J Fungi (Basel). 2021 Oct 16;7(10):867. doi: 10.3390/jof7100867.

Effect of High-Temperature Stress on Plant Physiological Traits and Mycorrhizal Symbiosis in Maize Plants

Sonal Mathur [1 2], Richa Agnihotri [3], Mahaveer P Sharma [3], Vangimalla R Reddy [2], Anjana Jajoo [1 4]

Affiliations

PMID: 34682289 PMCID: PMC8539748 DOI: 10.3390/jof7100867

Free PMC article

Abstract

Increasing high temperature (HT) has a deleterious effect on plant growth. Earlier works reported the protective role of arbuscular mycorrhizal fungi (AMF) under stress conditions, particularly influencing the physiological parameters. However, the protective role of AMF under high-temperature stress examining physiological parameters with characteristic phospholipid fatty acids (PLFA) of soil microbial communities including AMF has not been studied. This work aims to study how high-temperature stress affects photosynthetic and below-ground traits in maize plants with and without AMF. Photosynthetic parameters like quantum yield of photosystem (PS) II, PSI, electron transport, and fractions of open reaction centers decreased in HT exposed plants, but recovered in AMF + HT plants. AMF + HT plants had significantly higher AM-signature 16:1ω5cis neutral lipid fatty acid (NLFA), spore density in soil, and root colonization with lower lipid peroxidation than non-mycorrhizal HT plants. As a result, enriched plants had more active living biomass, which improved photosynthetic efficiency when exposed to heat. This study provides an understanding of how AM-mediated plants can tolerate high temperatures while maintaining the stability of their photosynthetic apparatus. This is the first study to combine above- and below-ground traits, which could lead to a new understanding of plant and rhizosphere stress.

Keywords: PSI; PSII; arbuscular mycorrhizal fungi; fatty acid biomarkers; high temperature; maize (Zea mays L.); photosynthesis.

Figures

Review Physiol Mol Biol Plants. 2021 Nov;27(11):2589-2603. doi: 10.1007/s12298-021-01091-2. Epub 2021 Nov 3.

Role of arbuscular mycorrhizal fungi as an underground saviuor for protecting plants from abiotic stresses

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Abstract

To increase food production, prevalent agricultural malpractices such as intensive use of fertilizers and pesticides have led to degradation of the ecosystem. In this situation, there is a need to encourage eco-friendly and sustainable methods for improving crop production under ever increasing abiotic stress conditions. One such method can be through use of arbuscular mycorrhizal fungi (AMF or AM fungi). Soil microorganisms such as AMF serve as a link between plants and the soil resources. AMF represent a key functional group of soil microbiota that is fundamental for soil fertility, crop productivity, yield, quality and ecosystem resilience. AMF potentially increases bioavailability of water as well as various micro- and macro- nutrients which enhances production of plant photosynthates. In plants, inoculation with AMF led to increased photochemical efficiency ultimately resulting in enhanced plant growth. In this review we have summarized amelioration of drought or water scarcity, salt stress, increasing temperature or high temperature and heavy metal stresses etc. in crop plants by AMF through its effects on various physiological and biochemical processes including photosynthesis. The review also highlights AMF induced tolerance and adaptive mechanisms which protect crops from stresses. We conclude the review with a discussion of unseen issues and suggestions for future researches.

Keywords: Abiotic stresses; Arbuscular mycorrhizal fungi; Crop improvement; Nutrient availability; Photosynthesis.

Related information

H2O2 signaling regulates seed germination in ZnO nanoprimed wheat (Triticum aestivum L.) seeds for improving plant performance under drought stress

Environmental and Experimental Botany (IF5.545), **Pub Date : 2021-06-23**, *DOI: 10.1016/j.envexpbot.2021.104561* (http://doi.org/10.1016/j.envexpbot.2021.104561)

Prabha Rai-Kalal, Rupal Singh Tomar, Anjana Jajoo

Nanopriming has proved to be an effective technique to protect plants from various stresses. The aim of the present work is to investigate the underlying mechanism of zinc oxide (ZnO) nanopriming in imparting drought stress tolerance in wheat. The changes in primed and unprimed wheat plants associated drought stress were studied by monitoring their physiological and biochemical performance. Results showed that zinc oxide nanoparticles (ZnO NPs) pre-treatment prevented chlorophyll degradation under drought condition thereby improving overall photosynthetic performance and overall plant growth. Study *a* fluorescence induction kinetics showed a drastic increase in various photosynthetic parameters in primed drought stressed plants. Nanopriming seems to protected the photosynthetic apparatus of plant by improving the efficiency of primary photochemistry of PSII under drought stress conditions. Furthermore, activity of antioxidant enzymes such as catalase (CAT), peroxidase (POD), superoxide dismutase (SOD) and glutathione reductase (GR) as well as malondialdehyde (MDA) content were decreased significantly in nanoprimed drought stressed (NP + DS) plants as compared to unprimed drought stressed DS) plants. Generation of more reactive oxygen species (ROS) mainly hydrogen peroxide (H_2O_2) was observed in nanoprimed germinating seeds. We prop role of H_2O_2 to act as signaling molecule in improving seed germination and vigor by enhancing activity of α-amylase. Lower levels of reactive oxygen spec (ROS) production in NP + DS plants was observed which indicates better tolerance to drought stress in nanoprimed plants. It is concluded that nanoprimin facilitates improved seed germination and increased seedling vigor through H_2O_2 signaling networks.

Cyclic Electron Flow Plays an Important Role in Protecting PSI against Fluoride Stress in Maize Plant

Singh B and Jajoo A

Published on: 2021-06-21

Abstract

The problem of environmental contamination by fluoride compounds is linked to industrial operations and artificial fertilizers. This raises a possible environmental danger for plants. The toxic effects of fluoride on the process of photosynthesis, particularly energy conversion of Photosystem I (PSI) and Photosystem II (PSII) in maize plants (Zea mays L) has been studied. By evaluating the performance of both PSI and PSII, which act as an internal environmental sensor, it was revealed that activity of both photosystems was negatively affected by fluoride. However, the quantum yield of PSII, Y (II), was reduced at all concentrations of NaF, whereas the quantum yield of PSI, Y (I), decreased at 400 mg/l N The decline in Y (II) was accompanied by an increase in non-regulated energy dissipation, Y (e decrease in Y (I) induced by fluoride was caused by donor-side, and acceptor side limitation PSI. Electron transport (ETRI and ETRII) decreased as the quantum yield of Y (NPQ) was increased by fluoride treatment. Cyclic electron flow (CEF) was activated and was associated with the inhibition of linear electron flow (LEF) after fluoride treatment. The inhibition of LEF and induction of CEF seems to be es ial for the tolerance of PSI to fluoride toxicity.

