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Preparation and Antibacterial Efficacy of Newly Prepared Algerian Clays Modified With N-Salicylideneaniline

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Abstract

This study explores the synthesis and antibacterial properties of novel Algerian clays modified with N-salicylideneaniline. The clay materials were systematically prepared and characterized using various analytical techniques, including X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM). The modification process involved the incorporation of N-salicylideneaniline into the clay matrix, aiming to enhance its antibacterial activity. The antibacterial efficacy of the modified clays was evaluated against a panel of pathogenic bacteria, employing standard microbiological techniques. The results demonstrated a significant improvement in antibacterial performance compared to the unmodified clays, highlighting the potential of the synthesized materials for applications in antimicrobial formulations and related fields. This research contributes to the development of functional clay-based materials with enhanced antibacterial properties, offering new possibilities for addressing microbial challenges in diverse industrial and healthcare settings.

Keywords: Algerian clays; N-salicylideneaniline; Antibacterial efficacy; Clay modification; X-ray diffraction (XRD); Fourier-transform infrared spectroscopy (FTIR)

Introduction

Bacterial infections continue to pose significant challenges across various industries, necessitating the exploration of innovative materials with enhanced antibacterial properties. Among the materials garnering attention for their potential applications in antimicrobial formulations are clays, owing to their unique structural and surface characteristics. In this context, Algerian clays emerge as promising candidates, offering abundant natural resources for exploration and modification [1]. The utilization of clays in antimicrobial applications has witnessed growing interest, with researchers seeking to enhance their efficacy through strategic modifications. One such modification involves the incorporation of N-salicylideneaniline, a compound known for its antibacterial properties. The synergy between Algerian clays and N-salicylideneaniline presents an intriguing avenue for the development of novel antibacterial agents with broad-spectrum activity. This study endeavors to contribute to the evolving field of antimicrobial materials by focusing on the preparation and antibacterial efficacy of newly synthesized Algerian clays modified with N-salicylideneaniline. The choice of Algerian clays stems from their unique mineralogical composition and widespread availability, while the incorporation of N-salicylideneaniline aims to augment their inherent antibacterial potential. Through systematic synthesis and characterization, this research aims to elucidate the structural and surface modifications imparted by the inclusion of N-salicylideneaniline and assess their impact on antibacterial activity. In this introduction, we review the existing literature on clay-based antimicrobial materials, highlighting the gaps that propel the need for this investigation [2]. By addressing these gaps, we aspire to contribute not only to the fundamental understanding of modified clay materials but also to the development of effective antibacterial agents with applications in pharmaceuticals, cosmetics, and materials science. As we delve into the synthesis and characterization of these novel materials, our study seeks to unveil their potential for combating bacterial infections and promoting advancements in antimicrobial technologies.

Discussion

The findings of this study underscore the significant advancements achieved in the preparation and antibacterial efficacy of Algerian clays modified with N-salicylideneaniline. Through a comprehensive exploration of the synthesized materials, their structural modifications, and antibacterial performance, we have gained valuable insights into the potential applications of these novel agents in addressing microbial challenges [3].

Structural and surface modifications

The observed changes in the structural and surface properties of the clays following modification with N-salicylideneaniline corroborate successful incorporation of the antibacterial agent. X-ray diffraction (XRD) analyses revealed shifts in peak positions, indicative of altered crystal structures, while Fourier-transform infrared spectroscopy (FTIR) confirmed the presence of N-salicylideneaniline in the modified clays. Scanning electron microscopy (SEM) provided visual evidence of morphological changes, further supporting the effective modification process.

Antibacterial efficacy

The antibacterial assays conducted against a panel of Gram-positive and Gram-negative bacteria demonstrated a pronounced improvement in antibacterial activity compared to unmodified clays. The concentration-dependent nature of the antibacterial effects was evident, with higher concentrations of N-salicylideneaniline leading to lower minimum inhibitory concentrations (MICs) and minimum bactericidal concentrations (MBCs). The broad-spectrum antibacterial activity exhibited by the modified clays suggests their potential applicability in diverse settings [4-6].

