RJC

RASĀYAN *J. Chem.*
Vol. 14 | No. 2 |1341-1350| April - June | 2021
ISSN: 0974-1496 | e-ISSN: 0976-0083 | CODEN: RJCABP
http://www.rasayanjournal.com
http://www.rasayanjournal.co.in

MOLECULAR MODELING, ADMET PREDICTION, SYNTHESIS AND THE CYTOTOXIC ACTIVITY FROM THE NOVEL *N*-(4-*tert*-BUTYLPHENYLCARBAMOYL)BENZAMIDE AGAINST HELA

B.T. Purwanto[1,✉], Siswandono[1], D. Kesuma[2], T. Widiandani[1] and I. Siswanto[3]
[1]Department of Pharmaceutical Sciences, Faculty of Pharmacy, Universitas Airlangga, Surabaya-60286, East Java-Indonesia
[2]Department of Pharmaceutical Chemistry, Faculty of Pharmacy,Universitas Surabaya, Surabaya-60293, East Java-Indonesia
[3]Department of Chemistry, Faculty of Science and Technology, Universitas Airlangga, Surabaya-60268, East Java-Indonesia
✉Corresponding Author: bambangsutony@gmail.com

ABSTRACT

Efforts to develop urea derivatives as anticancer agents thrive due to their proven anticancer activities. *N*-(4-*tert*-butylphenylcarbamoyl)benzamide was synthesized by Schotten Baumann reaction, rendering 59%. To determine the purity, a thin-layer chromatography method in 3 different mobile phases was adopted, indicating a stain with distinguishing Rf. Structure identification indicating the compound was *N*-(4-*tert*-butylphenylcarbamoyl)benzamide. To predict cytotoxic activity, molecular docking with Autodocks Program was used by supplementing CHK1 enzyme (code PDB: 2YWP) against HeLa cells. The prediction score was confirmed by Molecular Docking Simulation (MDS). *N*-(4-*tert*-butylphenylcarbamoyl)benzamide (-4.41) has a smaller docking score compared to that of hydroxyurea (-2.69), suggesting higher cytotoxicity. MDS score highlighting this compound with (-13.1223±4.6818) total energy, smaller than the one in reference compound, (-0.0446±0.3621). This new compound indicated properties with favorable anticancer activity in the ADMET prediction, due to the toxicity displayed against the organ. On the cytotoxic activity test against HeLa cells, the IC_{50} of-(4-*tert*-butylphenylcarbamoyl)benzamide is 3.78 nM, smaller than that of hydroxyurea, IC_{50} 9.91 nM. The data suggest that the synthesized *N*-(4-*tert*-butylphenylcarbamoyl) benzamidedisplays higher cytotoxic activity compared to hydroxyurea. This synthesized compound allows further study in drug development, serving as a new anticancer agent.

Keywords: Molecular Docking, Molecular Dynamic Simulation, ADMET Prediction, Synthesis, Cytotoxic Activity, *N*-(4-*tert*-butylphenylcarbamoyl)benzamide, HeLa Cells

RASĀYAN *J. Chem.*, Vol. 14, No.2, 2021

INTRODUCTION

The imbalance between the production and scavenging of Reactive Oxygen Species (ROS) results in the disruption of normal cell function, leading to damage on protein, DNA, tissue, and biomolecule that induces the growth of new cells known as cancer cells. In the future, cancers will be more and more diagnosed, with lung and breast cancers rank the highest. According to National Breast Cancer Foundation in America, approximately 200,000 women were diagnosed with breast cancer.[1]

Cancer has become the second leading cause of mortality across the globe. As a result, coping with cancer is inevitably crucial in the field of medicine. The use of complementary and alternative drugs has become ubiquitous, encouraging rapid growth in drugs development, particularly in Asian countries.[2]

Modern drugs have successfully become an effective treatment for malignant tumors, and they are continuously developing. The failing therapy on cancers is primarily due to unspecific drug compounds, drug resistance, and the complications of the patients. Hydroxyurea is one of the cancer drugs working to inhibit the mitosis process of cancer cells and thus prevent them from proliferating. The urea protein

structure as a pharmacophore allows other urea derivative compounds to display anticancer activity as well.[3]

