**Wieczorek P. P., Lipok J., Górka B.**
Faculty of Chemistry, Opole University, Oleska 48, 45-052 Opole, Poland

# Biologically active compounds isolated from algae and their application as a plant growth regulators

*В сельскохозяйственную практику был внедрен комплексный препарат из гуминовых кислот и фитогормонов. Для определения оптимального способа применения и дозировки были объединены теоретические модели и практический опыт, а разработанные рекомендации по внесению были испытаны на 6000 га опытных площадей в немецких сельскохозяйственных предприятиях. По сравнению с необработанным контролем был получен прирост урожая от 3,5 до 8,5%, и более чем на 20% повысилась концентрация азотфиксирующих и фосформобилизирующих почвенных бактерий.*

*Due to their preferred features, algae became the important source of fine chemicals used in many branches of human activity. However the complexity of the processes of isolation, purification and identification of substances of interest, constantly seems to limit the utilization of this natural source of chemicals. Some aspects of this problem in respect to use of supercritical fluid extraction (SFE) as an alternative to traditional methods of extraction of plant growth promoters from algal biomass will be presented.*

Algae and microalgae are potentially a great source of natural compounds that could be used as ingredients in many branches of human activity. Interesting organic compounds, like carotenoids, phycobilins, fatty acids, polysaccharides, vitamins, sterols, polyphenols, lipids, or proteins are isolated from the biomass of algae by different extraction methods [1]. These natural fine chemicals may act as e.g.: plant growth promoters, animal feed additives, cosmetics ingredients or active pharmaceuticals [1]. Carotenoids (β-carotene, astaxantin, canthaxantin), phycocyanine (water-soluble phycobiliprotein) isolated from algae are used as natural pigments for food [1]. Cells of *Arthrospira (Spirulina) maxima* contain polyunsaturated γ-linolenic acid (GLA), C18:3 ω6 which has pharmaceutical applications (schizophrenia, multiple sclerosis, diabetes and rheumatoid arthritis [2].

Until now, biologically active compounds were extracted from the biomass of algae by conventional solvent extraction. In this method a big amount of organic solvents, mostly expensive and toxic is used. Moreover, solvent extraction methods require additional steps of solvent recovery and post-treatment what may influence the physicochemical properties of compounds isolated from algae and their functionality especially in case of the contact with organic solvents [3]. Worth noting is that recent regulations aim to eliminate the use of organic solvents due to their environmental impact and health safety [2]. Therefore, supercritical fluid extraction (SFE) can be successfully used as an alternative to traditional extraction methods. Carbon dioxide is mostly applied as an extractant, considered as 'green', nontoxic and noncorrosive solvent, easily separated from the extract [3]. The advantage of SFE-$CO_2$ are mild extraction conditions, no consumption of organic solvents and no residues of such solvents will be present in extracts. The extraction process is relatively fast and safe for compounds which are thermally sensitive, besides fractionation of the compounds is facilitated. Nevertheless the high power consumption and high costs are thought as the main disadvantages of supercritical fluid extraction [4].

The methods of isolation of specific organic compounds originated from algal extracts, acting as a plant promoters, their separation and qualitative and quantitative determination will be discussed. Typical separation and isolation methods like solvent-solvent and solid phase extraction and fractionation as well as chromatographic methods for determination will be pointed. Additionally the biological activity and role of algal extracts and their components in plant growth and development will be presented with special respect to crop plants [5].

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**Literature**

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