

Synthesis, antimicrobial evaluation, docking and dynamic investigation of novel stearoyl mannopyranoside. [cwcp2025.06900d1]

Md. Hasinul Babu, Abul Fazal Md. Sanaullah *

“Synthetic Organic and Medicinal Chemistry Laboratory, Department of Chemistry, Faculty of Science, University of Chittagong, 4331, Bangladesh”

*Corresponding Author’s Email: sanaullahfazal@cu.ac.bd ; mobile:+8801711984612

ABSTRACT

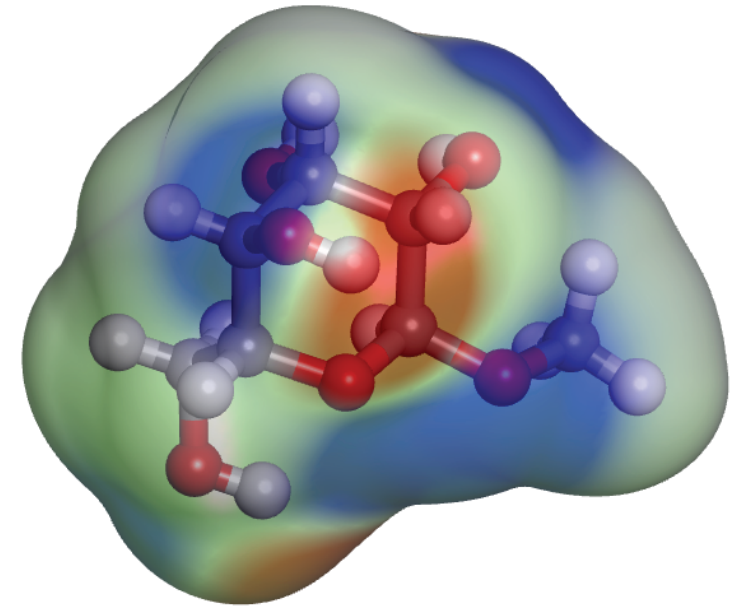
The goal of this project is to synthesize acylated mannose derivatives, i.e., the Mannopyranoside stearate esters in structure 1, and examine the efficacy of these agents towards resistant fungal pathogens. We were able to synthesize-6-O-stearoyl- α -D-mannopyranoside and convert this standard into different biologically active esters. According to the results of in-vitro analysis, these esters are most potent fungistatic agents and also effective antibacterial compounds. The binding affinity of the compounds with the Lanosterol 14 α -demethylase protein was found to be which revealed being good binders with potential as non-azole biodegradable antifungal agents according to molecular docking studies.

Introduction

Mannopyranoside acts as a crucial monosaccharide, holds significance among carbohydrate related compounds due to it’s diverse biological functions. Therefore we aimed to explore it’s structural modification at different positions, expecting to discover novel compounds with promising biological activity.

Stearoyl derivatives of this compound are found to be non-toxic, biodegradable, non-allergic, non-irritating, fat replacer, and emulsifier properties.

Commercially available deoxy sugar methyl α -D-mannopyranoside was selected as our starting material for regioselective synthesis.