Hydroxyurea has gained popularity as an anticancer drug. Yet, its ability to penetrate biological membranes is uncertain. The hydroxyl group bound to one of the nitrogen atoms turns the compound to be hydrophilic. Changing the structure of the urea compound is to improve the compound's penetration into a biological membrane. Adding a phenyl group to one of the nitrogen atoms will result in better penetration of this urea derivatives compound compared to hydroxyurea. The phenyl group, as in the *N*-phenyl urea compound, will lead to a more lipophilic compound compared to hydroxyurea. Thus the compound can penetrate the biological membrane more easily.[4]

Some researchers have developed *N*-phenylurea and its derivatives as anticancer agents. Song *et al*. (2009) has synthesized 3-haloacylamino-phenylureas. Bromoacetil group bound to one of the hydrogen atoms exhibit potent anticancer activity against 8 human tumor cells with $IC_{50}$of 0.38 - 4.07 uM.[5] Another study conducted by Szafranski *et al*. (2015) synthesized 4-substituted-*N*-(phenylcarbamoyl)-3-pyridine sulfonamide compound and its derivatives. One of the derivatives *N*-(4-chlorophenylcarbamoyl)-4(4-(3,4-dichlorophenyl)piperazine-1-yl)pyridine-3-sulfonamide has potent antitumor activity against leukemia, colon cancer and melanoma with IC_{50} of 13.6-14.9 uM.[6] In addition, another *N*-phenylurea derivative compound- 1-(2-methyl-6-arylpyridine-3-yl)-3-phenylurea - has been synthesized with its 51 derivatives having potent anticancer activities against lung cancer A549 and colon cancer HCT-116 with IC_{50} of 3.22±0.2 dan 2.71±0.16 uM.[7]

Predicting anticancer activity of *N*-phenylurea derivatives may adopt *In-silico* test molecular modeling with certain computer programs e.g. Autodock. This program allows investigating the reaction between the compound and the receptor or enzymes that play roles in the proliferation of cancer cells. One of these enzymes is Checkpoint kinase-1(CHK1) which contributes to the increasing damage of DNA on p-53 deficient cell. This DNA damage induces the phosphorylation process which terminates cell proliferation on phase S and G2. Therefore, the rise in Checkpoint kinase-1(CHK1) may expand DNA damage selectively on cancer cells, thus the existence of a selective inhibitor compound on CHKI is applicable for highly favorable cancer therapy.[8] The compound prepared for a synthesis underwent an activity prediction test for its anticancer properties, through *In-silico* and molecular docking process against CHK-1 enzyme to obtain Molecular Docking Score (MDS) which would be compared with the standard compound, hydroxyurea.[8] The ADMET prediction process was also required due to the novelty of *N*-(4-*tert*-butylphenylcarbamoyl)benzamidecompound to properly investigate the prediction score of absorption, distribution, metabolism, excretion and also the toxicity. This enables further development of the compound as a novel anti-cancer agent.[9]

N-(4-*tert*-butylphenylcarbamoyl)benzamide, the synthesized *N*-phenylurea derivative compound, was derived from nucleophilic acylation between *N*-phenylurea and 4-tert-butylbenzoyl chloride using Schotten Baumann method.[10] The physical and chemical properties of the synthesized compound changed in the process. The lipophilic, electronic and steric properties turned higher compared to the original compound, thus enhancing the anticancer activity of the synthesized compound.[4]

By applying the MTT assay method and using HeLa cancer cells - standard cells most commonly used in anticancer activity test - anticancer activity test was performed.[11]

EXPERIMENITAL

Material

Materials for physicochemical synthesis and analysis: *N*-phenylurea, 4-t-butylbenzoyl chloride, pyridine, variants of organic solvent (acetone, ethyl acetate, *n*-hexane, chloroform, ethanol, and methanol with pro analysis quality), Kieselgel 60 F_{254}, DMSO-d_6.

Materials for activity test: Synthesized compound, HeLa culture cell, Culture Media DMEM. DMSO, Phosphate-buffered Saline (PBS), MTT [3-(4,5-dimethylthiazol-2-il)-2,5-diphenyltetrazolium bromide], SDS 10% in 0,1 N HCl.Standard compound: hydroxyurea (Sigma Aldrich).

