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Разработка композита для косметической промышленности на основе черного тмина, молочной сыворотки и синтезированного нигелона

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Аннотация. *Исследования потребительских предпочтений, проводимые в косметической промышленности, неизменно показывают преимущество компонентов природного происхождения. Важными критериями при разработке косметических средств являются отсутствие токсичных, аллергических реакций, способность внутриклеточной доставки активных веществ и обеспечение пролонгированного биологического действия. Нашему творческому коллективу представляется актуальным разработка компонента-концентрата на основе уникальной по составу молочной сыворотки с эффективным актиоксидантом - нигелоном из черного тмина, который будет соответствовать современным критериям инновационных средств косметической индустрии.*

Ключевые слова: молочная сыворотки, нигелон, черный тмин, косметическая промышленность

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Research article

Analysis of the composition of black cumin for the purpose of developing a component-concentrate based on milk whey and synthesised nigelone for use in the cosmetic industry

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Abstract. *Consumer preference studies conducted in the cosmetics industry consistently show an advantage among components of natural origin. Important criteria in the development of cosmetics are the absence of toxic, allergic reactions, the ability of intracellular delivery of active substances and the provision of prolonged biological action. It seems relevant to our creative team to develop a concentrate*

component based on a unique composition of whey and an effective actioxidant - nigelog from black cumin, which will meet the modern criteria of innovative cosmetics industry products.

Keywords: milk whey, nigelon, black cumin, cosmetic industry

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Introduction. Black cumin seeds (*Nigella Sativa* L.) have been known since ancient times and grow in various parts of the world, including Ethiopia, Saudi Arabia, Egypt, the USA, India, Central Asia, Transcaucasia, the Mediterranean and the North Caucasus, and have many names: "Indian cumin", "nigella", "cumin", "Roman coriander", "zira", "jeera", "shabray", "kmin" [1, 2, 3, 4, 5, 6]. Cumin seed oil has been used for the complex treatment of various diseases for over three thousand years. The healing properties are described in the medical treatises of Hippocrates and the pharmacologist of Ancient Greece Dioscorides. In ancient Egypt, this oil was used as a cosmetic and as a component of an antidote for snake bites and to normalize the functioning of the liver, kidneys and lungs. Cumin oil has many benefits:

- prevents the occurrence of seborrhea;
- dandruff, itching and flaking of the scalp;
- protects hair from loss and premature graying.

Using cumin oil in its pure form can have an intense effect on the skin, so it is better to use the oil in combination with other components and oils: olive, sesame, linseed, almond, cedar and grape seed oil. Due to its unique properties, cumin oil is often included in masks and creams for the care of oily and problematic skin, as well as in hair masks. It is also a component of skin cleansers, products for delicate skin in the décolleté and bust area, and part of massage oils.

Another feature of caraway seeds is that they contain plant antimicrobial peptides (AMPs) belonging to the α-harpinin family and representing a relatively new family of compounds found in both cultivated and wild plants. α-harpinins are substances with a wide range of biological activity: antibacterial, antifungal and ribosome-inactivating effects, as well as an inhibitor of serine proteinases such as trypsin and trypsin-like enzymes. One of the sources of antimicrobial peptides (AMPs) are black cumin seeds (*Nigella sativa* L., family *Ranunculaceae*). A number of AMPs belonging to the families of defensins, thionins and lipid-transfer proteins have been isolated and characterized from black cumin seeds. This complex was named nigellone [3, 4, 5, 6, 7, 8, 9, 10 11-15].

Relevance of the study. The development and implementation of new technological processes for the synthesis of niggelone (nigelase) from black cumin seeds is one of the promising tasks of the modern cosmetic industry. Currently, manufacturers of care cosmetic products pay considerable attention to black cumin oil, as one of the most effective antioxidants.

Materials and research methods. Analysis of modern trends allowed to formulate the concept of obtaining an original, innovative and universal ingredient for many formulas of care products based on nigelone and secondary milk raw materials. One of the fundamental principles of this concept is to achieve a significant effect of the component-concentrate on damaged areas of human skin in case of burns, acne, hyperpigmentation, scars.

Research results and their discussion. The wide spectrum of pharmacological action of black cumin is characterized by a high content of biologically active components, allowing them to be considered as promising plant raw materials in cosmetology, medicine, and pharmacy.

To successfully begin scientific research, it is necessary to study the composition of black cumin. Table 1 shows the chemical composition of the main components contained in the seeds, oil and extract of black cumin. It is important to note that the component composition of black cumin has not been fully determined by various scientific schools. Our creative team, among other

things, faces the task of determining the content of unknown components in cumin and, as a result, developing an innovative component concentrate based on whey and synthesized nigelone from black cumin for use in the cosmetic industry.

