Supercritical Fluid Extraction of Fats and Oils in Seeds

Seeds generally consist of three main elements: proteins, fats and oil, and carbohydrates. Seeds have a high content of proteins and fats and oils. The carbohydrate content varies, however, depending on the kind of seed. The fatty acids found in seeds include both saturated and unsaturated fatty acids. The content ratio of saturated and unsaturated fatty acids also varies depending on the kind of seed. In particular, walnut and almond have a high content of linolic acid, which is a type of polyhydric unsaturated fatty acid. The following results were obtained after measuring the extraction of elements from the above mentioned seeds:

- The various elements extracted were dependent on the different kinds of seeds.
- The different kinds of fats and oils extracted were dependent on the varying extraction pressures applied.

Figure 1 to 3 shows examples of the extraction process for each of the seeds above under extraction pressure of 100 kg/cm².

The data obtained on almond, walnut and sunflower seeds includes different time course data with varying absorbance values observed between 1750 cm⁻¹ and 1600 cm⁻¹. The peak observed at 1750 cm⁻¹ is assigned to fats and oils; the peak observed at 1600 cm⁻¹ is assigned to water. The time course date at 100 kg/cm² indicates that significantly more water is extracted compared with extraction at 200 kg/cm². Extraction using supercritical fluid obtains only minute amounts of such polymer elements as proteins and fibers. Conversely, water, odor, fats and oils, and fatty acid ester are mainly extracted when using supercritical fluid. The data describe above confirms that the elements extracted depend on the kind of seed and extraction pressure applied to obtain different kinds of extracted elements.

**Condition**

- **Sample weight:** 1 g
- **Pressure:** 100 kg/cm², 200 kg/cm²
- **CO₂ flow rate:** 2 mL/min
- **Temperature:** 50°C
- **Accumulation:** 4 times, 2 times
- **Measurement time:** 10 min. to 20 min.
- **Sample:** Almond, walnut and Sunflower seeds

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Figure 4 shows extraction process data under an extraction pressure of 200 kg/cm². Stable extraction of the Carbonyl function group (C=O) of fats and oils (based on the 1750 cm⁻¹ peak) is possible under high pressure (200 kg/cm²). Extraction under low pressure (100 kg/cm²) is not very effective. The peak observed at 1750 cm⁻¹ is apparently based on triglyceride; the peak observed at 1600 cm⁻¹ is apparently based on water.