

**Ministerul Educației și Cercetării
Institutul de Microbiologie și Biotehnologie**

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**Stresul oxidativ și efectele lui asupra
cianobacteriilor și microalgelor de interes
biotehnologic**

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Monografia elucidează aspectele apariției și evoluției stresului oxidativ în cadrul proceselor biotehnologice cu implicarea mai multor specii de microalge și cianobacterii de interes biotehnologic. În lucrare sunt descrise mecanismele și sursele de apariție a radicalilor liberi, care generează starea de stres oxidativ în celulele microalgelor și cianobacteriilor. De asemenea, monografia include o descriere a sistemelor de protecție antioxidantă specifice microalgelor și cianobacteriilor. Sunt arătate efectele negative ale fenomenului de supraproducere a radicalilor liberi și posibilitatea utilizării stresului în calitate de instrument biotehnologic de dirijare a componenței biochimice a biomasei cianobacteriilor și microalgelor. Sunt analizate mecanismele generale de apariție a stresului și particularitățile specifice stresului termic, de lumină, salin, precum și stresului provocat de xenobiotice, inclusiv de diferite tipuri nanoparticule. Este arătat rolul stresului oxidativ și a sistemelor celulare de protecție antioxidantă în procesele de bionanosinteză și de biofuncționalizare a nanoparticulelor cu utilizarea în calitate de matrice a microalgelor și cianobacteriilor.

Se recomandă biotehnologilor, ficologilor, studenților care își fac studiile în domeniul biologiei și biologiei aplicate.

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PREFAȚĂ

În condițiile epuizării resurselor naturale, schimbărilor climatice, deficitului de terenuri fertile, tehnologiile scientointensive, inclusiv biotehnologiile și în special bionanotehnologiile sunt direcțiile cele mai de perspectivă în contextul dezvoltării armonioase a țărilor mici, precum este Moldova. Producerea de microalge și cianobacterii în diferite scopuri se înscrie perfect în reorientarea majoră a economiei mondiale spre bioeconomie prietenoasă atât mediului, cât și omului. Biomasa de microalge și cianobacterii prezintă o sursă valoroasă de proteine, vitamine, microelemente, lipide și carbohidrați. Mai multe specii de microalge și cianobacterii, cum ar fi *Arthrospira platensis*, *Porphyridium cruentum*, *Dunaliella salina*, *Haematococcus pluvialis*, sunt recunoscute ca sigure pentru consumul uman și animal. Unele dintre acestea, de exemplu, *Arthrospira platensis*, cunoscută ca *spirulina*, sunt evaluate ca alimente complete din punct de vedere nutrițional, potrivite pentru îmbunătățirea valorii hranei pentru oameni și animale.

Biomasa microalgelor și cianobacteriilor este o materie primă potrivită pentru obținerea diferitor produse alimentare și farmaceutice. Spre exemplu, din microalge și cianobacterii, în cadrul unui singur flux tehnologic, se obțin proteine, pigmenți, acizi grași polinesaturați, antioxidanți de diferită natură, polizaharide sulfatate; minerale și metale fixate în moleculele organice, ceea ce oferă o valoare adăugată importantă produselor obținute. O asemenea abordare este orientată spre satisfacerea cerințelor pieței globale de produse alimentare, farmaceutice și nutraceutice într-un mod eficient și durabil din punct de vedere ecologic.

Productivitatea obiectelor ficologice o depășește esențial pe cea a plantelor de cultură, iar suprafețele utilizate pot fi reduse semnificativ. De asemenea, există numeroase instrumente biotehnologice și moleculare (utilizarea diferitor stimulatori specifici, inclusiv nanomateriale, modelarea unui set de condiții fizice ce determină răspunsuri specifice, instrumente avansate de inginerie genetică ș.a.) pentru a dezvolta biotehnologii cu o eficiență mult mai înaltă ca cele tradiționale.

Toate aceste intervenții orientate spre îmbunătățirea proprietăților biotehnologice ale microalgelor și cianobacteriilor, pe lângă efectele pozitive preconizate, pot provoca și anumite reacții adverse, primul dintre care este stresul oxidativ, generat de supraacumularea speciilor reactive ale oxigenului. Formarea de radicali liberi este un proces inevitabil și absolut necesar organismelor vii, atunci când este vorba despre radicalii primari. Aceștia joacă roluri importante în transducția de semnale, creșterea și diferențierea celulelor, realizării apoptozei ș.a. Sistemele antioxidante ale celulelor sunt adaptate la un anumit nivel al speciilor reactive și asigură o protecție eficientă și un echilibru redox perfect în condiții fiziologice normale.

Condițiile tehnologice, inclusiv cele care asigură producerea de biomasă ficologică pot fi o sursă de stres și pot provoca un dezechilibru dintre radicalii liberi și antioxidanți în biomasa cianobacteriilor și microalgelor. În aceste condiții biomasa produsă poate fi o potențială sursă de pericol, conținând de rând cu diferiți compuși valoroși, radicali liberi și produse ale degradării oxidative ale compușilor organici. Cunoașterea potențialelor pericole și managementul lor eficient este o condiție a siguranței biotehnologiilor aplicate și a produselor obținute.

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