Review Front Microbiol. 2021 Jun 22;12:655620. doi: 10.3389/fmicb.2021.655620. eCollection 2021.

Tapping Into Actinobacterial Genomes for Natural Product Discovery

Tanim Arpit Singh [1] [2], Ajit Kumar Passari [3], Anjana Jajoo [2], Sheetal Bhasin [1], Vijai Kumar Gupta [4], Abeer Hashem [5] [6], Abdulaziz A Alqarawi [7], Elsayed Fathi Abd Allah [7]

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PMID: 34239507 PMCID: PMC8258257 DOI: 10.3389/fmicb.2021.655620

Free PMC article

Abstract

The presence of secondary metabolite biosynthetic gene clusters (BGCs) makes actinobacteria well-known producers of diverse metabolites. These ubiquitous microbes are extensively exploited for their ability to synthesize diverse secondary metabolites. The extent of their ability to synthesize various molecules is yet to be evaluated. Current advancements in genome sequencing, metabolomics, and bioinformatics have provided a plethora of information about the mechanism of synthesis of these bioactive molecules. Accessing the biosynthetic gene cluster responsible for the production of metabolites has always been a challenging assignment. The genomic approach developments have opened a new gateway for examining and manipulating novel antibiotic gene clusters. These advancements have now developed a better understanding of actinobacterial physiology and their genetic regulation for the prolific production of natural products. These new approaches provide a unique opportunity to discover novel bioactive compounds that might replenish antibiotics' exhausted stock and counter the microbes' resistance crisis.

Keywords: actinobacteria; antibiotics; biosynthetic gene cluster; genomics; secondary metabolites.

Figures

Funct Plant Biol. 2021 Aug;48(9):905-915. doi: 10.1071/FP21079.

Seed nanopriming by silicon oxide improves drought stress alleviation potential in wheat plants

Prabha Rai-Kalal [1], Rupal S Tomar [1], Anjana Jajoo [2]

Affiliations

PMID: 34366002 DOI: 10.1071/FP21079

Abstract

The present study explored the effectiveness of SiO2 nanoparticles (NPs) as seed priming agent (15 mg L-1) to improve drought tolerance in the wheat cultivar HI 1544. Seed germination studies showed significant enhancement in the rate of seed germination, seedling growth and vigour, seed water uptake, and amylase activity in nanoprimed (NP) seeds compared with unprimed (UP) seeds. Pot experiments using wheat plants subjected to drought stress showed that SiO2 nanopriming enhanced the ability of wheat plants to withstand water deficit conditions by balancing the production of reactive oxygen species and the activity of enzymatic antioxidants like peroxidase, catalase, and superoxide dismutase. Investigations of photosynthetic parameters showed that under drought conditions, nanoprimed plants had a higher number of active reaction centres, high absorbance, trapping, and electron transport rates compared with unprimed plants. These results suggest the effects of silicon nanopriming in enhancing drought tolerance in wheat by alleviating drought induced inhibition of plant photosynthetic machinery and maintaining biochemical balance, ultimately resulting in an increase in biomass production. Results revealed the use of silicon oxide nanopriming to be a good option to increase drought tolerance in wheat plants.

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Journal of Agronomy and Crop Science / Volume 207, Issue 4 / p. 577-588

REVIEW ARTICLE

Behind the scene: Critical role of reactive oxygen species and reactive nitrogen species in salt stress tolerance

Rupal Singh Tomar, Sunita Kataria, Anjana Jajoo

First published: 20 March 2021
https://doi.org/10.1111/jac.12490

Abstract

Salinity is one of the most important abiotic factors which affects plant growth and development and reduces crop productivity. Plants have stress tolerance ability to respond to a particular type of stress. For salt stress alleviation, plants retain specific mechanisms, such as activation of signalling cascades, ion channels, receptors, hormonal stimulation, ion exchange, osmolytes and antioxidant enzymes which are involved either directly or indirectly in plant protection. In plants, reactive oxygen species (ROS) and reactive nitrogen species (RNS) are produced in different cell compartments and involved in the “oxidative signalling” mechanism. Based on the recent studies in signalling and mechanisms for salt tolerance in plant, we explored the role of the salt overly sensitive system (SOS) related to antiporters of plasma and mitogen-activated protein kinase (MAPK) cascades. Considering the importance of ROS and RNS, the present review has focused on different aspects and mechanisms that play key role in plants cell signalling network in response to salinity stress. In addition, this review highlights the differential expression of ROS, RNS and various antioxidative enzymes in C3, C4 and CAM plants. Moreover, the strategies for alleviation of salt stress such as magnetopriming, nanopriming, biopriming and arbuscular mycorrhizal fungi (AMF) in plants to achieve improved salt tolerance in crops under field conditions and their effects through ROS and RNS is also discussed. We conclude the review with a discussion of unseen issues and suggestions for future researches.

Study of high temperature stress induced damage and recovery in photosystem II (PSII) and photosystem I (PSI) in Spinach leaves (*Spinacia oleracia*)

- Original Article
- Published: 07 January 2021

Study of high temperature stress induced damage and recovery in photosystem II (PSII) and photosystem I (PSI) in Spinach leaves (*Spinacia oleracia*)

- Divya Agrawal[1] &
- Anjana Jajoo ORCID: orcid.org/0000-0002-2333-0067[1]

Journal of Plant Biochemistry and Biotechnology **volume 30**, pages 532–544 (2021)Cite this article

Abstract

Plant Physiol Biochem. 2021 Mar;160:341-351. doi: 10.1016/j.plaphy.2021.01.032. Epub 2021 Jan 27.

Priming with zinc oxide nanoparticles improve germination and photosynthetic performance in wheat

Prabha Rai-Kalal [1], Anjana Jajoo [2]

Affiliations

PMID: 33548801 DOI: 10.1016/j.plaphy.2021.01.032

Abstract

The present study is the first attempt to demonstrate the beneficiary effects of seed priming with zinc oxide nanoparticles (ZnO NPs) in wheat cultivar H-I 1544. Wheat seeds primed with ZnO NPs (10 mg/L) showed a significant positive influence on seed germination performance and vigour index as compared to unprimed (control) and hydroprimed seeds. Furthermore, nanopriming also enhanced seed water uptake resulting in enhanced α-amylase activity. Content of photosynthetic pigments in nanoprimed plants (chlorophyll a, chlorophyll b and total chlorophyll content) was significantly enhanced. Chlorophyll a fluorescence measurements were performed 30 days after cultivation of nanoprimed seeds to investigate the effect of nanopriming on plant photosynthetic performance. Results suggested that ZnO NPs affects the overall primary photochemistry by enhancing the performance of water splitting complex at donor side of PSII (Fv/Fo). The numbers of active reaction centres (RC) per chlorophyll molecule were increased in nanoprimed plants followed by increase in the absorption (ABS), efficiency of excitation energy trapping (TR) and electron transport (ET) from active reaction centres. The impact of nanopriming on oxidative status of plants was also studied by measuring the activity enzymes like peroxidase (POD), catalase (CAT), superoxide dismutase (SOD) and degree of lipid peroxidation. A prominent decrease in the activity of these enzymes was observed which may be attributed to low reactive oxygen species (ROS) levels in nanoprimed plants as compared to control. This is the first report showing ZnO NPs as a promising seed priming agent to improve germination as well as photosynthetic performance of wheat seeds.

