

Fusarium venenatum CULTURE TECHNIQUE

In vitro antidiabetic and antioxidant activities of protein hydrolysates via alkaline autolysis of *Fusarium venenatum* mycoprotein

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Abstract

Fusarium venenatum mycoprotein was produced by submerged fermentation in a 3 L Winpact stirred-tank bioreactor on molasses. Four autolysis routes were compared; alkaline autolysates gave the highest antioxidant activity (DPPH ~556, ABTS ~235 μmol Trolox/g) and ~35% α -glucosidase inhibition.



Winpact Fermentation System

Introduction

Motivation: diabetes is projected to affect 600 million people by 2050, and synthetic antioxidants and preservatives carry safety concerns, driving demand for natural bifunctional antioxidant and antidiabetic compounds.

Gap: autolysis has been studied mainly in baker's yeast; the bioactive properties of *F. venenatum* mycoprotein hydrolysates had never been investigated, despite a 45–55% protein content and a porous chitin/ β -glucan cell wall.

Objective: compare four lysis routes on bioreactor-grown mycoprotein and evaluate the resulting hydrolysates for antioxidant, α -amylase and α -glucosidase inhibitory, antibacterial and antifungal activity.

Materials and Methods

Biomass production:

F. venenatum IR372C was pre-grown on Vogel agar and in shake flasks (25 °C, 180 rpm), then submerged-fermented in a 3 L Winpact stirred-tank bioreactor (USA). Molasses replaced glucose in a defined mineral medium; aeration 1 vvm, agitation 400 rpm, 28 °C, pH 5.6, 72 h. A 72 °C / 10 min heat shock was applied at the end to reduce RNA content, and the biomass was sieved and freeze-dried.

Autolysis treatments (controls):

15% (w/v) biomass suspensions treated four ways at 55 °C for 48 h with sampling every 12 h — acidic (pH 5.5), alkaline (pH 8.5), plasmolysis (1.5% ethyl acetate + 5% NaCl) and enzymatic hydrolysis (pH 8.5 + 0.2% Alcalase) — with untreated mycoprotein as reference.

Analysis:

Degree of hydrolysis by OPA; sugars by HPAEC-PAD; amino acids and surface hydrophobicity by HPLC; structure by FTIR-ATR; DPPH and ABTS; α -amylase and α -glucosidase inhibition; antibacterial and antifungal well-diffusion assays.

Results

Alkaline autolysis gave the highest degree of hydrolysis and soluble protein (~31%), and the highest antioxidant activity (DPPH 556.56, ABTS 235.78 μ mol Trolox/g), roughly double that of untreated mycoprotein. Intact mycoprotein showed the strongest α -amylase inhibition (~62%), attributed to physical entrapment of the enzyme in the porous cell wall, whereas 48 h alkaline autolysates gave the highest α -glucosidase inhibition (~35%), tracking the degree of hydrolysis. No antimicrobial activity was found at up to 100 mg/mL. Fermentor relevance: controlled submerged fermentation on low-cost molasses at fixed aeration, agitation, temperature and pH produced reproducible biomass of defined composition, which was the common starting material for all four lysis comparisons.

References

In vitro antidiabetic and antioxidant activities of protein hydrolysates via alkaline autolysis of *Fusarium venenatum* mycoprotein. Scientific Reports (2025) 15:13287

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