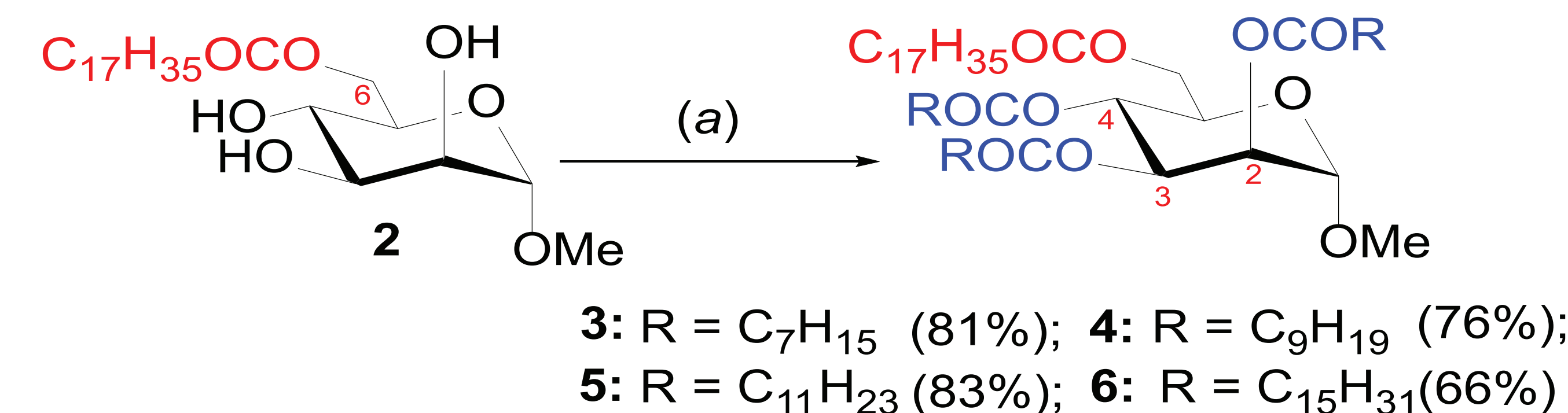
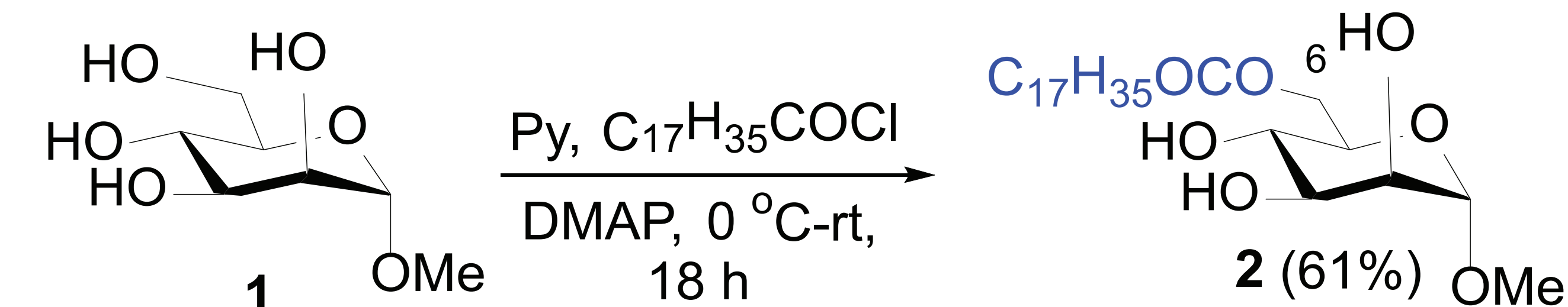


Objectives

The objective of the study "Synthesis and Antimicrobial Evaluation of Some Novel Stearoyl Mannopyranosides" is to

1. Synthesize a series of novel stearoyl mannopyranosides for effective antimicrobial agents.
2. Evaluate the antimicrobial activity of these synthesized compounds through SAR molecular docking, PASS studies & Molecular Dynamic Simulation.

Scheme



Reagents and conditions: (a) dry Py, RCOCl, DMAP, 0°C-rt, 14-18 h

Results & Discussion

PASS-based biological calculations

Drugs	Biological activity analysis of mannopyranoside esters							
	Anti-bacterial		Anti-fungal		Anti-carcinogenic		Anti-Viral (Herpes)	
	Pa	Pi	Pa	Pi	Pa	Pi	Pa	Pi
1	0.541	0.013	0.628	0.016	0.731	0.008	0.508	0.009
2	0.528	0.014	0.669	0.012	0.769	0.006	0.501	0.009
3	0.551	0.012	0.673	0.011	0.614	0.012	0.496	0.010
4	0.551	0.012	0.673	0.011	0.614	0.012	0.496	0.010
5	0.551	0.012	0.673	0.011	0.614	0.012	0.496	0.010
6	0.551	0.012	0.673	0.011	0.614	0.012	0.496	0.010
FCZ	----	----	0.726	0.008	----	----	----	----
ICZ	----	----	0.846	0.003	----	----	----	----
NYS	0.967	0.000	0.986	0.000	0.416	0.028	0.508	0.009
TTC	0.694	0.005	0.523	0.027	----	----	0.383	0.017

Note. FCZ = Fluconazole, ICZ = Itraconazole; NYS = Nystatin, TTC = Tetracycline; Pa > 0.7 indicates higher probability of activity experimentally.