Keywords: Chlorophyll a fluorescence; Nanopriming; Photosystem II; Wheat; Zinc oxide nanoparticles.

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ORIGINAL RESEARCH article

Front. Plant Sci., 10 February 2021 | https://doi.org/10.3389/fpls.2021.627012 (https://doi.org/10.3389/fpls.2021.627012)

Regulation of Photosystem II Heterogeneity and Photochemistry in Two Cultivars of C_4 Crop Sugarcane Under Chilling Stress

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[4]Department of Agricultural Botany, Tanta University, Tanta, Egypt
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In subtropical regions, chilling stress is one of the major constraints for sugarcane cultivation, which hampers yield and sugar production. Two recently released sugarcane cultivars, moderately chilling tolerant Guitang 49 and chilling tolerant Guitang 28, were selected. The experiments were conducted in the controlled environment, and seedlings were exposed to optimum (25°C/15°C), chilling (10°C/5°C), and recovery (25°C/15°C) temperature conditions. PSII heterogeneity was studied in terms of reducing side and antenna size heterogeneity. Under chilling, reducing side heterogeneity resulted in increased number of Q_B non-reducing centers, whereas antenna side heterogeneity resulted in enhanced number of inactive β centers in both cultivars, but the magnitude of change was higher in Guitang 49 than Guitang 28. Furthermore, in both cultivars, quantum efficiency of PSII, status of water splitting complex, and performance index were adversely affected by chilling, along with reduction in net photosynthesis rate and nighttime respiration and alterations in leaf optical properties. The extents of negative effect on these parameters were larger in Guitang 49 than in Guitang 28. These results reveal a clear differentiation in

Ecotoxicology. 2021 Mar;30(2):268-276. doi: 10.1007/s10646-020-02334-w. Epub 2021 Jan 14.

Enzymatic pathway involved in the degradation of fluoranthene by microalgae Chlorella vulgaris

Rupal Singh Tomar [1], Anjana Jajoo [2 3]

Affiliations

PMID: 33443715 DOI: 10.1007/s10646-020-02334-w

Abstract

In the present study, the potential of a microalga, Chlorella vulgaris, was assessed for the bioremediation of fluoranthene (FLT), a four ring polycyclic aromatic hydrocarbon (PAH). With an initial cell density of C. vulgaris (OD_{680} = 0.100), 54-58% of 25 µM FLT was removed from the growth medium within 3 days and almost 90-94% after 7 days of incubation. Enzymatic studies confirmed that the enzyme involved in FLT metabolism was catechol 2,3, dioxygenase (C2,3D) which increased almost 2 times in 5 µM FLT and 2.4 times in 25 µM FLT inoculated culture. Activity of dehydrogenase and superoxide dismutase (SOD) was significantly reduced, while peroxidase (POD) activity was induced very prominently in FLT inoculated cultures. Changes in growth, physiological parameters and biochemical compositions of the algae with 5 µM and 25 µM FLT were also analyzed and compared to control. The analysis showed that parameters including growth rate, biomass, chlorophyll, carbohydrate and protein contents, were negatively affected by the higher concentration of FLT, whereas the lipid and carotenoids content significantly increased. To our knowledge, this is the first report to suggest the role of C2,3D pathway for the metabolism of FLT in a eukaryotic algae.

Keywords: Bioremediation; Catechol 2,3, dioxygenase; Chlorella vulgaris; Fluoranthene; Polycyclic aromatic hydrocarbons (PAHs).

Related information

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[Now published in full after the initial publication as an Epub ahead of print on Sept 15, 2020, at www.fluorideresearch.online/epub/files/100.pdf]

COMPARATIVE ANALYSIS OF FLUORIDE INHIBITION OF PHOTOSYNTHESIS IN C_3 (WHEAT) AND C_4 (MAIZE) PLANTS

Bhupendra Singh,[a] Anjana Jajoo[b,*]

Indore, India

ABSTRACT: Effects of fluoride (F) on photosynthetic activity of maize and wheat plants were studied by analyzing chlorophyll *a* (Chl *a*) fluorescence induction kinetics. The results revealed that F affects the overall primary photochemistry by inhibiting the number of active reaction centres (RC) of Photosystem II (PSII). However, the efficiency of each of the active RC is not affected. As compared to wheat (C_3 plant), photosynthesis of maize (C_4 plant) was relatively more inhibited by F toxicity. Results from the present investigation strongly indicate that the most significantly changed Chl *a* fluorescence parameters could be used as an efficient tool for the diagnosis of F toxicity in maize. The present findings may be helpful to select suitable crops in F endemic areas.

Keywords: Chlorophyll *a* fluorescence; Maize; Photosynthesis; Photosystem II; Wheat.

INTRODUCTION

Fluoride (F) exists in soil, air, and water, in varying amounts, naturally and/or due to diverse industrial activities.[1,2] Chronic exposure to F can be toxic and cause varying degrees of pathological changes in humans[3,4] and domestic animals.[5-8] F exposure also induces various pathological changes in plants.[9] However, very limited research work has been conducted so far on F exposure in relation to morphological, biochemical, photochemical, and physiological alterations in plants.[9]

C_4 plants such as maize, sorghum, and sugarcane, have an approximately 50% higher photosynthesis efficiency than C_3 plants such as rice, wheat, and potato.[10] Photosynthesis is a sensitive and vital process which has an important affect on crop yield and is significantly influenced by any kind of environmental stress. Varying concentrations of F cause reduction in chlorophyll content in *Cyamopsis tetragonoloba (*cluster bean),[11] *Oryza sativa* (rice),[12] and *Citrullus lanatus* (watermelon) [13] which ultimately reduce the photosynthetic efficiency under F stress. It has been reported that crops and crop varieties respond differently to increased soil F concentration and accumulate differential F amounts in their vegetative and reproductive parts.[14] The toxicity of F adversely affects germination, growth, mineral nutrition, photosynthesis, breathing, cell enzyme activity, and crop yield.[15] However, the mechanism of F toxicity in plants is still unclear. Moreover, no comparative study has yet been performed on effects of F on C_3 (wheat) and C_4 (maize) plants. Therefore, in the present study, chlorophyll *a* (Chl *a*) fluorescence kinetics were measured to evaluate the efficiency of various components involved in the photosynthesis process. Chl *a* fluorescence analysis provides relevant information about the physiology of plants growing under abiotic stress and is particularly suitable as an indicator of photosystem II (PSII) efficiency.[16]