The Tools used for Synthesis and Analysis of Compound Structure

Glass tube, UV-vis Shimadzu HP 8452 ASpectrophotometer, Jasco FT-IR 5300 Spectrophotometer, NMR

Hitachi R-1900Spectrometer, Electrothermal Mel-Temp, Corning Hot Plate P 351, Shimadzu LM-20 analytical balance.

Tools for Cytotoxic Test
Micropippet 200, 1000 µL and tip, culture tube, *microplate, Conical tube,* ELISA-Reader.

Devices and Software used for Molecular Modelling
Lenovo computer, operating system Windows 10, 64 bit, intel core i-5-7200 U, CPU@250 GHz, 8.00 GB RAM. Mgl Tools (Version 1.5.6). AutoDockTools (Version 4.2.6) with Autogrid.

Devices used for ADMET Prediction
Lenovo computer, operating system Windows 10, 64 bit, intel core i-5-7200 U, CPU@250 GHz, 8.00 GB RAM. Chem.Bio.Draw Ultra Version 12 (Cambridge Soft); Chem.Bio3D Ultra Version 12 (Cambridge Soft); Online SMILES Translator, and pkCSM online tool.

Docking Method Validation
When doing docking protocol on *N*-(4-*tert*-butylphenylcarbamoyl)benzamidecompound using Autodock 4.2.6 dan Autogrid program, it is required to perform method validation by redocking its native ligand to A41_1 protein, whose native ligand has been removed. The parameter for this method validation is the value of Root Mean Square Deviation (RMSD), with a tolerable value of ≤ 2.0 A^{o}.[12]

***In-silico* Prediction on Cytotoxic Activity**
Autodocks software (Version 4.2.6) was used to predict the cytotoxic activity of this compound. Molecular docking simulation is performed between the test compound and checkpoint kinase1 enzyme (CHK1), ID PDB: 2YWP which contains a ligand of 1-(5-chloro-2,4-dimethoxyphenyl)-3-(5-cyanopyrazin-2-yl)urea (A42_1), downloaded from Protein Data Bank (PDB) server.
To prepare protein and ligand molecule, Mgl Tools (Version 1.5.6) was used. And to obtain a perfect/great assignment grid parameter of each ligand, the grid box was generated by trials and errors.
The grid box dimension of X: 32, Y: 20, Z: 16, while the grid box center of X: -3.864, Y: 9.389, Z: -18.202 were used for docking calculation. Subsequently, the docking process was conducted by running the Lamarckian Genetic Algorithm. Here, the default parameters and one hundred independent docking runs were carried out for every chemical structure.[13-17]

Molecular Dynamics Simulation
The ligand-receptor binding energy that has been calculated using molecular docking procedure should allow validations on molecular dynamics simulation.[18] This simulation procedure adopts the Amber Molecular Dynamics program package for 10ns simulation.[19] The trajectory files from this simulation were analyzed to calculate free energy binding between receptors and each of the ligands. To calculate the simulation, Python interpreter module and MMPBSA.py in Amber Molecular Dynamics Package Program were employed. Before calculating, the complex bindings between the receptor of checkpoint kinase1 and the native ligand model (PDB ID: 2YWP) were downloaded from the PDB server. This process worked with the UCSF Chimera program.[20] Partial atomic charges were added to each standardized residual of the receptor using Molecular Mechanics (MM) software with AMBER ff14SB force field. While for non-standardized residuals of the ligand, the semi-empirical AM1-BCC method was applied.[21] Other ligands in this experiment - 4TBPCB, and HU were converted from their 2D to 3D ligands using the semi-empirical PM6 method.

ADMET Prediction
The prediction on pharmacokinetic properties (ADMET: Absorption, Distribution, Metabolism, Excretion and Toxicity) of the active compound was determined using pkCSM online tool software. The 2D structure of the active compound was illustrated in Chem. Bio. Draw. Ultra-Version 12.0 programe. To obtain the 3D image of the structure, the illustration was copied to Chem. Bio. 3D Ultra Version 12.0

software and saved on *.sdf files and subsequently interpreting the active compound data on SMILE format in Online SMILES translator (http://cactus.nci.nih.gov/translate/). In its SMILES format, the active compound underwent ADMET prediction by utilizing pkCSM online tool (htpp://biosig.unimelb.edu.au/pkCSM/prediction).[22,23]

Synthesis of-(4-tertier-butylphenylcarbamoyl) benzamide Compound

0,03 mol of *N*-phenylurea compound was mixed with 40 ml of tetrahydrofuran and pyridine4 ml on a 200 in a round-bottom flask. 4-t-butylbenzoyl chloride 0,01 mol was added at 5ºC temperature into 20 ml of tetrahydrofuran and placed on a magnetic stirrer hotplate. Once 4-t-butylbenzoyl chloride solution was completely heated up, the mixture was refluxed and stirred for 8 hours.

