



Σχολή Θετικών Επιστημών και Τεχνολογίας

Χημική και Βιομοριακή Ανάλυση

Διπλωματική Εργασία

Παραγωγή εξωκυτταρικών πολυμερικών ουσιών από καλλιέργεια
μικροφυκών σε απόβλητα και χαρακτηρισμός τους

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Περίληψη

Η αύξηση του ανθρώπινου πληθυσμού, σε συνδυασμό με τις προκλήσεις που αντιμετωπίζουν τα αγροδιατροφικά συστήματα, επιτάσσει τη διερεύνηση εναλλακτικών πηγών τροφής, ώστε να αποφευχθούν επισιτιστικά προβλήματα. Παράλληλα, οι Ευρωπαϊκές πολιτικές για μηδενικό περιβαλλοντικό αποτύπωμα και μείωση των βιομηχανικών ρύπων αποτελούν σημαντικό κίνητρο για την αξιοποίηση βιομηχανικών παραπροϊόντων και την παραγωγή νέων θρεπτικών συστατικών.

Τα μικροφύκη λόγω της σύνθεσης και του βιοχημικού τους προφίλ έχουν αρχίσει να αξιοποιούνται στη βιομηχανία τροφίμων ως μια καινοτόμα και βιώσιμη πηγή θρεπτικών συστατικών.

Ο σκοπός της παρούσας εργασίας ήταν η αξιοποίηση των αποβλήτων της γαλακτοβιομηχανίας, ως συμπληρωματικό θρεπτικό μέσο στην καλλιέργεια του μικροφύκου *Dunaliella tertiolecta*, με στόχο την αύξηση της παραγόμενης βιομάζας και την παραγωγή βιοδραστικών συστατικών. Μελετήθηκαν οι χημικές και τεχνολογικές ιδιότητες τόσο της βιομάζας όσο και των βιοδραστικών συστατικών, σε σχέση με τις ανάγκες της βιομηχανίας τροφίμων, για την αξιοποίηση νέων βιοενεργών ενώσεων.

Σύμφωνα με τα αποτελέσματα της εργασίας προκύπτει ότι η προσθήκη αποβλήτων της γαλακτοβιομηχανίας στην καλλιέργεια του μικροφύκου βελτίωσε τα παραγωγικά χαρακτηριστικά της βιομάζας του και αύξησε κατά 30% την παραγωγή βιοδραστικών συστατικών. Επιπλέον, οι βιοχημικές αναλύσεις των βιοδραστικών συστατικών έδειξαν σημαντική αύξηση της αντιοξειδωτικής ικανότητας, της ποσότητας πολυφαινόλων και της περιεκτικότητας σε πρωτεΐνη και σάκχαρα, στην καλλιέργεια των μικροφυκών με την προσθήκη αποβλήτων σε σχέση με τον μάρτυρα. Το σύνολο των πρωτεϊνών αυξήθηκε κατά 68% στα βιοδραστικά συστατικά της μιξότροφης καλλιέργειας και η περιεκτικότητα σε σάκχαρα ήταν 3,5 φορές υψηλότερη σε σχέση με την καλλιέργεια μάρτυρα. Ωστόσο, το σύνολο των πολυφαινόλων και η αντιοξειδωτική ικανότητα της βιομάζας των κυττάρων ήταν σε σημαντικά υψηλότερα επίπεδα στην καλλιέργεια μάρτυρα συγκριτικά με τη μιξότροφη.

Οι μετρήσεις που εκτελέστηκαν για την αξιολόγηση των τεχνολογικών ιδιοτήτων των έδειξαν ότι οι προερχόμενες από τη μιξότροφη καλλιέργεια είχαν καλύτερες αποδόσεις.

Λαμβάνοντας υπόψη τα αποτελέσματα της παραπάνω μελέτης τα βιοδραστικά συστατικά και η βιομάζα των κυττάρων θα μπορούσαν να αποτελέσουν ένα καινοτόμο και εναλλακτικό πρόσθετο στη βιομηχανία ενώ είναι απαραίτητη περαιτέρω έρευνα σχετικά με τα βιοδραστικά

συστατικά που παράγονται από τα μικροφύκη, καθώς δεν υπάρχει εκτεταμένη βιβλιογραφία για το συγκεκριμένο αντικείμενο.

Λέξεις – Κλειδιά

Μικροφύκη, βιοδραστικές ενώσεις, *Dunaliella tertiolecta*, απόβλητα βιομηχανίας τροφίμων, αποβλήτων γαλακτοβιομηχανίας, FTIR

Abstract

The escalating human population, combined with the challenges faced by agri-food systems, necessitates the investigation of alternative food sources to mitigate impending food crisis issues. Simultaneously, European policies aiming for a zero environmental footprint and the reduction of industrial pollutants serve as a significant incentive for the valorization of industrial by-products. Their exploitation holds the potential to emerge as a novel sustainable resource for nutritional components.

Microalgae, owing to their composition and biochemical profile, are being harnessed by the food industry as an innovative and sustainable source of nutritional components.

The objective of this study was to utilize dairy industry wastewater as a supplementary nutritional medium in the cultivation of the microalgae *Dunaliella tertiolecta*, aiming to enhance biomass production and bioactive substances yield. The chemical and functional properties of both biomass and bioactive substances were investigated in relation to the requirements of the food industry, aiming to exploit novel bioactive compounds.

According to the findings of the study, it appears that the addition of dairy industry wastewater to the cultivation of the microalgae improved the productivity of its biomass and increased the production of bioactive substances by 30%. Furthermore, biochemical analyses of the bioactive substances revealed a significant increase in antioxidant capacity, and the content of polyphenols, proteins, and sugars in the substances of the culture cultivated with industrial waste compared to the control culture. The total protein content increased by 68% in the bioactive substances of the mixotrophic culture, and the sugar content was 3.5 times higher compared to the photoautotrophic culture. However, the total polyphenol content and antioxidant capacity of the cell biomass were significantly higher in the photoautotrophic culture compared to the mixotrophic.

The functional properties of the bioactive substances evaluated and revealed that those derived from the mixotrophic culture exhibited superior performances.

Taking into consideration the results of the above study, the bioactive substances and cell biomass could potentially serve as an innovative and alternative additive in the industry. Further research on the bioactive substances produced by microalgae is essential, as there is limited literature on the specific subject.

Keywords

Microalgae, bioactive substances, *Dunaliella tertiolecta*, food industry wastewater, dairy industry wastewater, FTIR.

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