MATERIAL AND METHODS

Growth conditions: Wheat (*Triticum aestivum*; Purna HI 1544) and maize (*Zea mays*; Ganga safed) cultivars were used as plant material. Five uniform seeds were

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Biocatalysis and Agricultural Biotechnology
Volume 29, October 2020, 101766

Optimization of various encapsulation systems for efficient immobilization of actinobacterial glucose isomerase

Tanim Arpit Singh [a, b], Anjana Jajoo [b], Sheetal Bhasin [a]

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https://doi.org/10.1016/j.bcab.2020.101766

Highlights

- Immobilization of glucose isomerase was carried out by alginate, chitosan and agar.
- Encapsulation systems were optimized for enhancing enzyme activity and stability.
- High fructose corn syrup production was done using immobilized glucose isomerase.

Abstract

Glucose isomerase (GI) converts glucose into fructose by a reversible reaction. This reaction is industrially valuable for the production of high fructose corn syrup (HFCS) which is used as a sweetener by food and beverage industries. GI being an expensive enzyme necessitates its usage in immobilized form for increasing its reusability and economic viability. Global HFCS production accounts to 10 million tons which is highest among products yielded by immobilized process. Current study evaluates different encapsulation systems for immobilization of GI produced by *Streptomyces* sp. T.S.A.KP which was found to be *Streptomyces enissocaesilis* (Accession number **MN911386**). This is the first report of extracellular GI production by a strain of *Streptomyces enissocaesilis*. GI was immobilized using chitosan, alginate and agar to enhance its stability and conversion efficiency. The concentration of polymeric gel with cross linking agent was optimized to get ideal pore size for maximum GI activity. Immobilization on chitosan significantly increased ($P < 0.05$) the GI activity by 47.18%. Agar increased the GI activity by 19.7% and alginate exhibited 18.5% higher activity than soluble enzyme. Thermal stability was increased by all three processes but maximally enhanced by chitosan immobilization. Chitosan immobilized GI exhibited enhanced activity at acidic pH whereas agar immobilization enhanced GI activity in alkaline range. The chitosan-TPP immobilization proved better than other encapsulation systems. HFCS was produced using immobilized GI. High performance liquid chromatography (HPLC) analysis of HFCS revealed that it comprised of an equilibrium mixture of glucose and fructose.

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Short communication

Arbuscular mycorrhizal fungi protects maize plants from high temperature stress by regulating photosystem II heterogeneity

Sonal Mathur [a], Anjana Jajoo [a, b]

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https://doi.org/10.1016/j.indcrop.2019.111934

Abstract

Although protective role of arbuscular mycorrhizal fungi (AMF) during abiotic stress condition is well known, however, the mechanism of it is still unclear. In order to elucidate the role of AMF in regulating photosystem (PS) II heterogeneity, experiments were carried out with maize plants grown in soil enriched with AMF that experienced high temperature (HT) stress. Chlorophyll *a* fluorescence induction kinetics were performed to measure PSII heterogeneity for control, AMF, AMF + HT, and HT in maize plants. Presence of AMF was able to provide conditions that favour conversion of inactive β and γ centers to active α centers, and Q_B non-reducing centers to reducing centers in maize plants. Such possibility of AMF action was not reported earlier in maize plants under high temperature stress. This is first ever study to report role of AMF in regulating PSII heterogeneity under high temperature stress in maize plants. The study will be helpful to use PSII heterogeneity as a bioindicator to know about level of stress in plants.

Introduction

Environmental variations have led to an increase in temperature range. This increase in temperature results in decreased plant growth, productivity and biomass. Photosynthesis is considered as one of the most susceptible processes to high temperature stress that alters photosystem II (PSII) oxido-reduction characteristics. HT downregulates the electron transport chain in PSII (Mathur and Jajoo, 2014; Kalaji et al., 2016). In response to high temperature stress, plants evoke certain defence mechanisms in their physiological behaviour for their survival. Maize (*Zea mays* L.) is one of the most widely grown cereals of world (Fahad et al., 2017). Maize production and productivity varies constantly depending on environmental conditions (Ammani et al., 2012). Temperature higher than 30 °C may affect growth and development of maize plants.

In rhizosphere region, microorganism are present in consortiums that are beneficial for plant growth and actively participate in mineral nutrient exchange and maintain soil fertility for a longer period (Priyadharsini and Muthukumar, 2015). Arbuscular mycorrhizal fungi (AMF) is one of these groups of root obligate biotrophs that depend solely on their host plant for completion of their life cycle. AMF make availability of water, micro, and macro nutrients to their host, and inturn host plant provides photosynthates (carbohydrates) to AMF. AMF also contribute to alleviate effects of biotic and abiotic stresses (high temperature, drought, salinity stress) in plants (Banuelos et al., 2014; Pérez et al., 2016; Mathur et al., 2018, 2019).

Another mechanism by which mycorrhizal fungi protect plants under high temperature stress is by providing better water uptake to their host plant due to presence of external hyphae which is often associated with increased root or plant hydraulic conductivity to water flow and favourable adjustment of the osmotic balance and composition of carbohydrates (Augé, 2004; Zhu et al., 2011).

Photosynth Res. 2020 Dec;146(1-3):197-211. doi: 10.1007/s11120-019-00692-z. Epub 2019 Nov 21.