Upon terminating the reaction, tetrahydrofuran was then evaporated on rotavapor. Saturated natrium bicarbonate liquid was supplemented on the reaction outcome and stirred to eliminate any bubbles. Using Buchner filter funnel, the solid substance was rinsed with 50 ml water and repeated twice, followed by a wash with 10 ml ethanol two times. The recrystallization process was performed by diluting the solid substance with hot ethanol adequately while stirred in a hot plate. The solution was filtered while hot and stored at room temperature overnight. The crystallized substance was filtered with a Buchner funnel, washed in 10 ml ethanol twice. Recrystallization can also be conducted using another appropriate solution depending on the synthesized compound, like acetone-water. The crystal formed was transferred to a petri dish, dried in a 50ºC oven to obtain a constant mass.[24-27]

The structure identification of active N-(4-*tert*-butylphenylcarbamoyl)benzamide utilized the following instruments: UV-Vis dan IR spectrophotometer, ^{1}H-NMR, dan Mass spectrometer.[28]

The reaction between *N*-phenylurea with 4-t-butylbenzoyl chloride compound can be seen in Fig.-2 as follows:

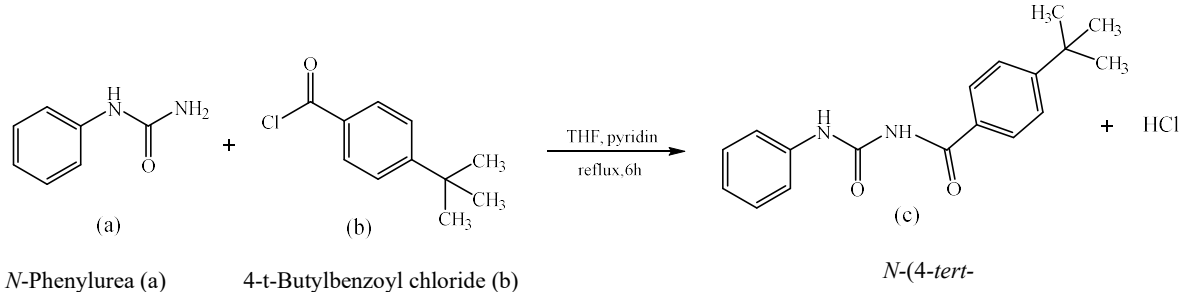


Fig.-2: The Synthesis Reaction of *N*-(4-*tert*-butylphenylcarbamoyl)benzamide

Cytotoxic Activity Test

Anticancer activity or cytotoxic test in vitro with cancer cells were proceeded with MTT assay approach. A mother compound was prepared from the test compound, *N*-(4-*tert*-butylphenylcarbamoyl)benzamide, as much as 5000 µg/mL in DMSO solution. From each mother compound, a series of standard compounds with 250, 500, 750, 1000, 1500, 2000 µg/mL concentrations were prepared by dilution. As a positive control, standard anticancer drug solution, hydroxyurea was prepared along with solvent blanks as a negative control.

The culture of cancer cells (HELA cells) was prepared, and so with normal cells in cell suspension with 10^5-$2.10^{6.}$ density. Each 100 µL of the cells were seeded in Microplate wells, except those for control media. 0,2 mL of standard solution, positive and negative control, each was added in a microplate well. Each standard solution was replicated 3 times. The microplate was incubated for 24 hours in 5% CO_2 incubator at 37ºC with pH 7.4-7.7.

