New directions of biology and biotechnology in urban environmental sciences

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Abstract

Living organisms and biological methods are widely used in recycling urban waste and improving the quality of the urban environment. Urban biology is a branch of biology that studies organisms living in cities. We propose using the new term "urban biotechnology". Urban biotechnology is the use of biotechnological methods to protect the urban environment and in urban energy. Urban biotechnology in the future may be included in the curriculum of the Master's degree programs "Biotechnology", "Ecology " (profile "Applied Ecology"), "Chemistry" (profile " Chemistry of the urban environment "), and Chemical Engineering (profile "Chemical and Biochemical Engineering "). We consider it important to train specialists in the fields of urban biology and urban biotechnology. We hope that urban biotechnology and urban biology will become independent disciplines in the future.

Keywords: urban biotechnology; urban biology; ecology; chemical and biochemical engineering; de-icing agents.

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LETTER TO THE EDITOR

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Biological sciences are important in the study and solution of urban environmental problems. New directions of urban environmental sciences are of great importance - such as urban biology and urban biotechnology.

Urban biology

The term "urban biology" is rarely used [1,2]. Urban biology is a branch of biology that studies organisms living in cities. We suggest considering urban biology as an academic discipline.

Urban biotechnology

Applied biotechnology includes environmental biotechnology, medical biotechnology, industrial biotechnology, agricultural biotechnology, food biotechnology, bioenergy, and other directions. We propose using the new term "urban biotechnology", which is a recent direction in biotechnology and bioengineering. Urban biotechnology is the use of biotechnological methods to protect the urban environment and in urban energy. Energy urban biotechnology (urban bioenergy) could be an important area in the future. Establishing the microbial fuel technology as an alternative source for the generation of renewable energy sources can be a state of art technology owing to its high efficiency, cleanliness [3].

Living organisms and biological methods are widely used in recycling urban waste and improving the quality of the urban environment.

Biotechnological methods can increase the resilience of plants to urban environments. As an example, consider plants and de-icing agents. De-icing agents are a major cause of soil salinisation in urban ecosystems. The application of de-icing salts maintenance is recognized as a major environmental factor to the decline of urban plants [4,5]. Sodium chloride (NaCl) is one of the most used de-icing agents [6,7].

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How can you reduce the negative effects of de-icing agents on plants?

We suggest using urban biotechnology in greening. We have obtained plants that are resistant to de-icing agents [8,9,10]**.** We used cell selection to obtain salt-tolerant plants. This biotechnology has been used to obtain lawn grasses that are resistant to de-icing agents.

Urban biology studies aspects of life of organisms living in cities. Urban biotechnology uses biotechnological methods to protect the urban environment.

We consider it important to train specialists in the fields of urban biology and urban biotechnology.

Urban biotechnology in the future may be included in the curriculum of the Master's degree programs "Biotechnology", "Ecology " (profile "Applied Ecology"), "Chemistry" (profile "Chemistry of the urban environment"), and Chemical Engineering (profile "Chemical and Biochemical Engineering ").

Education bachelor's degree program "Urban Biological and Environmental Sciences"

We propose the creation of an educational programme in the future on "Urban Biological and Environmental Sciences".

We offer an education bachelor's degree program "Urban Biological and Environmental Sciences", direction "Urban Sciences" (Table 1).

Table 1. Disciplines in the education bachelor's degree program "Urban Biological and Environmental Sciences" (direction "Urban Sciences")

Academic discipline (specialist discipline)
Urban biotechnology
Urban ecology
Urban biology
Urban botany and phytotechnology
Basics of biotechnology, bioenergy, and bioengineering
Ecology
Chemistry of the urban environment
Protection of the urban environment

Academic disciplines " Ecology" and "Biology" provide fundamental biological and ecological training of students. The main specialist disciplines are Urban Biology, Urban ecology, Urban biotechnology, Chemistry of the urban environment, and Urban botany and phytotechnology.

We hope that urban biological sciences will become independent scientific disciplines in the future.

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SAŽETAK

Novi pravci biologije i biotehnologije u naukama o zaštiti urbane životne sredine

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(Pismo uredniku)

Živi organizmi i biološke metode imaju široku primenu u reciklaži gradskog otpada i poboljšanju kvaliteta urbane sredine. Urbana biologija je grana biologije koja proučava organizme koji žive u gradovima. Predlažemo korišćenje novog termina „urbana biotehnologija“. Urbana biotehnologija je upotreba biotehnoloških metoda za zaštitu urbane životne sredine i za primenu u urbanoj energiji. Urbana biotehnologija u budućnosti može biti uključena u nastavne planove i programe studijskih programa "Biotehnologija", "Ekologija" (profil "Primenjena ekologija"), "Hemija" (profil "Hemija urbane sredine"), i Hemijsko inženjerstvo (profil "Hemijsko i biohemijsko inženjerstvo“). Smatramo da je važno osposobljavanje stručnjaka u oblastima urbane biologije i urbane biotehnologije i nadamo se da će urbana biotehnologija i urbana biologija u budućnosti postati samostalne discipline.

Ključne reči: urbana biotehnologija; urbana biologija; zaštita životne sredine; hemijsko i biohemijsko inženjerstvo; agensi za odmrzavanje