Protection of PSI and PSII complexes of wheat from toxic effect of anthracene by Bacillus subtilis (NCIM 5594)

Lakshmi Jain [1], Anjana Jajoo [2]

Affiliations

PMID: 31755008 DOI: 10.1007/s11120-019-00692-z

Abstract

Contamination of polycyclic aromatic hydrocarbons (PAHs) in environment indicates a serious problem to the present era. These are carcinogenic and mutagenic compounds and pose a potential risk to photosynthetic organisms. The present study illustrates the protection of Photosystem I and Photosystem II complexes of wheat plant by Bacillus subtilis (NCIM 5594) from toxic effects of anthracene (ANT). Initially, Chl a fluorescence induction curve measurement revealed declined J-I and I-P phase in ANT-treated plants. Efficiency of light absorption, trapping, and electron transport was reduced in ANT-treated plants, while in ANT + Bacillus subtilis (NCIM 5594)-treated plants value of these parameters was restored. Effect of ANT and ANT + Bacillus subtilis (NCIM 5594) on energy conversion of Photosystem I and Photosystem II was measured. Quantum yield of Photosystem I (YI) and Photosystem II (YII) was decreased in the presence of ANT, while these values were recovered in ANT + Bacillus subtilis (NCIM 5594)-treated plants. Reduction in Y(II) was associated with an increase in non-regulated energy dissipation NO. Likewise the reduction of Y(I) was induced due to donor-side and acceptor-side limitation of Photosystem I caused by toxic effect of ANT. Toxic effects of ANT on electron transport rate (ETR_I and ETR_{II}) were found to be reduced in ANT + Bacillus subtilis (NCIM 5594)-treated plants. Activation of Cyclic electron flow around Photosystem I in ANT-treated plants was recovered by bacteria. It was concluded that toxic effect of ANT on Photosystem I and Photosystem II complexes was recovered by Bacillus subtilis (NCIM 5594) strain, and thus it is useful strain for crop improvement in ANT-polluted soil.

Keywords: Anthracene; Bacillus subtilis (NCIM 5594); PSI; PSII; Polycyclic aromatic hydrocarbons (PAHs); Wheat.

Related information

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Production and application of glucose isomerase from *Streptomyces enissocaesilis* and amylase from *Streptomyces* sp. for the synthesis of high fructose corn syrup

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- Research Article
- Published: 09 November 2020

Production and application of glucose isomerase from *Streptomyces enissocaesilis* and amylase from *Streptomyces* sp. for the synthesis of high fructose corn syrup

- Tanim Arpit Singh[1,2],
- Anjana Jajoo[2] &

J Biochem Mol Toxicol. 2021 Aug;35(8):e22814. doi: 10.1002/jbt.22814. Epub 2021 May 28.

Syringic acid, a novel thyroid hormone receptor-β agonist, ameliorates propylthiouracil-induced thyroid toxicity in rats

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PMID: 34047416 DOI: 10.1002/jbt.22814

Abstract

The aim of this study was to evaluate the potential of syringic acid (SA) against propylthiouracil (PTU)-induced hypothyroidism in rats. SA at a prestandardized dose, 50 mg/kg/day, was orally administered to PTU-induced hypothyroid rats for 30 days, and alterations in the levels of serum triiodothyronine (T_3), thyroxine (T_4), thyrotropin (TSH), alanine transaminase (ALT), and aspartate transaminase (AST); tumor necrosis factor-α (TNF-α) and interleukin-6 (IL-6); total cholesterol (CHOL) and triglycerides (TG); hepatic lipid peroxidation (LPO) and antioxidants (superoxide dismutase, catalase, glutathione peroxidase, and glutathione content), as well as histological changes in liver and thyroid were examined. The molecular interactions of the ligand, SA, with thyroid-related protein targets, such as human thyroid hormone receptor β (hTRβ), and thyroid peroxidase (TPO) protein, were studied using molecular docking. Whereas in hypothyroid animals, T_4, T_3, and antioxidants were decreased, there was an increase in TSH, TNF-α, IL-6, ALT, AST, and hepatic LPO; administration of SA in PTU-induced animals reversed all these indices to near normal levels. SA also improved the histological features of liver and thyroid gland. Our study clearly demonstrates SA as a novel thyroid agonist for augmenting the thyroid functions in rats. Molecular docking analysis reveals that SA possesses good binding affinity toward both the targets, hTRβ and TPO. Through this approach, for the first time we provide the evidence for SA as a novel thyroid agonist and suggest a receptor-mediated mechanism for its thyroid stimulatory potential.

Keywords: TPO; antioxidants; hTRβ; hypothyroidism; inflammation; syringic acid.

Related information

MedGen
PubChem Compound
PubChem Compound (MeSH Keyword)
PubChem Substance

Skip to main content

Agnucastoside C, isolated from *Moringa oleifera* ameliorates thyrotoxicosis and liver abnormalities in female mice

Peel extract of *Trichosanthes dioica* has the potential to ameliorate T_4-induced thyrotoxicosis and hyperglycemia in mice

- Research Article
- Published: 27 January 2020

Peel extract of *Trichosanthes dioica* has the potential to ameliorate T_4-induced thyrotoxicosis and hyperglycemia in mice

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- Anand Kar[1] &
- Sunanda Panda[2]

Advances in Traditional Medicine **volume 20**, pages 99–105 (2020)Cite this article

Abstract

Peels of the vegetables are usually considered as kitchen wastes. This view may not hold true for all types of vegetable peels. In this investigation, we have primarily tested the unknown potential of *Trichosanthes dioica* (*T. dioica*) peel extract in L-thyroxin (L-T_4)-induced thyrotoxicosis and hyperglycemia. Swiss albino male mice were made thyrotoxic by injecting pre-standardized dose of L-thyroxin (L-T_4) for 12 days and in them the effects of test

Biosciences Biotechnology Research Asia

In Vitro Assessment of Chromium, Lead, Cadmium and Nickel Tolerance of B. Clausii, a Prospective Probiotic Microorganism for in Vivo Bioremediation (http://www.biotech-asia.org/vol17no2/in-vitro-assessment-of-chromium-lead-cadmium-and-nickel-tolerance-of-b-clausii-a-prospective-probiotic-microorganism-for-in-vivo-bioremediation/)

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DOI : http://dx.doi.org/10.13005/bbra/2830 (http://dx.doi.org/10.13005/bbra/2830)

ABSTRACT: Researches have demonstrated the ability of probiotic microorganisms to prevent and treat ailments especially those associated with the gastrointestinal tract. Probiotics like *Lactobacillus* spp. have also displayed the property of bioremediation of heavy metals under *in vitro* as well as *in vivo* conditions. The aim of this study was to assess the effects of chromium, lead, cadmium and nickel stress on the properties of *B. clausii*, a probiotic species of genus *Bacillus*. The minimum inhibitory concentration (MIC) of the organism under test was determined for Cr (VI), Pb (II) Cd (II) and Ni (II), followed by assessment of morphological and biochemical properties of the *B. clausii*, antibiotic sensitivity and probiotic efficacy by acid and bile tolerance assays. *B. clausii* exhibited exceptionally high MICs for the

Mediators Inflamm. 2020 Nov 10;2020:3429541. doi: 10.1155/2020/3429541. eCollection 2020.

