Biointerface Research in Applied Chemistry
Open-Access Journal (ISSN: 2069-5837)

Article
Volume 13, Issue 1, 2023, 52
https://doi.org/10.33263/BRIAC131.052

Uridine-Derived 4-Aminophenyl 1-Thioglucosides: DFT Optimized FMO, ADME, and Antiviral Activities Study

Mohammad Atiqur Rahman [1], Unesco Chakma [2], Ajoy Kumer [3], Md. Rezaur Rahman [4], Mohammed Mahbubul Matin [1,*]

[1] Bioorganic and Medicinal Chemistry Laboratory, Department of Chemistry, Faculty of Science, University of Chittagong, Chittagong, 4331, Bangladesh; atiqchemcu@gmail.com (M.A.R.); mahbubchem@cu.ac.bd (M.M.M.);
[2] Department of Electrical and Electronic Engineering, European University of Bangladesh, Gabtoli, Dhaka, 1216, Bangladesh; unescochakma@gmail.com (U.C.);
[3] Department of Chemistry, European University of Bangladesh, Gabtoli, Dhaka, 1216, Bangladesh; ajoy@eub.edu.bd (A.K.);
[4] Department of Chemical Engineering and Energy Sustainability, Faculty of Engineering, Universiti Malaysia Sarawak, Jalan Datuk Mohammad Musa, Kota Samarahan, 94300, Malaysia; rmrezaur@unimas.my (M.R.M.);
* Correspondence: mahbubchem@cu.ac.bd (M.M.M.);

Scopus Author ID 7006284929
Received: 12.11.2021; Accepted: 16.12.2021; Published: 30.01.2022

Abstract: The biological roles of carbohydrates, especially their synthetic glycoconjugates, are at the forefront of research, and their applications and research are in the development of an impressive area of carbohydrate-derived vaccines. Considering this, several thioglucosides 2-6 conjugated with para-aminophenyl and uridine moieties are investigated for their possible application as hepatitis antiviral applications. Geometry optimization of these uridine thioglucosides by density functional theory (DFT) indicated that their glucopyranose rings are in $^4C_1$ chair conformation with β-glucosidic linkage. Frontier molecular orbital (FMO), molecular electrostatic potential (MEP), lower hardness, and softness calculations indicated their higher electrophilic nature. Solubility and ADMET studies indicated that the uridine thioglucosides might be safer drugs to use. With these encouraging results, molecular docking of 2-6 was conducted with hepatitis C virus (HCV, 3su4) and hepatitis B virus (HBV, 5e0i) proteases where the binding affinities for 2-6 were found higher than the standard anti-hepatitis drug sofosbuvir. Overall, the thioglucosides showed a better binding affinity with HBV protease (5e0i) than the HCV protease (3su4), indicating their prospect against these viruses.

Keywords: DFT optimization; docking; 5e0i; glucoconjugates; Hepatitis viral infection; pharmacokinetic properties; protease inhibition; 3su4.

1. Introduction

Changes in glycosylation can alter inflammatory responses, promote cancer cell metastasis and enable viral immune escape, including damage to kidney function that affects health problems and diseases. In this respect, glycoconjugation of selected monosaccharides/carbohydrates with chosen proteins and other biomolecules improve the ability to fine-tune immunological responses and boost immune responses to cancer. A sufficient fundamental understanding of glycoconjugates' structural insights and functions may enrich glycomedicine. Most glycoconjugate relies on a covalent link between carbohydrates and chosen molecule or macromolecule (protein) [1]. The biosynthesis of highly glycosylated glycoproteins found on the surface of several viruses is prepared by glycosyltransferases (GTs)