

LIGHT INDUSTRY AND FOOD INDUSTRY

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CREATION OF VEGETABLE INGREDIENTS FROM SPICE BLENDS

Abstract. *The industrial application of dry spices is sometimes difficult, and an excellent alternative is the use of extracts obtained by the method of supercritical CO₂-extraction. At different extraction regimes, by varying the parameters of temperature (35 - 45 °C), pressure (15 - 35 MPa) and time (60 - 180 min), ingredients with high content of natural flavoring compounds were obtained from the mixture of spices: coriander seeds, allspice berries, summer savory, black peppercorns. The yield of the fat-soluble fraction extraction process is up to 67.6%.*
Keywords: *spices, supercritical CO₂ extraction, fat-soluble extract, defatted meal, bioactive compounds, flavor.*

Introduction

In the food industry there is a growing trend in the market of natural flavors thanks to the increased interest of consumers for natural, familiar and safe sources.

Without a little bit of seasoning the food, it would not have the same taste and would not be as appreciated. The spices change the taste of any food and have the

role of transforming any simple food, which does not have a very unique taste, into a delicious preparation.

Aromatic plant and spices extracts are used in food processing to provide flavor or other functional properties [1]. Natural antioxidants, which are contained in extracts, not only prevent food degradation, but can be used in the formulation of functional mixtures for use in the food, pharmaceutical and cosmetic industries. [2]

Both individual spice extracts and their mixtures are used to add flavors, stimulate appetite and impart preservative and therapeutic effects to healthy foods (confectionery, etc.), beverages (tonic beverages, etc.).

The industrial use of dry spices is sometimes difficult, an example of this can serve the problem of adding seeds or berries, like peppercorn (red, black and juniper) in sausages. An alternative to dry spices is the use of extracts obtained by the method of supercritical CO₂-extraction. These extracts have several advantages, such as: long shelf life, simplicity of incorporation technology into the finished product, sterility, more efficient use of the compounds they contain.

Vegetable raw materials with high content of bioactive compounds and flavors

There is a wide range of agri-food raw materials, rich in biologically active compounds and flavor components, that could be processed in order to capitalize on and obtain natural ingredients.

Coriander seeds

Dried coriander seeds, rich in essential oils, are used as a spice in the food industry, in the preparation of sausages and meat dishes, in the bakery industry and alcoholic beverages (liqueurs, etc.); it is part of the curry sauce.

The volatile oil in coriander fruits is an important source in obtaining linalool, it is used as a flavoring in the tobacco, wine and perfumery industries. The extracts are used to flavor or correct the taste, but also have bactericidal, fungicidal and anthelmintic activity. [3]

Coriander seeds contain 1.5% essential oils, especially linalool and also α -pinene, p-cement, limonene, camphor, α -terpineol, geraniol, geraniol acetate and small amounts of other substances. [3]

Allspice

Allspice is a concentrate of flavors, with the aroma of pepper, cinnamon, nutmeg and cloves, that's why it's also called: four spices. It is used in flavoring cakes, gingerbread, pies, compotes, chocolate and sauces for sweet-sour combinations. Allspice berries are widely used for marinating crustaceans and fish (herring) or marinating grilled meat.

Allspice contains flavonoids, phenolic acid, catechin, essential oil and others. The essential allspice oil mainly contains eugenol and myrcene, which has antibacterial, anti-inflammatory, anticancer, antioxidant effect. [4]

Summer savory

The warm and pungent taste and rich aroma of the leaves make summer savory a popular spice for a lot of culinary dishes, especially for bean, lentil food, but also in the preparation of sarmale (stuffed grapes leaves), pork and hunting.

The main compounds of summery savory oil are carvacrol, p-cymene, α -thujone, α -pinene, β -myrcene, β -terpinene, thymol, linalool, and β -caryophyllene. [5]

Black pepper

The fruits of black pepper do not smell, but contain the alkaloid piperine which has a strong spicy, hot taste. Due to these properties black pepper has become a common spice used in food industry. It is also used in various medicines and cosmetics, and pepper oil is used as an Ayurvedic massage oil or in certain beauty treatments.