Plasma Proteome Profiling of Coronary Artery Disease Patients: Downregulation of Transthyretin-An Important Event

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PMID: 33299376 PMCID: PMC7707994 DOI: 10.1155/2020/3429541

Free PMC article

Abstract

Coronary artery disease (CAD) is a prevalent chronic inflammatory cardiac disorder. An early diagnosis is likely to help in the prevention and proper management of this disease. As the study of proteomics provides the potential markers for detection of a disease, in the present investigation, attempt has been made to identify disease-associated differential proteins involved in CAD pathogenesis. For this study, a total of 200 selected CAD patients were considered, who were recruited for percutaneous coronary intervention (PCI) treatment. The proteomic analysis was performed using two-dimensional gel electrophoresis (2-DE) and MALDI-TOF MS/MS. Samples were also subjected to Western blot analysis, enzyme-linked immunosorbent assay (ELISA), peripheral blood mononuclear cells isolation immunofluorescence (IF) analysis, analytical screening by fluorescence-activated cell sorting (FACS), and in silico analysis. The representative data were shown as mean ± SD of at least three experiments. A total of 19 proteins were identified. Among them, the most abundant five proteins (serotransferrin, talin-1, alpha-2HS glycoprotein, transthyretin (TTR), fibrinogen-α chain) were found to have altered level in CAD. Serotransferrin, talin-1, alpha-2HS glycoprotein, and transthyretin (TTR) were found to have lower level, whereas fibrinogen-α chain was found to have higher level in CAD plasma compared to healthy, confirmed by Western blot analysis. TTR, an important acute phase transport protein, was validated low level in 200 CAD patients who confirmed to undergo PCI treatment. Further, in silico and in vitro studies of TTR indicated a downexpression of CAD in plasma as compared to the plasma of healthy individuals. Lower level of plasma TTR was determined to be an important risk marker in the atherosclerotic-approved CAD patients. We suggest that the TTR lower level predicts disease severity and hence may serve as an important marker tool for CAD screening. However, further large-scale studies are required to determine the clinical significance of TTR.

J Food Sci Technol. 2020 Aug;57(8):2819-2827. doi: 10.1007/s13197-020-04313-9. Epub 2020 Mar 6.

Evaluation of antithyroid potential of *Luffa acutangula* peel extract and its chemical constituents as identified by HR–LC/MS

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Affiliations

PMID: 32624590 PMCID: PMC7316940 DOI: 10.1007/s13197-020-04313-9

Free PMC article

Abstract

Although some reports are there indicating the medicinal values of fruit peels, on vegetable peels investigations are meager. The present study is an attempt to explore the hitherto unknown potential of *Luffa acutangula* peel extract in T_4-induced hyperthyroid female mice. Animals were made hyperthyroid by administering pre-standardized dose of l-thyroxin (l-T_4 at 0.5 mg/kg/day) for 12 consecutive days and then the effects of the test peel extract at 25 and 50 mg/kg for 15 days were studied on the changes in serum thyroid hormones, glucose, different lipids; hepatic lipid peroxidation (LPO); enzymatic antioxidants such as superoxide dismutase, catalase, glutathione peroxidase, and in reduced glutathione. The main chemical constituents of the extract were identified by high resolution liquid chromatography mass spectrometry. Administration of the test peel extract to the hyperthyroid mice at both the test doses decreased the levels of serum thyroid hormones, glucose and tissue LPO suggesting its antithyroid, antihyperglycemic and antiperoxidative potential. These positive effects were also supported by an improved lipid profile as well as liver histology. LC-MS analyses revealed the presence of kaempferol-3-*O*-rutinoside, kameferol-*O*-neohesporoside, quercetin, cinnamic acid ethyl ester, caffeic acid derivatives such as 4-*O*-caffeyol quinic acid, 3-sinapoylquinic acid and 4,5-dihydroxyprenyl caffeate, orientin and sinapic acid. It is presumed that the antithyroid and anti-hyperglycemic actions of the test plant extract could be the result of antioxidative properties of these phytochemicals.

Keywords: Catalase; Hyperglycemia; Lipid peroxidation; Liver histology; Superoxide dismutase; Thyrotoxicosis.

Figures

Curr Comput Aided Drug Des. 2020;16(2):155-166. doi: 10.2174/1573409915666181221114107.

Towards further Understanding the Structural Requirements of Combretastatin- like Chalcones as Inhibitors of Microtubule Polymerization

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Affiliations

PMID: 30574854 DOI: 10.2174/1573409915666181221114107

Abstract

Background: Microtubules are dynamic filamentous cytoskeletal structures which play several key roles in cell proliferation and trafficking. They are supposed to contribute in the development of important therapeutic targeting tumor cells. Chalcones are important group of natural compounds abundantly found in fruits & vegetables that are known to possess anticancer activity. We have used QSAR and docking studies to understand the structural requirement of chalcones for understanding the mechanism of microtubule polymerization inhibition.

Methods: Three dimensional (3D) QSAR (CoMFA and CoMSIA), pharmacophore mapping and molecular docking studies were performed for the generation of structure activity relationship of combretastatin-like chalcones through statistical models and contour maps.

Results: Structure activity relationship revealed that substitution of electrostatic, steric and donor groups may enhance the biological activity of compounds as inhibitors of microtubule polymerization. From the docking study, it was clear that compounds bind at the active site of tubulin protein.

Conclusion: The given strategies of modelling could be an encouraging way for designing more potent compounds as well as for the elucidation of protein-ligand interaction.

Keywords: 3D QSAR; Chalcones; docking; inhibitors; microtubule polymerization; structure activity relationship..

Related information

PubChem Compound (MeSH Keyword)

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Bentham Science Publishers Ltd.
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Mol Biol Rep. 2020 Apr;47(4):2801-2810. doi: 10.1007/s11033-020-05405-7. Epub 2020 Apr 3.

Ameliorative effect of Aloe gel against L-T $_4$-induced hyperthyroidism via suppression of thyrotropin receptors, inflammation and oxidative stress

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Affiliations

PMID: 32242301 DOI: 10.1007/s11033-020-05405-7

Abstract

Untreated hyperthyroidism may develop serious complications. This attempt was made to investigate the potential of Aloe vera gel in regulating experimentally induced hyperthyroidism in rats. Female Wistar rats were made hyperthyroid with L-thyroxine (L-T_4) at 0.5 mg/kg/day, i.p. for 14 days and the effects of Aloe vera methanolic fraction (AVMF) (50 or 500 mg/kg/day, p.o.,) and a conventional antithyroid drug propylthiouracil (PTU) (10 mg/kg, i.p.) for 30 days were studied in those hyperthyroid rats. At the end, alterations in serum thyroid hormones and thyroid stimulating hormone (TSH); hepatic 5'mono-deiodinase-1(5'D1) activity, oxidative stress markers and antioxidants; serum inflammatory cytokines and the expression of thyrotropin receptor in thyroid gland were evaluated in all experimental animals. Hyperthyroid condition was confirmed by an increase in thyroid hormone levels and hepatic 5'D-1 activity with a decrease in TSH. However, either AVMF or PTU treatment in hyperthyroid rats decreased the levels of thyroid hormones and 5'D1 activity. AVMF administration in T_4-induced rats also decreased the oxidative stress markers such as thiobarbituric acid reactive substances and lipid hydroperoxides and increased the antioxidant levels in liver tissues. Levels of liver marker enzymes, cytokines and different lipids were decreased in T_4-induced AVMF treated rats. Further, a down regulation in the TSHR expression in thyroid was observed in AVMF or PTU treated groups. All these thyroid inhibiting effects were supported by an improvement in thyroid histology in hyperthyroid rats. It appears, about 15 compounds, as evidenced by LC-MS/MS study, mostly phenolics are involved in this anti-thyroid effects of the test compound.

