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Study of the Effect Operational Parameters on the Supercritical Extraction Efficient Related to Sunflower Oil Seeds

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ABSTRACT

Super critical extraction is a new method for separation of efficient processes and effective method for extracting a necessary foundation of solid or liquid material are suitable purity. Seed sunflower seed oil is the second one year after soy which is cultivated for its oil on the world. In this study, sunflower seed oil is extracted by liquid carbon dioxide in super critical conditions. Effects of temperature, pressure and grain size in the rate of extraction efficiency were the change in particle size among other parameters extraction efficiency. Because they have a role and the smaller the size, the efficiency is higher. Results proves is that temperature changes and pressure changes in comparison with particle size in the process of extraction efficiency was less effect because of reduced grain size increased 75 percent extraction efficiency. While the temperature increase of 16 percent and increasing pressure about 5 percent increase in extraction efficiency was observed.

1. Introduction

Oleic sunflower oil is liquid in the normal temperature environment, in the food industry and in health- cosmetic formulations compounds has many applications [1]. Sunflower oil most commonly compared to a vegetable oil is considered high-value. Because it has clear color, mild taste and a high proportion of Linoleic acids [2, 3]. Sunflower seeds are especially high in vitamin E and selenium. These function as antioxidants to protect your body's cells against free radical damage, which plays a role in several chronic diseases [4].

Decomposition of the characteristics of the road is a large amount of vitamin E [5]. Common fluid in the super critical extraction is carbon dioxide. This fluid is non-toxic and ineffective and the critical atmosphere conditions are 31°C and 72°C [6-9]. It is available easily and with high purity. Playback speed super critical fluid is higher than liquids and thus in comparison of a liquid solvent extraction; it makes the extraction faster [9-13]. Priority use of the super critical fluid as solvent extraction process due to two very important property of permeability, high solubility fluid papers super critical influence and solid material by dissolving the soluble extract is in itself. Another benefit of extraction with super critical fluid is low operation temperature and the possibility of complete separation of the solvent extracted product by reducing the pressure [14, 15]. Many studies by researchers in the super critical extraction of oil seed plant are slightly different that can include canola oil, hazelnut, oil, and turmeric, oil hyacinth the said [16-19].

2. Materials and Methods

First raw sunflower seeds are prepared; then the seeds are separated from the skin form of the existing cabinets Dryer, (figure 1), the dry samples in the container are kept refrigerated until testing day. The dried samples should be changed of dried and milling to small particles has become. After that screen by the sieve sizes available with 0.5, 1, 1.5 and 2 mm sieve mesh, also by using carbon Dioxide (99.9%), nitrogen, ethyl alcohol (99.8%), Acetone to machine wash dishes

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and prepare new test, all the above mentioned materials are produced in Iran.