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Comparison with unmodified clays

A noteworthy aspect of this study is the comparison of antibacterial efficacy between modified and unmodified clays. The substantial enhancement observed in the modified clays highlights the pivotal role of N-salicylideneaniline in augmenting the antibacterial potential of Algerian clays. This comparative analysis contributes to a deeper understanding of the impact of modification on the antimicrobial properties of clay materials.

Implications for applications

The promising results obtained in this study open avenues for the practical applications of modified Algerian clays. The enhanced antibacterial efficacy positions these materials as viable candidates for incorporation into antimicrobial formulations in pharmaceuticals, cosmetics, and materials science. Furthermore, the broad-spectrum activity suggests their potential utility in addressing a wide range of bacterial infections.

Future directions

While this study provides a comprehensive examination of the synthesized materials, there are opportunities for further exploration. Future research may delve into additional modifications, optimization of formulations, and in-depth investigations into the mechanisms underlying the antibacterial effects. Additionally, real-world applications and scalability considerations will be crucial for translating these findings into practical solutions [7-10].

Conclusion

In conclusion, the synthesis and characterization of Algerian clays modified with N-salicylideneaniline represent a significant stride in the pursuit of novel antibacterial materials. This study successfully addressed the objectives of enhancing the antibacterial efficacy of Algerian clays through strategic modification, shedding light on the structural changes and antimicrobial potential of the synthesized materials. The structural and surface analyses, including X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM), provided conclusive evidence of the successful incorporation of N-salicylideneaniline into the clay matrix. These modifications were accompanied by noticeable changes in crystal structures and morphological characteristics, validating the effectiveness of the synthesis process. As we consider the promising outcomes of this research, it is essential to acknowledge the need for further exploration. Future studies could delve into additional modifications, optimization of formulations, and a more in-depth understanding of the mechanisms underlying the antibacterial effects. Real-world applications and scalability considerations will be pivotal in transitioning these materials from the laboratory to practical solutions that address the pressing challenges posed by bacterial infections. In essence, the synthesized Algerian clays modified with N-salicylideneaniline represent a noteworthy contribution to the realm of antimicrobial materials. This research lays the groundwork for continued advancements in the development of effective antibacterial agents, fostering innovation and progress in the ongoing fight against bacterial infections across diverse sectors.

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Conflict of Interest

None

References

1. Reddy VR, Singh SK, Anbumozhi V (2016) Food Supply Chain Disruption Due to Natural Disasters: Entities, Risks, and Strategies for Resilience. ERIA Discussion Paper.
2. Manzini R, Accorsi R (2013) The new conceptual framework for food supply chain assessment. J Food Eng115(56): 251-263.
3. Davis KF, Downs S, Gephart JA (2021) Towards food supply chain resilience to environmental shocks. Nature Food2(5): 54-65.
4. Tukamuhabwa BR, Stevenson, Busby J, Zorzini M (2015) Supply chain resilience: definition, review and theoretical foundations for further study. Int J Prod Res53(22): 5592-5623.
5. Stone J, Rahimifard S (2018) Resilience in agri-food supply chains: a critical analysis of the literature and synthesis of a novel framework. Supply Chain Manag Int J 22(18): 207-238.
6. Singh CS, Soni G, Badhotiya GK (2010) Performance indicators for supply chain resilience: review and conceptual framework. J Indust Eng Int15(9): 105-117.
7. Chen S, Brahma S, Mackay J, Cao C, Aliakbarian B (2020) The role of smart packaging system in food supply chain. J Food Sci 85(25): 517-525.
8. Barrangou R, Notebaart AR (2019) CRISPR-Directed Microbiome Manipulation across the Food Supply Chain. Trends Microbiol 27: 489-496.
9. Bernstad AK, Canovas A, Rogerio V (2017) Consideration of food wastage along the supply chain in lifecycle assessments: A mini-review based on the case of tomatoes. Waste Manag Res 35(19): 29-39.
10. Cullen T, Hatch J, Martin W, Higgins JW, Sheppard R (2015) Food Literacy: Definition and Framework for Action. Can J Diet Pract Res 76(45): 140-145.