Keywords: 5′D1; Aloe gel; Antioxidants; Cytokines; Hyperthyroidism; TSHR.

Related information

MedGen
PubChem Compound (MeSH Keyword)

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Blood Coagul Fibrinolysis. 2021 Oct 1;32(7):504-512. doi: 10.1097/MBC.0000000000001074.

Mannose-binding lectin-associated serine protease-1 cleaves plasminogen and plasma fibronectin: prefers plasminogen over known fibrinogen substrate

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Affiliations

PMID: 34650023 DOI: 10.1097/MBC.0000000000001074

Abstract

Mannose-binding lectin-associated serine protease-1 (MASP-1) is known to interact with complement and coagulation pathways. Recently it was reported that MASP-1 interacts with the fibrinolytic system but details remain unclear. The objective of the study is to find MASP-1 substrates that participate in the fibrinolytic system. Commercially available fibrinogen might contain some impurities. Fibrinogen was treated with MASP-1 followed by analysis on SDS-PAGE and the obtained cleaved fragments were identified by matrix-assisted laser desorption/ionization-time of flight/time of flight. Functional analysis of identified substrate was confirmed by fluorogenic and turbidimetric assay. Statistical analysis was done by using the Student t test. This study reports that plasminogen and plasma fibronectin are two hitherto unknown substrates of MASP-1. Conversion of plasminogen to plasmin like molecule by MASP-1 was confirmed by cleavage of plasmin specific substrate and digestion of fibrin clot. The role of MASP-1 in clot dissolution was confirmed by turbidity assay. Our study shows that MASP-1 selects plasminogen over fibrinogen to be a preferable substrate. MASP-1 promotes the fibrinolytic activity by the generation of plasmin like molecule from plasminogen and further destabilizes the clot by digestion of plasma fibronectin.

Related information

GEO Profiles
Gene
Gene (GeneRIF)
Nucleotide
Nucleotide
Nucleotide (RefSeq)
Nucleotide (RefSeq)
Nucleotide (Weighted)
Protein
Protein (RefSeq)
Protein (Weighted)
PubChem Compound (MeSH Keyword)
Taxonomy via GenBank

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Bioremediation of Diesel Oil Contaminated Soil by a Novel Isolated Potential Oil Degrading Staphylococcus argenteus MG2 Bacteria Using Biostimulation Method.

- **Source:** Nature Environment & Pollution Technology . Dec2020, Vol. 19 Issue 4, p1567-1576. 10p.

- **Author(s):** Golani, Mahima; Hajela, Krishnan

- **Abstract:** The potential oil-degrading isolate Staphylococcus argenteus MG2 was used for bioremediation of oil-contaminated soil. Hydrocarbon degradation by the soil microorganisms was evaluated in a soil experimentally contaminated with diesel oil. The effects of six different biological treatments on hydrocarbon degradation were determined during a 50 days incubation period to evaluate biostimulation via inorganic fertilizers (NPK) or manure (compost) with and without inoculum of Staphylococcus argenteus MG2. Eight soil samples were used: (S) uncontaminated control soil; (CS) contaminated soil; (CSF) contaminated soil + N-P-K fertilizer; (CSC) contaminated soil + compost; (CSI) contaminated soil + Inoculum; (CSFI) contaminated soil + N-P-K fertilizer + Inoculum; (CSCI) contaminated soil + compost + Inoculum; (SCSCI) sterile (oil) contaminated soil + compost + Inoculum. Percentage of oil degradation during bioremediation treatment of 50 days was found to be (CS) - 32%, (CSF) - 70.80%, (CSC) - 75%, (CSI) - 84.40%, (CSFI) - 91%, (CSCI) - 93%, (SCSCI) - 94% respectively. Results showed that not only inorganic nutrients NPK and compost stimulated hydrocarbon biodegradation but inoculation of Staphylococcus argenteus MG2 also enhanced hydrocarbon degradation. The microbial count was found to be higher in SCSCI soil sample. The germination percentage and growth of leguminous plant (Vigna radiata) in the treated soil was also notably greater. It may be concluded that the Staphylococcus argenteus MG2 bacteria possess remarkable oil-degrading properties and can be effectively employed in the bioremediation of oil-contaminated soils and can be used for agriculture purpose.

Research Article | Volume: 8, Issue: 5, Sep-Oct, 2020 Check for updates

Impact of oxidizing, reducing, and stabilizing agents on the inhibitory properties of *Cyamopsis tetragonoloba* trypsin inhibitor

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Open Access

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Abstract

Antinutritional factors in plants diminish the digestive action of stomach enzymes and reduce the accessible supplement for assimilation in the gut. Isolation of a trypsin-chymotrypsin inhibitor from *Cyamopsis tetragonoloba* seeds is being reported in this paper. The inhibitor was purified by DEAE-cellulose chromatography followed by gel permeation on Sephadex G-75. The inhibitor was found to be of 11 kDa on denaturing polyacrylamide gel electrophoresis and possess the highest inhibitory action at pH 7.5 and 37°C. The isolated inhibitor was found unusually stable at high temperatures and microwave heating. Freshly prepared inhibitor exhibits around 71% inhibition on incubation for 30 min in the temperature range from 20°C to 100°C. The inhibitory action was influenced in the presence of oxidizing and reducing agents. This inhibitor was stable in the presence of oxidizers dimethyl sulfoxide, hydrogen peroxide, and sodium hypochlorite. The effect of stabilizers shows that CaCl2 and glycerol support enhancement of the inhibitory activity. The inhibitor was also checked for antimicrobial activities. Inhibitor did not show any antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella*, *Pseudomonas*, *Salmonella* typhi, and *Proteus.*

Keyword: Cyamopsis tetragonoloba Trypsin-chymotrypsin inhibitor Antioxidant nature Thermostable.