Docking Non-Bonding Interaction

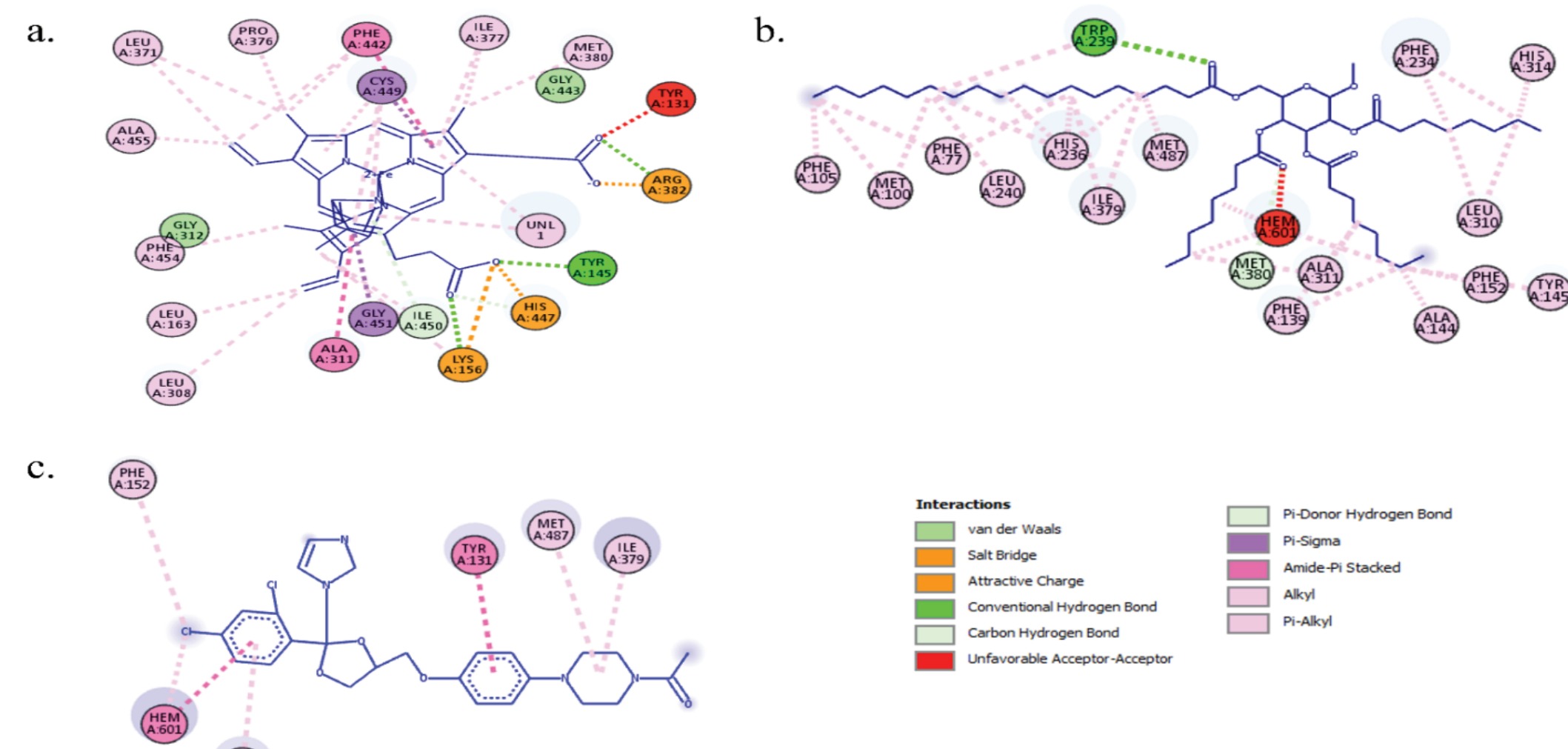