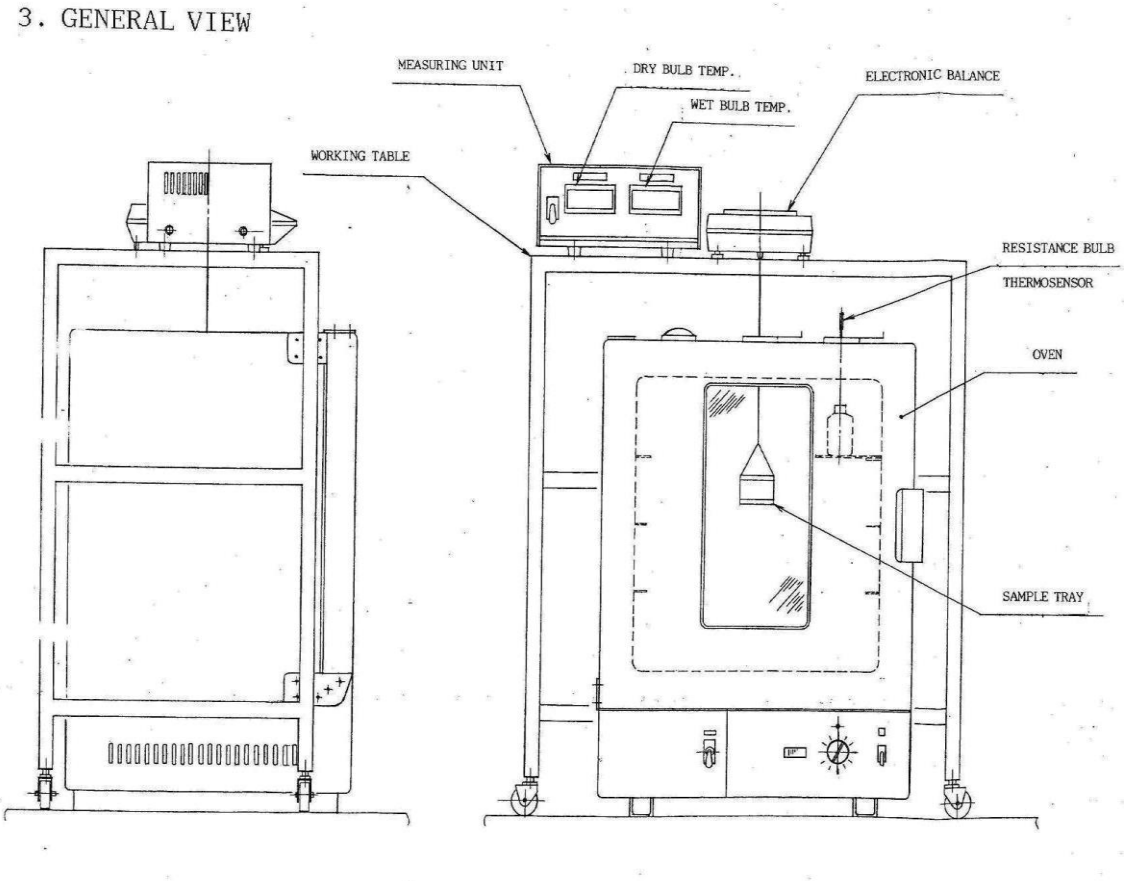

Figure1. Cabinet Dryer Schematic

3. Experimental Apparatus and Procedure

1.5 grams of sample material put on the super critical extraction device (SEF), (figure 2) and the CO_2 gas into Vessel 1 and N_2 gas pressurized, the established requirements as well as regulate the temperature and by starting the test pump, the residence time in the 120 minutes. In conclusion parameters pressure, temperature and particle size have been changed.