MTT reagent was prepared for 0,5 mg/ml treatment by diluting 1mL of MTT stock (there is 50 mg MTT in 10 mL PBS) with adequate media. After incubation, cell media was removed, and cells were washed in PBS then added with 100 µL of MTT reagent on each well, including control media (no cells included). The plate was incubated for 24 hours. Once formazan was formed, it was added with 100µL SDS 10% in 0,1 N HCl. The plate was covered with aluminium paper and incubated in a dark room at room temperature for 24 hours. The absorbance of each well was examined in an ELISA reader at 595 nm

wavelength. The more cells proliferate, the bigger is the absorbance. The IC_{50} of the test compound was determined with probit regression analysis.[29]

RESULTS AND DISCUSSION

Docking Validation Score

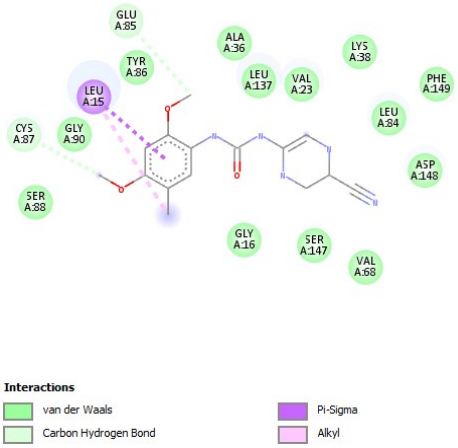
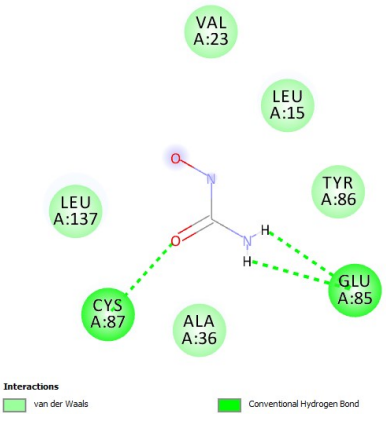
After performing the validation method by the redocking native ligand on A42_1 protein, whose native ligand has been removed, Root Mean Square Deviation (RMSD) value was obtained: 1.02 Aº. The tolerable RMSD value is ≤ 2.0 Aº.

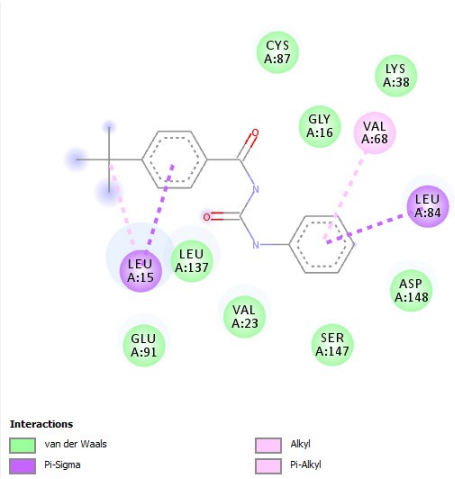
In this study, as indicated in Table-1, the average value of RMSD of a native ligand with A42_1 is 1.02. This means Autodock 4.2 and Autogrid method have met the requirements for validation.

In-silico Molecular Modeling

The result of molecular docking of standard ligand compound 1-(5-Chloro-2,4- dimethoxy-phenyl) -3-(5-cyanopyrazin-2-yl)urea, reference compound Hydroxyurea and test compound *N*-(4-*tert*-butylphenylcarbamoyl)benzamideusing Autodock 4.2.6 program can be seen in Table-1.

Table-1: Molecular Docking Score on Standard Ligand Compound, Hydroxyurea and *N*-(4-*tert*-butylphenylcarbamoyl)benzamide using Autodock 4.2.6 Program

Compound	MDS	Interactions of Ligand-amino acid
1-(5-Chloro-2,4-dimethoxyphenyl)-3-(5-cyanopyrazin-2-yl)urea RMSD : 1.02 Aº	-6.85	
Hydroxyurea	-2.69	