The major constituents of the black pepper essential oils are reported to be α -pinene, sabinene, β -pinene, δ -3-carene, limonene, and β -caryophyllene. [6]

Technology for the production of ingredients

Extraction is the most sensitive critical stage for obtaining bioactive compounds and flavorings from vegetable raw materials. Extraction methods can be selected according to the types and quantities of target bioactive compounds that can be obtained from vegetable raw materials. The extraction process can be influenced by several factors, such as: the source of the bioactive components, the part of the plant (stem, leaf, flower, fruit), temperature, pressure and type of solvent. Sample

preparation is also one of the crucial factors influencing the determination of the type and quantity of bioactive compounds extracted. [7]

The new technologies appear due to the limitations of conventional extraction methods, being characterized by difficulties in obtaining a high purity extract, the use of expensive solvents, long extraction time, possible degradation of thermolabile compounds and low extraction selectivity.

To cope with these limitations, several new and emerging technologies have been developed, which are currently used for the extraction process. One of these technologies is supercritical CO₂-extraction. Among the advantages of the extraction process with supercritical fluids are: [7]

- Lower viscosity and higher diffusion coefficient than liquid solvent extraction, which provides better mass transfer;
- Time saving;
- Ecological (environmentally friendly) method due to the need for a small amount of sample and solvent used;
- Minimal losses, as it is possible to reuse and recycle the supercritical fluid.

Samples of ingredients with high content of bioactive compounds and natural flavorings

As a source to obtain fat-soluble extracts were used vegetable raw materials (figure 1), purchased from the company "Rodals" LLC, Chisinau, Republic of Moldova.



Fig. 1. Samples of vegetable raw materials

There are several types of spice blends that give the food a special note and are internationally recognized: Curry, Indian, Garam Masala Indian, Mexico, Tex-Mex, Moroccan Spice Blend, Herbes de Provence, French Four Spice Blend, Spanish Pincho, Creole Seasoning Blend, etc..

When preparing a mixture of spices, it is important to dose the amount of each spice depending on the intensity of the flavor it has. Thus, the sweetest / finest spices will be present in greater quantities than spices with a strong flavor. [8]

New recipes were created to obtain the ingredients from the spice mixture (Table 1).

Table 1

Recipes for spice mixtures

No.	Spice	Taste of the spice	Recipe 1	Recipe 2
			Ratio of the spice in the recipe, %	
1	Coriander	Sweet / soft	89	60
2	Allspice	Bitter / poignant	10	25
3	Summer savory	Flavored / aromatic	-	10
4	Black pepper	Spicy / pungent	1	5

For the spice mixtures of coriander, allspice, summer savory and black pepper, preliminary regimes of supercritical CO₂ extraction have been developed to obtain ingredients rich in natural bioactive compounds and flavorings.

Table 2

Extraction regimes of ingredients from spice mixture

No.	Parameters	Regime 1	Regime 2	Regime 3
1	Pressure, MPa	15	25	35
2	Temperature, °C	45	40	35
3	Time, min	180	120	60

In the Food Technology laboratory, at the laboratory-pilot plant for supercritical CO₂ extraction, HA 120-50-01 model, samples of lipophilic ingredients (figure 2) were obtained from a mixture of coriander seeds, allspice berries, summer savory and black peppercorns, according to the elaborated recipes (table 1).