Citation: Patidar P, Golani M, Hajela S, Hajela K. Impact of oxidizing, reducing, and stabilizing agents on the inhibitory properties of *Cyamopsis tetragonoloba* trypsin inhibitor. J App Biol Biotech. 2020;8(05):68-71. DOI: https://dx.doi.org/10.7324/JABB.2020.80508

Short Communication

J App Biol Biotech. 2020; 8(1): 90-94 doi: 10.7324/JABB.2020.80115

Predicting receptor for mannose-binding lectin on neutrophil surface

Pankaj Kumar Patel, Sumati Hajela, Sadhana Sharma, Krishnan Hajela.

Abstract

Neutrophils play major phagocytes that participate in the various effector phase of immunity. Mannsoe binding lectin (MBL) assisted priming of neutrophils could trigger various processes including modulation of endocytosis rate, reactive oxygen production chemotaxix etc, through interactions with cell surface receptors. The physiological receptor for MBL on neutrophils surface are still unreported. As macromolecular docking could be attempted to determine the protein-protein interactions which are important for understanding cellular function and organization. Study was performed to identify the interacting partner of MBL present on neutrophils surface which leads to the activation of various cell processes. Protein network analysis, homology modeling and Rigid docking were performed to explore structural features and binding mechanism of MBL with its cellular receptors. The results indicates that CR1 interact with the MBL and leads to activation of the neutrophils.

Key words: Mannose Binding Lectin: Network analysis: Rigid docking: surface receptors

Immunobiology. 2020 Jul;225(4):151972. doi: 10.1016/j.imbio.2020.151972. Epub 2020 Jun 5.

Mannose-binding lectin and associate serine protease complex modulates neutrophil respiratory burst and gene expression in Capra hircus

Pankaj Kumar Patel [1], Komal Choudhary [2], Preeti Patidar [2], Sadhana Sharma [3], Krishnan Hajela [4]

Affiliations

PMID: 32747021 DOI: 10.1016/j.imbio.2020.151972

Abstract

Neutrophils are an essential cellular component of the innate immune system, responsible for multiple effector mechanisms and aspects of inflammation. Neutrophil priming results in a rapid elevation in antimicrobial activities and can be measured by reactive oxygen species production, bacterial endocytosis, and de-novo synthesis of components such as interleukins. Mannose binding lectin (MBL), a C-type lectin pathogen recognition receptor is associated with immune functions including complement activation, opsonization and modulating immune responses. Whether MBL opsonization of pathogen can induce neutrophil priming has not been studied so far. Hence, studies were performed using MBL and neutrophils of Capra hircus (domestic goat) to evaluate the effects of MBL + MASPs interactions on neutrophil functions. It was found that MBL + MASPs opsonization of zymosan stimulates neutrophil functions including increased oxidative burst, enhanced endocytosis and modulates the expression level of NCF4, XBP1, CCL2, and CR1 genes. The results suggest that MBL-MASP complex can regulate neutrophil functioning.

Keywords: MBL priming; Neutrophils activation; Opsonin; ROS.

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Research Article | Volume: 10, Issue: 1, January, 2022 Check for updates

Purification and biochemical characterization of protease from the seeds of *Cyamopsis tetragonoloba*

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Open Access
Published: Jan 07, 2022
DOI: 10.7324/JABB.2021.100121

Abstract

The present study was carried out to isolate, purify, and characterize protease from the seeds of *Cyamopsis tetragonoloba*. The protease was precipitated by a 60% ammonium sulfate cut and further purified by elution from ion-exchange chromatography at 0.3 M NaCl. The sodium dodecyl sulfate-polyacrylamide gel electrophoresis result showed that protease was monomeric having 69.9 kDa molecular weight. Gelatin zymography was carried out to confirm the proteolytic activity of the protease. The protease has a wide range of substrate specificity and could cleave natural substrates like casein, gelatin, bovine serum albumin (BSA), hemoglobin (Hb), and synthetic substrate like N-αBenzoyl-DL-arginine ?-nitroanilide (BAPNA). The *V*max value of the protease was 102.04 μM/minute with casein as the substrate and *K*m value was 56.56 μM/minute. The purified protease was completely inhibited by serine proteases inhibitors like Phenyl Methyl Sulfonyl Fluoride, soybean trypsin inhibitor, and aprotinin, and not inhibited by other protease inhibitors. This concluded that the purified protease was serine protease. The protease was highly stable at a wide range of temperatures from 20°C to 70°C. Gelatin showed the highest proteolytic activity when compared to the casein, Hb, and BSA. BAPNA showed 1.5101 U/mg specific activity. The sugar content of protease was estimated by the method of DuBois. The protease was highly glycosylated and contained 35 μg of sugar in 0.2 mg of protease.

Keyword: Protease purification characterization Cyamopsis tetragonoloba thermostable

A lab fermenter level study on anaerobic hydrogen fermentation using potato peel waste: effect of pH, temperature, and substrate pre-treatment

- ORIGINAL ARTICLE
- Published: 12 May 2021

A lab fermenter level study on anaerobic hydrogen fermentation using potato peel waste: effect of pH, temperature, and substrate pre-treatment

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Journal of Material Cycles and Waste Management **volume 23**, pages 1617–1625 (2021)Cite this article

- Review
- Published: 29 October 2020

Fermentative bio-hydrogen production using lignocellulosic waste biomass: a review

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Waste Disposal & Sustainable Energy **volume 2**, pages 249–264 (2020)Cite this article

Abstract

Solid waste management needs, increasing pollution level by burning or dumping of waste, and the use of fossil fuels and depleting energy resources are a few of the problems of the decade that need to find answers. Disposal of lots of compound polymers-rich biomass waste is done worldwide by dumping on land or into water bodies or else by incineration or long-term storage in an available facility commonly. This kind of disposal instead becomes a reason to add the soil, water, and air pollution. A lot of multidisciplinary collaboration in different streams of science and technology has added to the efficiency of using such waste for use as an alternative energy form, like biogas and biohydrogen. The use of biogas plants for converting biological waste into methane using municipal solid waste (MSW) is known since a long time. Along with MSW, a lot of other agricultural waste and kitchen waste are also added every day to nature. But the complex components of such waste material like lignocellulosic wastes still don't pass the test of qualifying as a resource for biogas and even more energy-efficient and cleaner biofuel, bio-hydrogen. It may be because of its complicated structure and a lot of parameters that affect its use for converting it into bio-hydrogen. This review is designed to analyze and compare these parameters for optimum lignocellulosic waste conversion, more specifically agriculture and food waste, into cleaner energy forms that would help to tackle the solid waste management and air pollution control more effectively.

Fig. 1

Fig. 2