N-(4-*tert*-butylphenylcarbamoyl)benzamide	-4.41	

Interactions between ligand molecules and receptors were as displayed in Table-1. *N*-(4-*tert*-butylphenylcarbamoyl)benzamide compound demonstrate docking score of -4.41, smaller compared to that of hydroxyurea, -2.69. This indicates that the binding between *N*-(4-*tert*-butylphenylcarbamoyl)benzamidewith its receptor is substantially more stable due to the smaller energy required. In addition, there are a lot more bindings between *N*-(4-t-butylphenylcarbamoyl)benzamide compound and amino acid proteins (CysA:87; LysA:38; GlyA:16; ValA:58; LeuA:84; AspA:148; SerA:147; Val A:23; LeuA:137; Leu A:15; GluA:91) compared to those with hydroxyurea (ValA:23; LeuA:15; Tyr A:86; GluA:85; Ala A:36; CysA:87; LeuA;137). Thus, the binding between *N*-(4-t-butyl-phenylcarbamoyl)benzamide with the receptors will be stronger. Therefore, it is predicted that *N*-(4-*tert*-butylphenylcarbamoyl)benzamidehas higher cytotoxic activity than that of hydroxyurea. However, when compared to the native ligand, A42_1, *N*-(4-*tert*-butylphenylcarbamoyl)benzamidehas a greater MDS value. Hence, it is predicted that this compound has less cytotoxic activity.

Molecular Dynamics Simulation

Binding free energy calculated from this simulation for hydroxyurea (HU) and *N*-(4-*tert*-butylphenylcarbamoyl)benzamide (4TBPCB) was listed in Table-2.

Table-2: Binding Free Energy between Receptor and Ligands after 10 ns Simulation

Energy Component	Ligands	
	4TBPCB	HU
VDWAALS	-14.8863 ± 5.0141	-0.0931 ± 0.4101
EGB	3.7761 ± 1.1997	0.0675 ± 0.1999
ESURF	-2.0121 ± 0.6470	-0.0190 ± 0.1092
DELTA G gas	-14.8863 ± 5.0141	-0.0931 ± 0.4101
DELTA G solv	1.7641 ± 0.7831	0.0485 ± 0.1223
DELTA Total	-13.1223 ± 4.6818	-0.0446± 0.3621

To substantiate the prediction of cytotoxic activity of *N*-(4-*tert*-butylphenylcarbamoyl)benzamidecompound, Molecular Dynamic Simulation (MDS) was performed as displayed in table 2. *N*-(4-*tert*-butylphenylcarbamoyl)benzamide has a component total energy of -13.1223, far smaller compared to that of hydroxyurea, -0.0446. This confirms the prediction that the cytotoxic activity of *N*-(4-*tert*-butylphenylcarbamoyl) benzamide is higher than that of hydroxyurea.

ADMET Prediction

ADMET prediction score of reference compound hydroxyurea (HU) and test compound *N*-(4-*tert*-butylphenylcarbamoyl)benzamide (4TBPCB) can be seen in Table-3.

Table-3: ADMET Prediction of Reference Compound hydroxi urea (HU) and Test Compound *N*-(4-*tert*-butylphenylcarbamoyl)benzamide(4TBPCB)

ADMET	Test	HU	4TBPCB
Absorption	Intestinal Absorption (human) in % Skin Permeability (log Kp, cm/h)	73.127 -4.319	90.931 -3.08
Distribution	VDss (logL/kg) BBB Permeability (logBB)	-0.495 -0.545	-0.238 0.365
Metabolism	CYP2D6 Substrate CYP2D6 Inhibitor	No No	No No
Excretion	Renal OCT2 Substrate Total Clearance (log ml/min/kg)	No 0.659	No 0.234
Toxicity	Ames Toxicity LD_{50} (mol/kg BW) in rat Hepatotoxic	Yes 2.116 No	No 1.611 No

As many as 2.245 drug compounds were analyzed by Lipinski *et al.*, and listed in World Drug Index and known as Lipinski rule of 5 since the resulted analysis values are multiples of Five. When a drug compound has a molecular weight > 500, it will be difficult to be absorbed with low permeability. The Partition Coefficient Log value on octanol/water (logP) is bigger than +5, hydrogen binding donor value (HBond=HBD) was expressed by the number of bindings of OH and NH groups, more than 5, and Hydrogen receptor (HBO) expressed by the number of O and N atoms, more than 10.30.

N-(4-*tert*-butylphenylcarbamoyl)benzamidecompound has a molecular weight of 296.36, smaller than 500, with Partition Coefficient Log value on octanol/water (logP) = 4.16, smaller than +5. The number of OH and NH groups = 2, less than 5, while the number of O and N atoms = 4, less than 10. Hence, this compound is predicted to have great absorption and high permeability.