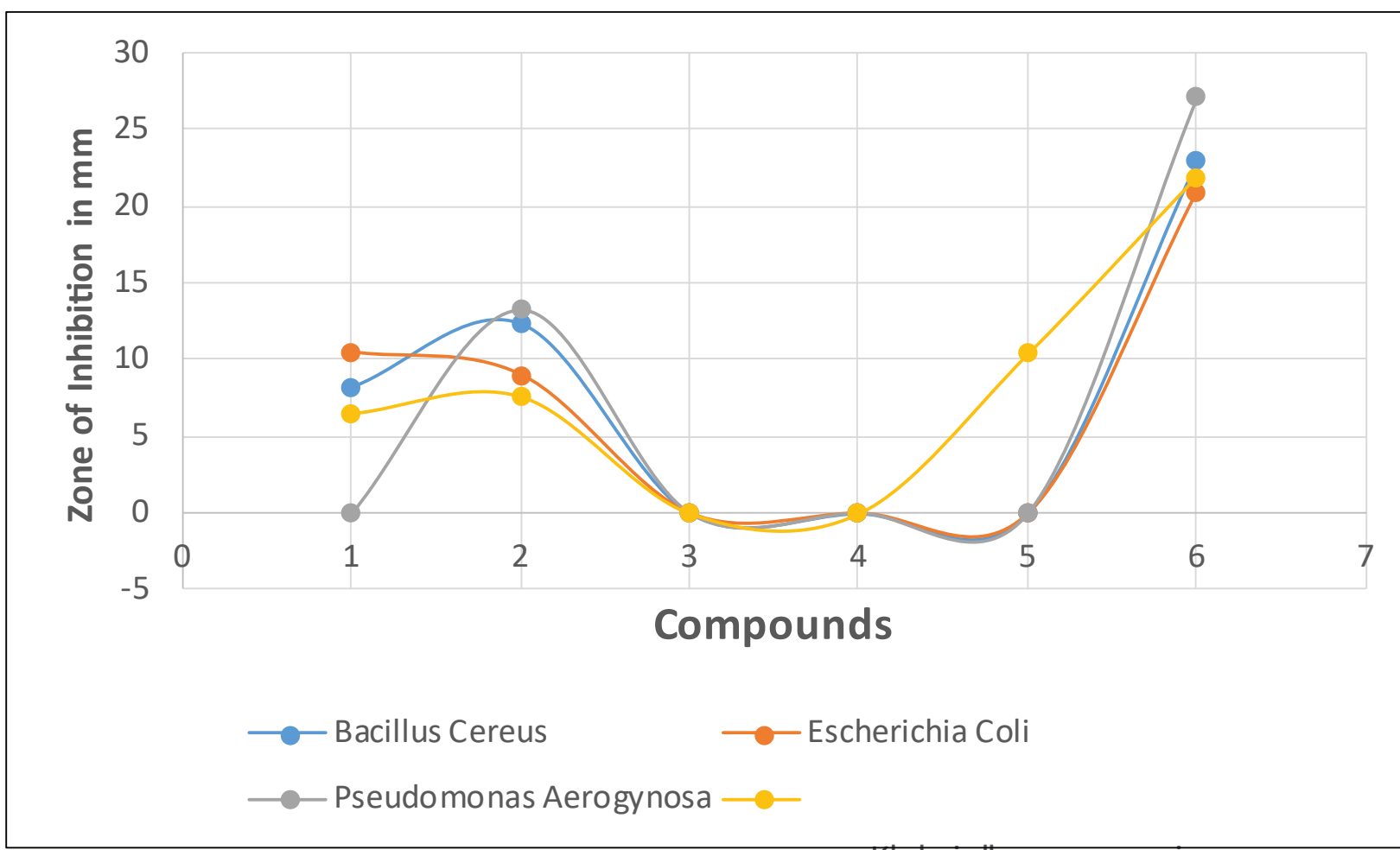
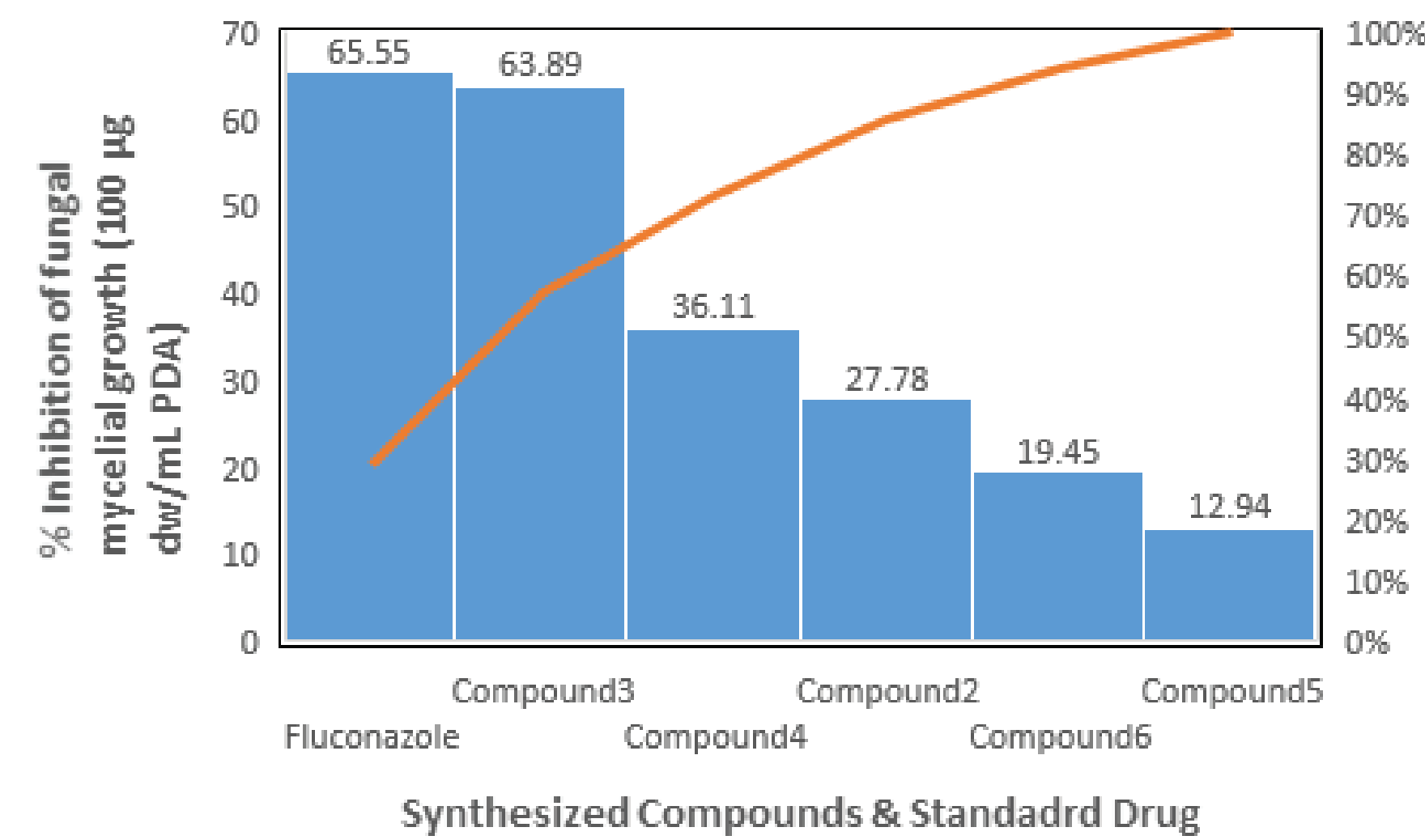


