methods also affect the environment as these processes of extraction uses a significant amount of heat, thus there are chances of leaking organic solvents into the environment. The methods involved in green extraction are considered as an approaching alternative over the traditional ones which use organic solvents and oil extraction grease since years.

Supercritical fluids-based technologies have started being used in various industries that has been showing significant progress in recent years. These industries include pharmaceuticals, food, cosmetics, chemistry, energy and waste treatment. The main advantage here is that Supercritical fluids are capable of producing products without any solvent residues. Examples of products include: squalene from shark liver oil, cholesterol-free butter, evening primrose oil, low-fat meat, *etc.* (Sapkale *et al.*, 2010).

### Conclusion

The following review article summarizes about the technique and applications of supercritical fluid technique for the extraction of important compounds in fisheries sector. Now-

a-days new methods of green extraction are considered as an important tool in the seafood industry. The extraction method of SFE will not only improve the efficiency of food processing, but it also helps in reducing the pollution and saving the energy at the same time. SCF extraction technology helps in extraction process of bioactive compounds and it also helps in overcoming different limitations which are experienced in other traditional extraction methods. The technique also helps in controlling the fluid density which is done by adjusting its temperature and pressure which further helps in attaining faster extraction rates. The technique has wider range of applications in fisheries and its allied sectors. The technology is furthermore easy to operate, very cheap, and also reproducible due to its capability to work under atmospheric pressure and at an ambient temperature.

### References

- Machado, B.A.S., Pereira, C.G., Nunes, S.B., Padilha, F.F., Umsza-Guez, M.A., 2013. Supercritical fluid extraction using CO<sub>2</sub>: Main applications and future perspectives. *Separation Science and Technology* 48(18), 2741-2760. DOI: <http://doi.org/10.1080/01496395.2013.811422>.
- Sapkale, G.N., Patil, S.M., Surwase, U.S., Bhatbhage, P.K., 2010. Supercritical fluid extraction: A review. *International Journal of Chemical Sciences* 8(2), 729-743.
- Yepez, B., Espinosa, M., López, S., Bolaños, G., 2002. Producing antioxidant fractions from herbaceous matrices by supercritical fluid extraction. *Fluid Phase Equilibria* 194-197, 879-884. DOI: [http://doi.org/10.1016/S0378-3812\(01\)00707-5](http://doi.org/10.1016/S0378-3812(01)00707-5).