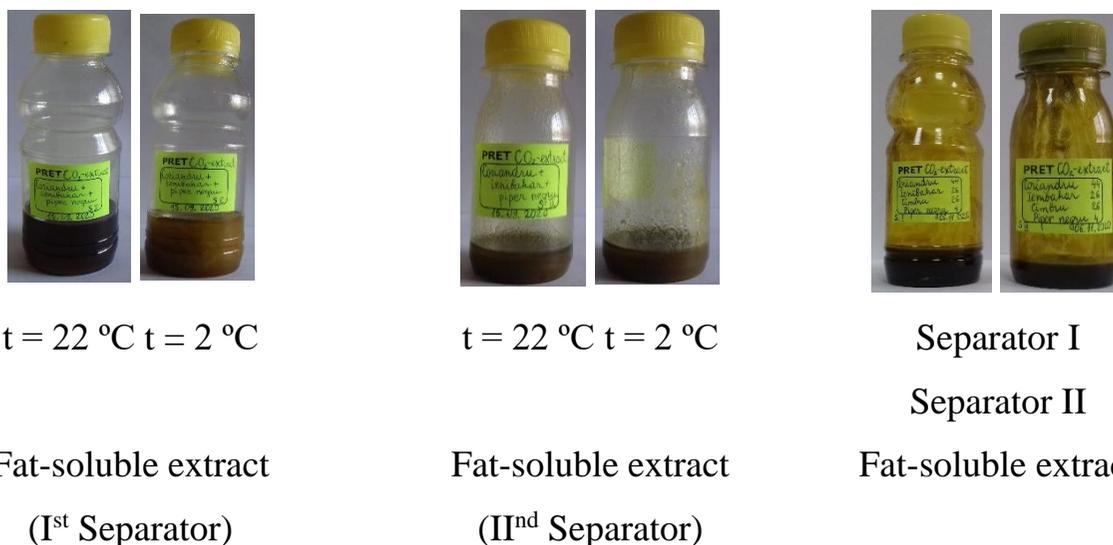


Fig. 2. Samples of fat-soluble ingredients extracted from spice mixture

The organoleptic properties of fat-soluble ingredients from vegetable raw materials are specified in Table 3.

Table 3

Organoleptic characteristic of lipo-soluble ingredients extracted from spice mixture

No.	Index	Characteristic
1	Exterior appearance and consistency	Lipo-soluble liquid or oily mass with homogeneous consistency, from fluid at room temperature to creamy (stored in the refrigerator T = 2 °C), with the presence of waxy substances, without other impurities. Stored cold, it has an uneven distribution of waxes in the volume of the product, which disappears easily after mixing and heating.
2	Transparency	Translucent at room temperature.
3	Color	Natural, characteristic color, from light brown with khaki-green shades to a dark brick tint.
4	Smell and taste	Pleasant smell, characteristic of the spices used, namely: coriander, allspice, summer savory and black pepper. Strongly pronounced pleasant spicy taste. Remaining slightly bitter taste.

During the supercritical carbon dioxide extraction process, only the lipophilic (fat-soluble) fraction containing biologically active (SBA) and flavoring substances is separated. Therefore, the hydrophilic (water-soluble) fraction, protein (amino acids) and dietary fiber remain in the spice meal.

In consequence, after the extraction of the fat-soluble fraction, in the extractor remains the meal of spicy vegetable raw materials (figure 3), which is low in fat.


Spice mixture
Spice meal
Spice meal

(vegetable raw material)

coriander, allspice, summer savory and black pepper

coriander, allspice and black pepper

Fig. 3. Samples of water-soluble ingredients (low-fat spice meal)

Table 4 describes the sensory properties specific to meal obtained after supercritical CO₂ extraction from the selected spices.

Table 4

Organoleptic characteristic of spice mixture meal

No.	Index	Characteristic
1	Exterior appearance	Mass of homogeneous, dry, powdery, friable particles, without lumps.
2	Color	From dark beige to dark brown with shades of gray.
3	Smell and taste	Characteristic flavor of the strong aroma of coriander, allspice, thyme and black pepper, slightly acidic, pleasant, without foreign smell. Spicy, hot taste and pungent odor. Strong aroma of summer savory.

It was established that the moisture content in the raw material is between 8.93 and 9.22%, depending on the mixture, and after the supercritical extraction process the moisture content decreases to 6.13% and 5.04%, respectively.

Depending on the composition of the spice mixture, the lipid content is 4.42 and 7.22%, respectively. The lipid content remaining in meal after supercritical extraction reached the values of 2.50 and 1.43%.

Thus, based on the lipid content in the flavoring vegetable raw material and the lipid content of its meal, it is found that the yield of the supercritical extraction

process of the fat-soluble fraction, depending on the regime, is between 65.4 and 67.6%.

Table 5

Quality indices of raw material and spicy mixture meal

No.	Product	Moisture content, %	Lipid content, %
1	Spice mixtures – Recipe 1	9,22	7,22
2	Spice mixtures meal 1	6,13	2,50
3	Spice mixtures – Recipe 2	8,93	4,42
4	Spice mixtures meal 2	5,04	1,43

Conclusions:

It was performed the study regarding the possibility of ingredients producing with high content of biologically active compounds and natural flavorings from vegetable raw materials. For the manufacture of food ingredients, it has been developed recipes of natural spicy mixtures, namely: coriander, allspice, summer savory and black pepper.

The food ingredients from spice blends with high content of bioactive compounds and natural flavors were obtained at different technological regimes, and the extraction parameters were within the limits: pressure 15 - 35 MPa, temperature 35 - 45 °C, time 60 - 180 min.

The highest experimental yield of fat-soluble fraction extraction from spicy mixtures by supercritical CO₂ extraction was 67.6%.

In laboratory conditions, it was obtained samples of ingredients from spice blends with high content of biologically active components and natural flavorings: fat-soluble extracts and low-fat meal.

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