Figure 1: Nonbonding interactions of top drug candidates with the 3LD6 (pose predicted by AutoDock Vina). (a) complex 2, (b) complex 3, and (c) Ketocanazole complex

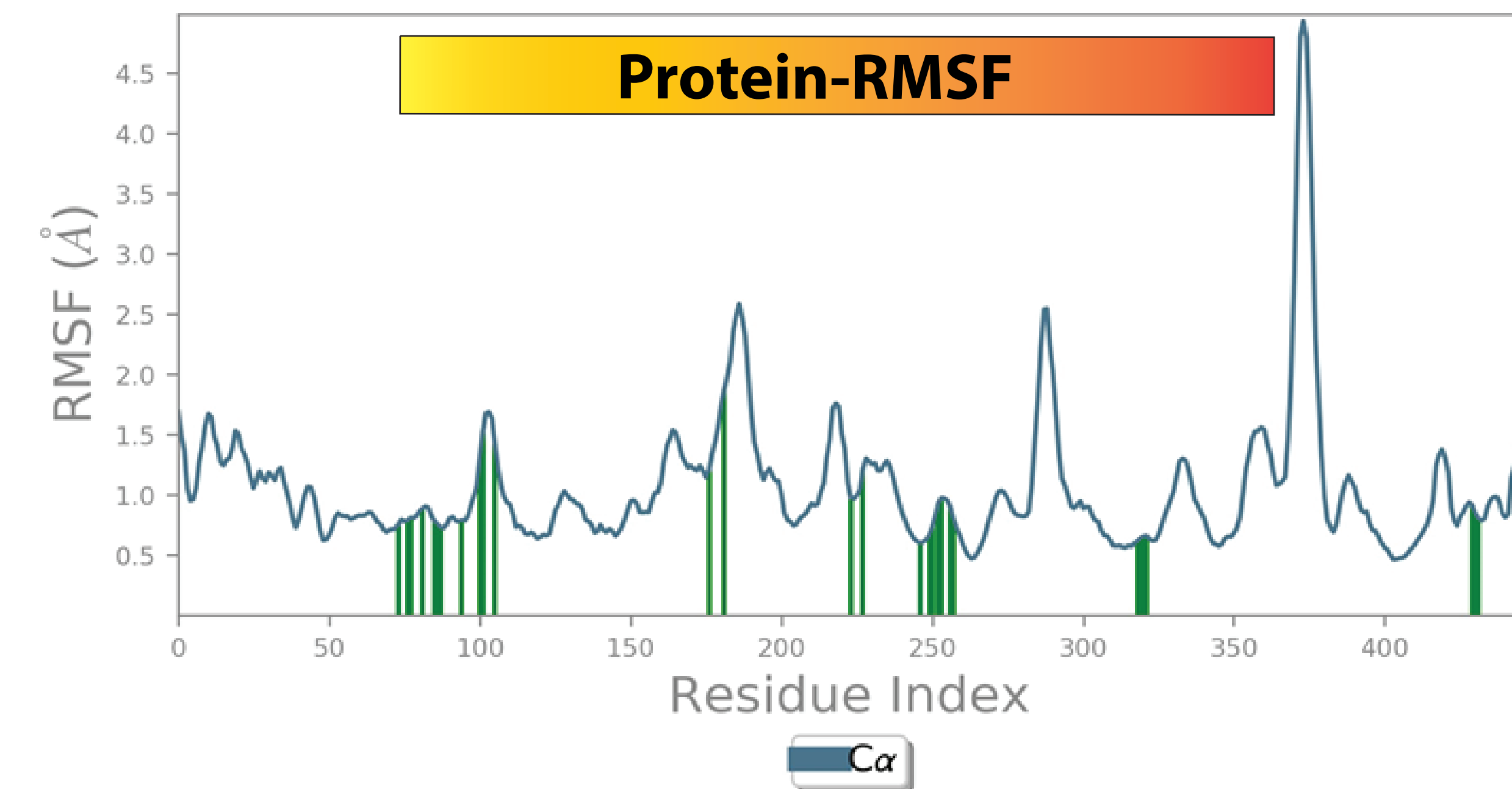
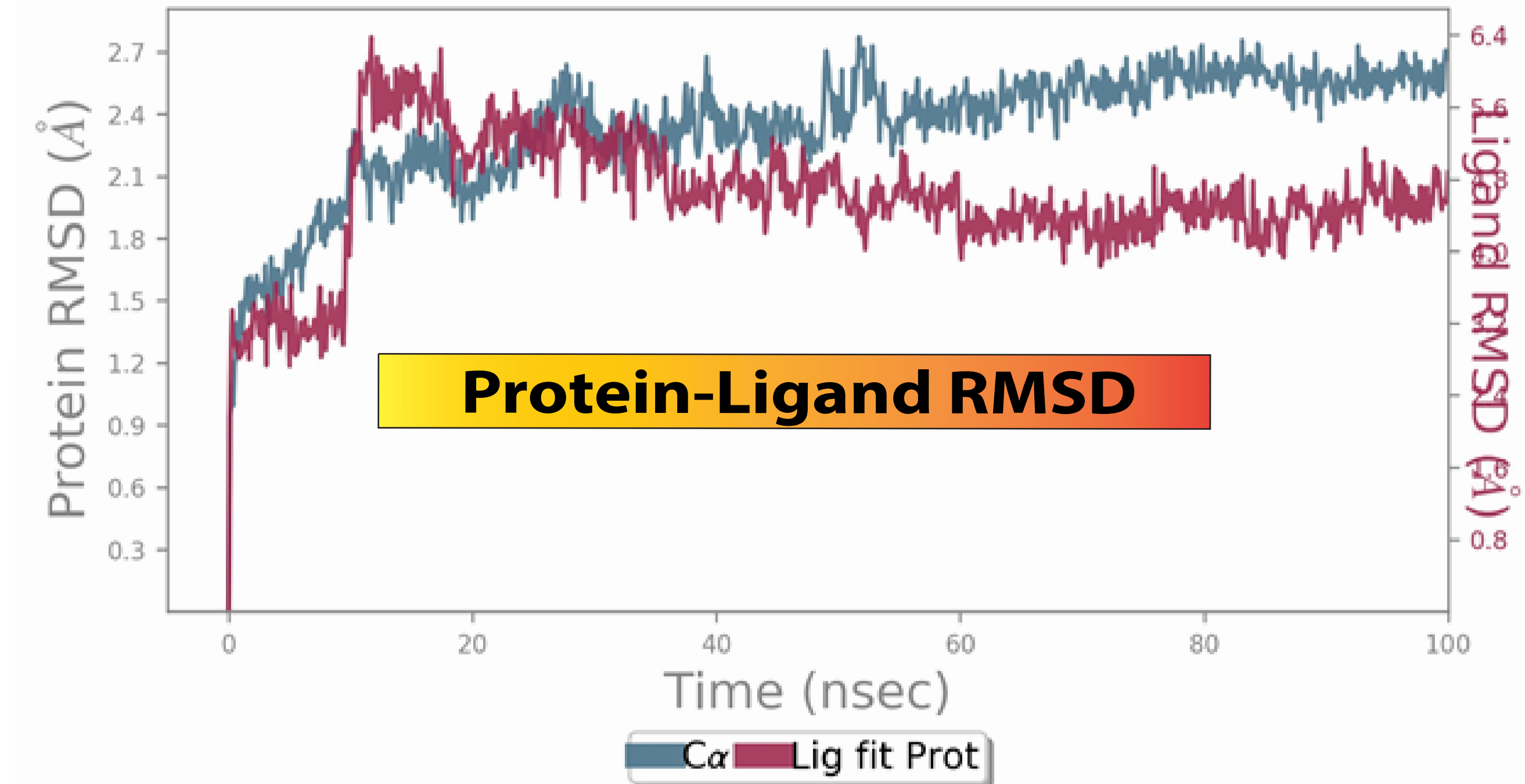
The inhibition against Gram-positive and gram-negative bacteria by the methyl α -D-mannopyranoside esters