After administering oral medication, drugs are normally best absorbed in the intestine. Here, the number of absorbed compounds can be predicted. When less than 30%, it means the absorption is poor.[30] Ideally, drug compounds have 90% of oral bioavailability with no individual variability.[31] In Table-3, *N*-(4-*tert*-butylphenylcarbamoyl)benzamideseems to have human intestinal absorption of 90.931%, meaning that the compound is predicted to have good bioavailability.

For transdermal drug development, skin permeability is compelling to study. Skin permeability coefficient is stated with Kp (cm/h) log value that allows skin permeability prediction on drug compound. One compound is predicted to have skin permeability when the Kp (cm/h) log value Kp > -2.5. In Table-3, *N*-(4-t-butyl-phenylcarbamoyl) benzamide compound has log value of Kp -3.08 (cm/h), which means that this compound has low permiability.[32]

The volume of distribution (VDss) is the theoretical volume of drugs total dosage required for distribution, thus enables equal concentration in blood. When a compound is high in VDss value, it can be said that the compound is distributed more in the tissue than in blood plasma. When the log value is VDss < -0.15, it suggests a low distribution. When the log value is VDss > 0.45 then it has high distribution.[32]

In table 3, *N*-(4-*tert*-butylphenylcarbamoyl)benzamidecompound is shown to have log value VDss -0.238, meaning that this compound has a low distribution volume.

According to Pires *et al* (2015), a compound is considered capable of penetrating the blood-brain barrier well when it has Log BB > 0,3. On the other hand, with log BB < -1 a compound is unable to distribute well. In Table-3, *N*-(4-*tert*-butyl-phenylcarbamoyl)benzamide compound indicates a value of log BB 0.365. Thus, it can be inferred that this compound is incapable of penetrating the blood-brain barrier.[32]

Cytochrome P450 is an important enzyme in the detoxification process and is the primary enzyme located in the liver. This enzyme plays a significant role in the oxidation process and may facilitate excretions of foreign organic compounds including drugs. It is crucial to note that drug compounds may inhibit the cytochrome P450 enzyme from functioning. In this study, it is represented by Cytochrome P3D6 isofarm (CYP2D6). *N*-(4-*tert*-butylphenylcarbamoyl)benzamidecompound in Table-3 indicates that it does not inhibit the function of the cytochrome P450 enzyme.

The excretion process of drug compounds is possible to predict by measuring the total clearance (Cltot) and Renal Organic Cation Transporter 2 (OCT2) substrate. C1 total is a combination of hepatic clearance

(metabolism in liver and bile) and renal excretion. In table 3, *N*-(4-*tert*-butylphenylcarbamoyl)benzamide compound has a value of 0.234 which indicates the excretion speed of the compound.
OCT2 is a transporter in the kidney that has an important role in the disposition and clearance of drug compounds and endogen compounds in the human body. *N*-(4-*tert*-butylphenylcarbamoyl)benzamidecompound in Table-3 demonstrates that this compound does not affect OCT 2, enabling the compound to excreted so easily.[32]
Ames cytotoxic test is an assay to demonstrate the toxicity of a compound and is commonly adopted to access the mutagenic nature of a compound using bacteria. When tested positive, it suggests that the compound is mutagenic dan possibly act as a carcinogen. *N*-(4-*tert*-butylphenylcarbamoyl)benzamidein Table-3 displays that this compound is nontoxic both in Ames test and hepatotoxicity. Hence, this compound is considered safe. In a compound with LD_{50} test on mice, the value is 1.611 mg/kgBW, suggesting that the compound has a low toxicity value. To kill a guinea pig 50%, it takes 457mg/kgBW dosage. [32]

Chemical Structure Identification

N-(4-tertier-butylphenylcarbamoyl)benzamide, yield: 59%; MP: 171°C; UV (methanol, λmaks, nm): 236; FT-IR (KBr pellet, cm^{-1}): 3467 (NH sec), 2965 (C-H alkane), 1685 and 1610 (2 C=O ureide), 1568, 1423 (C=C arom); ^{1}H-NMR (DMSO-d_6, σ, ppm): 7.00-8.20 (m, 9H, C_6H_5 and C_6H_4); 10.20 (s, 1H, NH); 10.80 (s, 1H, NH); 1.0-1.6 (m, 9H, $C(CH_3)_3$; MS (EI; m/e): 246 $(M)^+$.
According to the interpretation data of compound structure in item 4, where there are 2 carbonyl ureida groups on wave number 1685 and 1610 cm^{-1} on Infra-Red interpretation. This is then confirmed with 9 hydrogen atoms on 7.00-8.20 ppm chemical shifton ^{1}H-NMR spectrum. In addition, a molecular weight of the compound interpreted on Mass Spectral Method (246) shows that *N*-(4-*tert*-butylphenylcarbamoyl)benzamidecompound has been successfully synthesized and has structures as depicted in Fig.-5 below.

