

THE ROLE OF BIOLOGICALLY ACTIVE SUBSTANCES IN THE HUMAN BODY

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Abstract. *This article discusses the role of biologically active substances in the human body and biologically active additives.*

Keywords: *biological, food, substances, organism, harmful substances.*

РОЛЬ БИОЛОГИЧЕСКИ АКТИВНЫХ ВЕЩЕСТВ В ОРГАНИЗМЕ ЧЕЛОВЕКА

Аннотация. *В статье рассматривается роль биологически активных веществ в организме человека и биологически активных добавок.*

Ключевые слова: *биологический, пища, вещества, организм, вредные вещества*

Biologically active substances (BAS) are compounds that exert specific biological effects on living organisms. Within the context of food technology, they are used to enhance health benefits, sensory qualities, and preservation of food products. Increasing consumer interest in health-promoting diets has driven demand for functional foods and nutraceuticals enriched with BAS. Their roles span from preventive healthcare to technological functionality in food systems, making them integral to modern food innovations.

BAS can be broadly classified based on their biochemical nature and physiological effects:

Antioxidants: Substances such as tocopherols, polyphenols, and ascorbic acid protect foods from oxidative degradation and contribute to reducing oxidative stress in humans.

Bioactive peptides: Derived from enzymatic hydrolysis of food proteins, these peptides show antihypertensive, antimicrobial, antioxidant, and immunomodulatory properties.

Phytochemicals: Includes flavonoids, glucosinolates, carotenoids, and phenolic acids, known for anti-inflammatory, anticancer, and cardiovascular benefits.

Probiotics and prebiotics: Probiotics are live beneficial bacteria, while prebiotics (e.g., inulin) support their growth in the gut, improving digestive health and immune response.

Polyunsaturated fatty acids (PUFAs): Especially omega-3 and omega-6 fatty acids, vital for neurological development and heart health.

Vitamins and minerals: Such as vitamin D, zinc, selenium, and B-group vitamins, playing roles in metabolism, immunity, and cellular regulation.

The incorporation of BAS into food products has led to the emergence of functional foods—foods that provide health benefits beyond basic nutrition:

Dairy products fortified with calcium, vitamin D, and probiotics for bone and gut health.

Whole grain and cereal products enriched with soluble fibres and plant sterols that support cardiovascular health.

Fermented drinks such as kefir and kombucha with probiotic cultures and antioxidants.

Nutrient-rich snacks using superfoods (e.g., goji berries, cacao nibs, flaxseeds) to enhance satiety and energy levels.

Formulating functional foods involves maintaining the stability and bioavailability of BAS during production, storage, and digestion.

Biologically active substances also serve as natural preservatives that replace or reduce the need for synthetic additives:

Natural antimicrobials such as essential oils (thymol, eugenol) inhibit spoilage and pathogenic microorganisms.

Antioxidant extracts from rosemary, green tea, and grape seed delay lipid oxidation in fats and oils.

Active packaging technologies incorporate BAS into films that release protective agents during storage, extending shelf life and ensuring product safety.

The bioefficacy of many BAS is limited by their instability under processing or poor bioavailability. To address this, food technologists use advanced delivery systems:

Microencapsulation and nanoencapsulation protect sensitive compounds from heat, oxygen, and light.

Lipid-based carriers (e.g., liposomes, solid lipid nanoparticles) improve the delivery of fat-soluble vitamins and phytochemicals.

Emulsion systems are used for dispersing hydrophobic BAS in aqueous food matrices, enhancing solubility and absorption.

Such approaches meet consumer preferences for “clean-label” products with fewer artificial additives. These technologies enable controlled release and targeted delivery in functional food applications.

The integration of BAS into foods requires adherence to national and international safety standards:

GRAS (Generally Recognized As Safe) status in the USA, or novel food approval in the EU.

Strict guidelines for dosage limits and permissible claims on health effects (e.g., “reduces cholesterol” or “supports immunity”).

Transparent labeling and traceability of bioactive ingredients.

Risk assessment protocols to avoid toxicity, allergenicity, or undesirable interactions.

Ensuring consumer safety and maintaining trust are critical in commercialising BAS-enhanced products.

Biologically active substances are being widely adopted across multiple food sectors:

Dairy industry: Adding probiotics, omega-3 fatty acids, and vitamin D in yoghurts, cheeses, and milk.

Baking and cereal products: Enrichment with fibre, protein hydrolysates, and natural antioxidants.

Meat and seafood processing: Use of plant-derived antimicrobials and antioxidants to reduce microbial load and lipid peroxidation.

Beverage sector: Incorporation of adaptogens, herbal extracts, and functional minerals for cognitive and immune support.

Emerging tools such as 3D food printing, personalised nutrition, and AI-assisted formulation are revolutionising how BAS are applied in tailored food products.

Biologically active substances are central to the advancement of food technology. They provide not only nutritional benefits but also improve sensory qualities and preservation methods. As research into their mechanisms and applications continues, their role in shaping the future of health-focused and sustainable food products is undeniable. Innovation in encapsulation, personalised nutrition, and regulatory strategies will determine their long-term impact in global food systems.

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