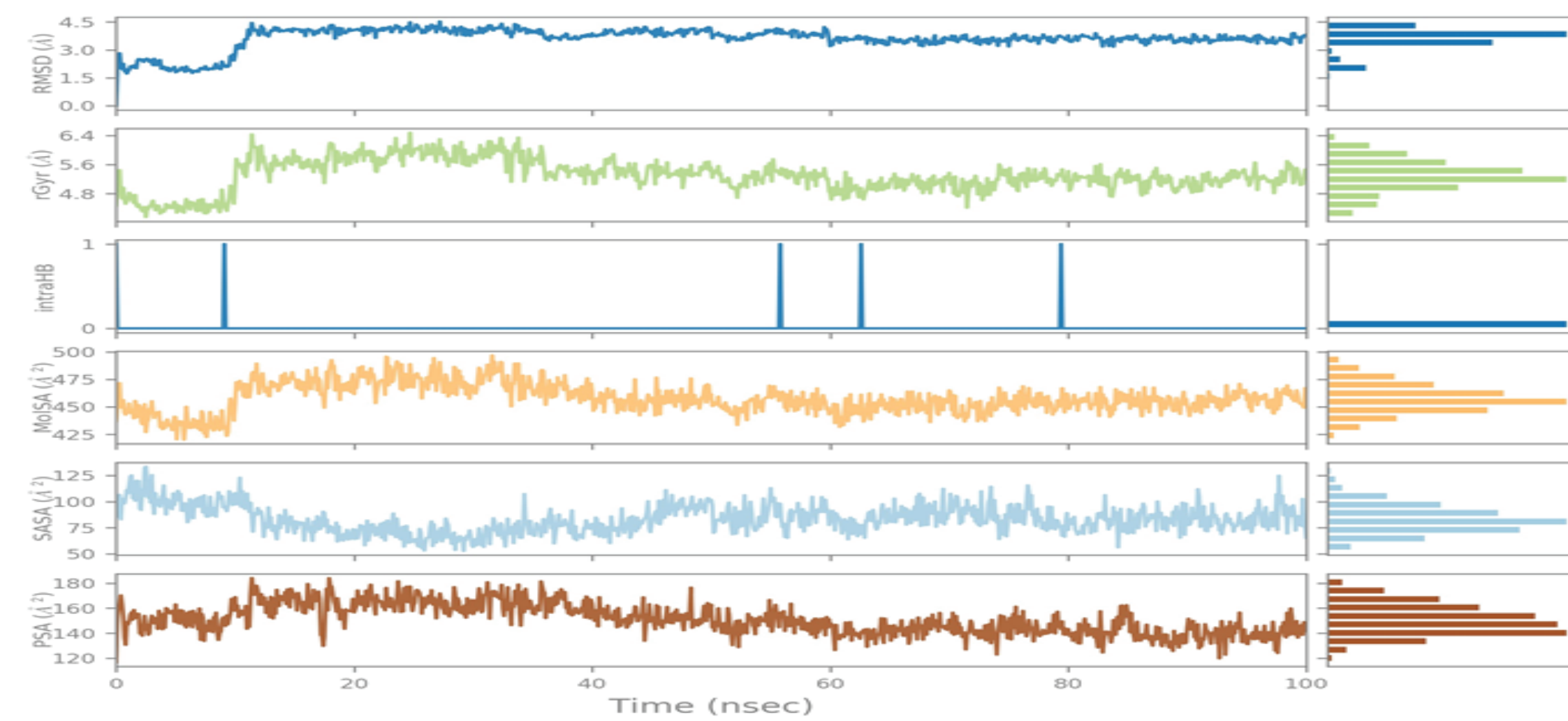
Zone of inhibition (%) against fungal pathogens by the methyl α -D- mannopyranoside esters.