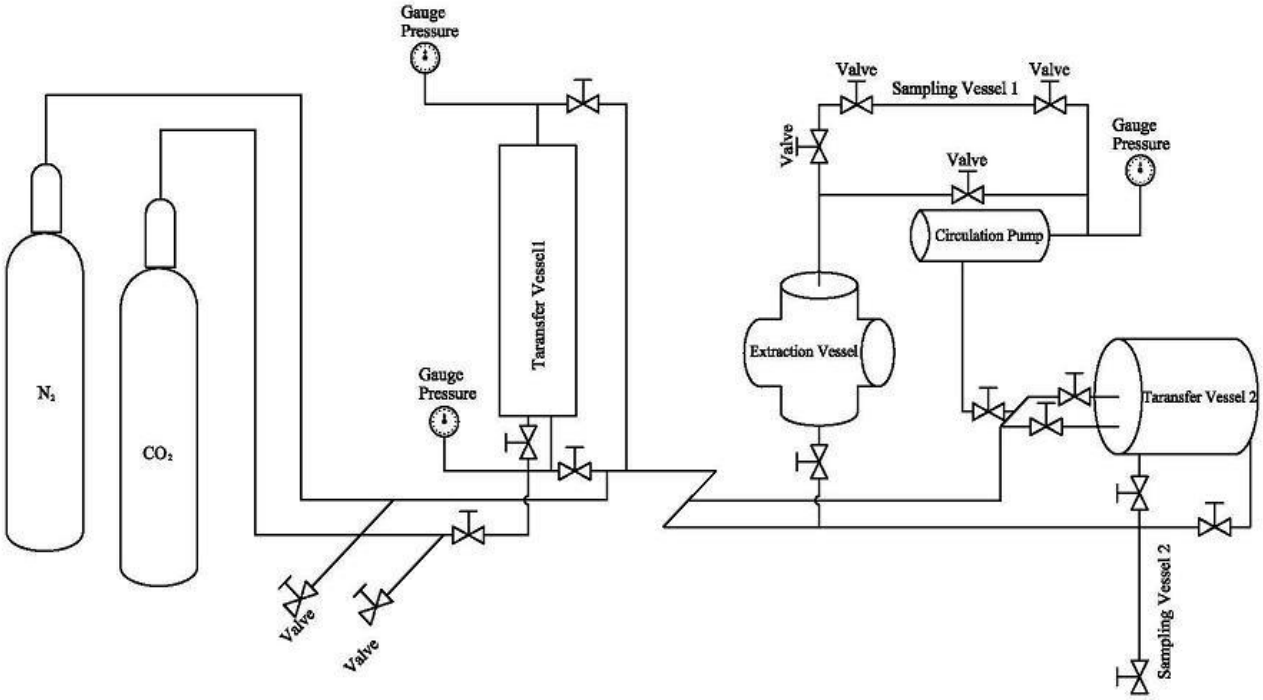

Figure2. Super Critical Extraction Fluid Device (SEF)

4. Optimized Extraction Temperature

- As mentioned earlier 1.5 grams of oleic sunflower seeds with 2 mm diameter;
- 80 bar pressure inside the SFE device;
- increased temperature according to Table 1 at each temperature after 120 minutes;
- the amount of extracted oil available by the scale of the accuracy of measurement is 0.001 grams;
- Percent extraction efficiency for each temperature have calculated the result is given in Table 1.

Table 1. The Effect of Temperature on Efficiency in Super Critical Fluid

Run	P (bar)	T (°C)	Oil Sample weight (gr)	Extraction Efficiency (%)
1	80	40	0.387	25.80
2	80	50	0.412	27.47
3	80	60	0.435	29.00
4	80	70	0.446	29.73
5	80	80	0.451	30.07

Table 1 illustrate that efficiency increases with increasing temperature, although increasing the temperature caused the vapor pressure, increasing of super critical fluid will be addressed.

The optimum temperature obtained according to Table 1 is optimized to obtain 1.5 grams of pressure oil sunflower seeds 2 mm in diameter in the temperature 80 degrees Celsius inside the SFE system and the pressure increases and Table 2 any pressure and after 120 minutes the amount of extracted oil has measured the results in Table 2 may be seen.

Table 2. The Effect of Pressure on Efficiency in Super Critical Fluid

Run	T (°C)	P (bar)	Oil Sample weight (gr)	Extraction Efficiency (%)
1	80	80	0.451	30.07
2	80	90	0.473	31.53
3	80	100	0.466	31.06
4	80	110	0.458	30.53
5	80	120	0.449	29.93

5. Optimized Extraction Pressure

According to Table 2 in general can be concluded that increased pressure extraction efficiency decreased. Because the increase in pressure super critical fluid extraction of oil increase density and reduce solvent vapor pressure material are soluble.

6. Effect of Grain Size

Obtain and review the effects of temperature and pressure extraction by sunflower seed oil in the fluid above the critical size of oil seeds paid Table 3.

Table 3. The Effect of Grain Size on Efficiency in Super Critical Fluid

Run	d (mm)	Oil Sample weight (gr)	Extraction Efficiency (%)
1	2.0	0.473	31.53
2	1.5	0.634	42.27
3	1.0	0.771	51.40
4	0.5	0.832	55.47

Increases and Table 2 any pressure and after 120 - minutes the amount of extracted oil has measured the results in Table 2 may be seen.

The Table 3 can be concluded with reduced diameter of 2 to 0.5 mm efficiency significantly increased the resistance of why smaller particles is less influential, less influential path and fluid contact area - is solid and more effective.

When the extraction of oil seeds is done due to larger times the particles of solvent influence off spring, part of the oil can be extracted.

7. Conclusion

Operating conditions (temperature and pressure) and size of grain size efficiency rate of oil extraction by sunflower seeds dioxide were above the critical. Results proves is that temperature changes and pressure changes in comparison with particle size in the process of extraction efficiency was less effect because of reduced grain size increased 75 percent extraction efficiency. While the temperature increase of 16 percent and increasing pressure about 5 percent increase in extraction efficiency was observed.

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