

Article

Investigation into the Phytochemical Composition, Antioxidant Properties, and In-Vitro Anti-Diabetic Efficacy of *Ulva lactuca* Extracts

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Abstract: In this research, the chemical compositions of various extracts obtained from *Ulva lactuca*, a type of green seaweed collected from the Nador lagoon in the northern region of Morocco, were compared. Their antioxidant and anti-diabetic properties were also studied. Using GC-MS technology, the fatty acid content of the samples was analyzed, revealing that palmitic acid, eicosenoic acid, and linoleic acid were the most abundant unsaturated fatty acids present in all samples. The HPLC analysis indicated that sinapic acid, naringin, rutin, quercetin, cinnamic acid, salicylic acid, apigenin, flavone, and flavanone were the most prevalent phenolic compounds. The aqueous extract obtained by maceration showed high levels of polyphenols and flavonoids, with values of 379.67 ± 0.09 mg GAE/g and 212.11 ± 0.11 mg QE/g, respectively. This extract also exhibited an impressive ability to scavenge DPPH radicals, as indicated by its IC_{50} value of 0.095 ± 0.12 mg/mL. Additionally, the methanolic extract obtained using the Soxhlet method demonstrated antioxidant properties by preventing β -carotene discoloration, with an IC_{50} of 0.087 ± 0.14 mg/mL. Results from in-vitro studies showed that extracts from *U. lactuca* were able to significantly inhibit the enzymatic activity of α -amylase and α -glucosidase. Among the various extracts, methanolic extract (S) has been identified as the most potent inhibitor, exhibiting a statistically similar effect to that of acarbose. Furthermore, molecular docking models were used to evaluate the interaction between the primary phytochemicals found in these extracts and the human pancreatic α -amylase and α -glucosidase enzymes. These findings suggest that *U. lactuca* extracts contain bioactive substances that are capable of reducing enzyme activity more effectively than the commercially available drug, acarbose.

Keywords: *Ulva lactuca*; fatty acids; phenolic compounds; antioxidant activity; enzyme inhibition; anti-diabetic properties; molecular docking

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Table of Contents Investigation Of Phytochemical Composition Of

1. Understanding the eBook Investigation Of Phytochemical Composition Of
 - The Rise of Digital Reading Investigation Of Phytochemical Composition Of
 - Advantages of eBooks Over Traditional Books
2. Identifying Investigation Of Phytochemical Composition Of
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Investigation Of Phytochemical Composition Of
 - User-Friendly Interface
4. Exploring eBook Recommendations from Investigation Of Phytochemical Composition Of
 - Personalized Recommendations
 - Investigation Of Phytochemical Composition Of User Reviews and Ratings

- Investigation Of Phytochemical Composition Of and Bestseller Lists
- 5. Accessing Investigation Of Phytochemical Composition Of Free and Paid eBooks
 - Investigation Of Phytochemical Composition Of Public Domain eBooks
 - Investigation Of Phytochemical Composition Of eBook Subscription Services
 - Investigation Of Phytochemical Composition Of Budget-Friendly Options
- 6. Navigating Investigation Of Phytochemical Composition Of eBook Formats
 - ePub, PDF, MOBI, and More
 - Investigation Of Phytochemical Composition Of Compatibility with Devices
 - Investigation Of Phytochemical Composition Of Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Investigation Of Phytochemical Composition Of
 - Highlighting and Note-Taking Investigation Of Phytochemical Composition Of
 - Interactive Elements Investigation Of Phytochemical Composition Of
- 8. Staying Engaged with Investigation Of Phytochemical Composition Of
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Investigation Of Phytochemical Composition Of
- 9. Balancing eBooks and Physical Books Investigation Of Phytochemical Composition Of
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Investigation Of Phytochemical Composition Of
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Investigation Of Phytochemical Composition Of
 - Setting Reading Goals Investigation Of Phytochemical Composition Of
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Investigation Of Phytochemical Composition Of
 - Fact-Checking eBook Content of Investigation Of Phytochemical Composition Of
 - Distinguishing Credible Sources

13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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