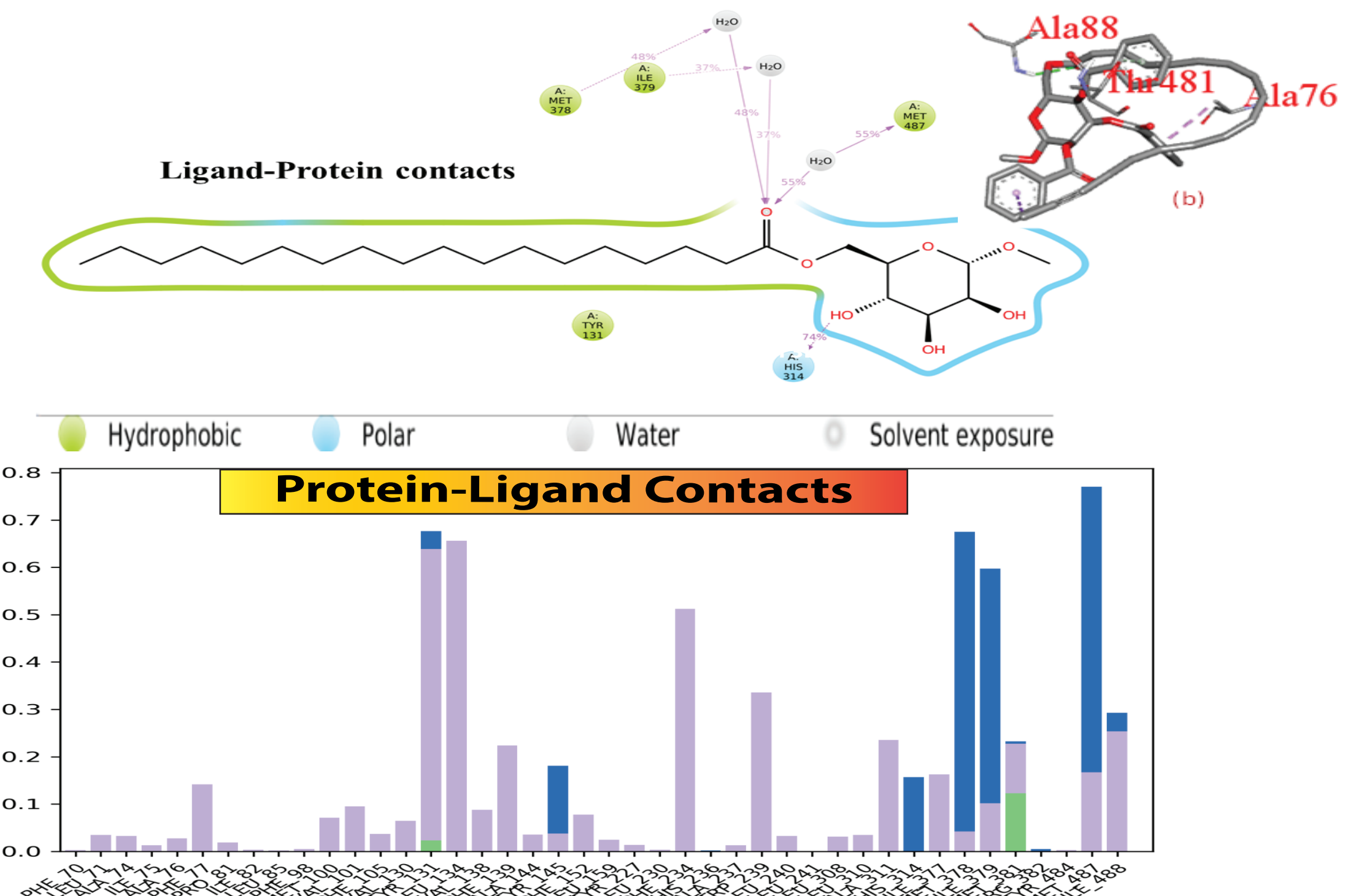
Molecular Dynamic Simluation



Ligand Properties



Ligand-Protein Contacts



Conclusion

In summary, our research successfully synthesized a range of steamroll mannopyranosides and assessed their antimicrobial activity. The results demonstrate that several of these compounds exhibit notable antimicrobial properties against antimicrobial agents. Overall, this work contributes to exploring carbohydrate-based compounds as an antimicrobial agent and lays the groundwork for future research.

Acknowledgement

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