Table 1 – Composition of black cumin

Phytochemical composition of black cumin campesterol, sitosterol, stigmasterol, cholesterol, α-spinasterol, β-sitosterol), alkaloids (nigelline, nigellimine N-oxide, nigellicin), lipase enzyme, essential oils, triglycerides, triterpene saponins, coumarins, flavonoids, phenolic acids, amino acids, carbohydrates, proteins, minerals, glycoside melantin, bitter and tannins, vitamins and minerals. [1, 2]	
in seeds: fatty oil	30–37.8%
in seeds: squirrel, fat, moisture, ash the rest is carbohydrates [3]	 21% 35% 5% 7%
in seeds: essential oil [4]	0.5-3%
in oil: glycerin, selinen, benzoic, phenylacetic, heptadecenoic, margarooleic, eicosadienoic acids [5,6]	no data in sources
in oil: dehydroretinol acetate, tocopherol acetate, methylretinol acetate and ergostenyl [7]	no data in sources
phospholipids in oil: phosphatidylcholine and phosphatidylinositol [8]	no data in sources
The saponifiable part is represented by triglycerides: diglycerides monoglycerides. They contain mainly: polyunsaturated linoleic acid (omega-6), monounsaturated oleic (omega 9), saturated palmitic, saturated stearic, cis-11,14-cosadienoic acid, polyunsaturated linolenic (omega-3) Contains trace amounts of myristic, palmitooleic, trans-oleic, a-linolenic, arachidic, and gondoic acids [9] ascorbic acid in leaves [1 0]	81.7–95.3% 3.9–15.2% 0.7–4.1% 55.8–60.6% 21.8–24.6% 10,012.8% 2.4–3.2% 2.3–2.6% no data in sources up to 0.43%
thymoquinone in lipid complexes, in essential oil [11]	0.7-2.6%
in essential oil: nigellone and carvone [12] in essential oil: melanthol, the biological properties of which have not yet been studied [13]	no data in sources
acyclic monoterpene (p- cymene) - the main component of caraway essential oil α-thuja ena γ-terpinene sabinena other components: α-pinene, β-pinene, limonene, fenchone, methyl chavicol, terpinen-4-ol, bornyl acetate, neral, geranial, carvacrol	~60% ~14,% ~3–10% ~2–4% does not exceed 5%
amino acids in the extract: essential (leucine, methionine, valine, threonine); nonessential (arginine, proline, serine, glycine)	no data in sources
Antimicrobial peptides of the thionin family from black cumin seeds	no data in sources
Biologically active elements of the seed include flavonoids, antioxidants, fatty acids, fatty and essential oils, triterpene saponins (sativoside A, sativosid B, α-hederin chemical composition includes: protein,	 26.7%

carbohydrates, vegetable fats and oils crude fiber total ash [1 4]	24.9% 28.5% 8.4% 4.8%
in seeds sterols; in particular, beta-sitosterol; cholesterol, a-spinasterol, 7-avenasterin [15] p-cymene, ethyl linoleate, B-thujone, thymohydroquinone, dipropyl disulfide, dibutyl disulfide, butyropyl disulfide; α-hederin, water-soluble pentacyclic triterpene, saponin [1 6]	no data in sources
amino acids (replaceable and essential), carbohydrates, fatty acids (saturated fatty acids: palmitic, stearic; monounsaturated fatty acids: palmitoleic, palmitoleic; polyunsaturated fatty acids: linoleic, oleic, arachidonic); phenolic compounds (rutin, gallic, chlorogenic, caffeic acids); α-sitosterol is the main sterol, stigmasterol; organic acids (malic, succinic, citric, lactic, ascorbic); macro- and microelements (potassium, sodium, magnesium, calcium, copper, zinc, iron, manganese)	~30% no data in sources 50-60% 20% no data in sources 44-54% 6.57-20.92% of total sterols no data in sources
in seeds: p-cymene, ethyl linoleate, B-thujone, thymohydroquinone, dipropyl disulfide, dibutyl disulfide, butyl propyl disulfide, α-hederin, water-soluble pentacyclic triterpene, saponin [17]	no data in sources
The main components of Nigella sativa oil are: 9,12-octadecadienoic acid, (E)-9-octadecenoic acid, 11-octadecenoic acid, palmitic acid, stearic acid, trans-anethole, p-cymene, limonene, carvone, thymoquinone, γ-terpinene, thymol, β-sitosterol, 9-eicosine, stigmasterol, linoleic acid and campesterol [18,19,20,21]	

Source: [5-15]

Conclusion. The available scientific data allow us to recommend this plant material as a source of essential fatty acids, thymoquinone, niggelone and essential oils with a polyvalent pharmacological purpose. Fatty acids included in the lipid complex may indicate the potential prospects of this plant material for the creation of drugs that affect lipid metabolism.

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