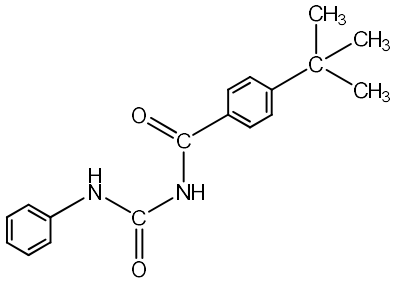


Fig.-5: Structure of *N*-(4-*tert*-butylphenylcarbamoyl)benzamide

Cytotoxicity Test with HeLa Cells

Data of cytotoxicity test with HeLa cells from reference compound Hydroxyurea and test compound *N*-(4-*tert*-butylphenylcarbamoyl)benzamide are shown in Figs.-3 and 4 and Table-4.

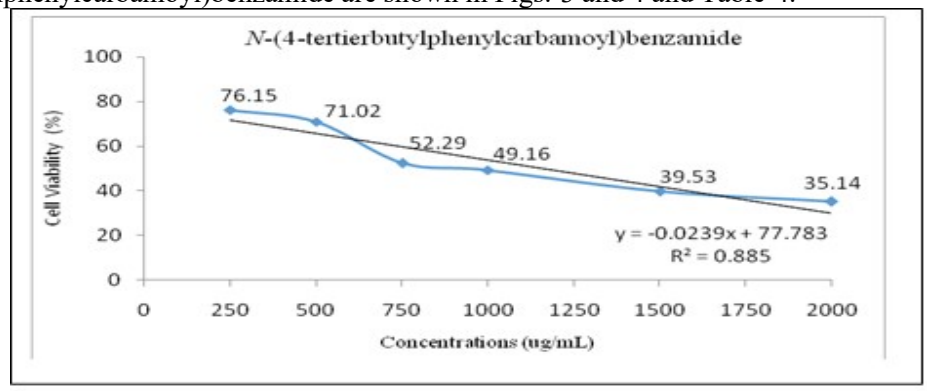


Fig.-3: Cytotoxic Activity Curve of *N*-(4-*tert*-butylphenylcarbamoyl)benzamide Compound

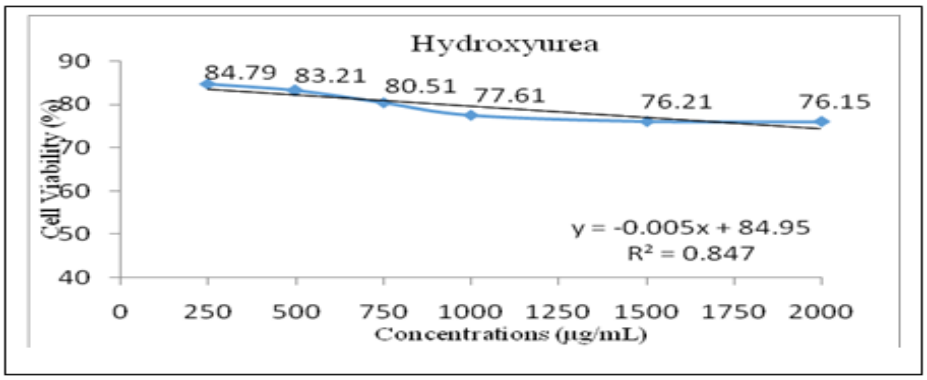


Fig.-4: Cytotoxic Activity Curve of Hydroxyurea

Table-4: Data of Cytotoxicity Test with HeLa Cells from Reference Compound Hydroxyurea and Test Compound *N*-(4-*tert*-butylphenylcarbamoyl)benzamide

Dosages (µg/ml)	%Viability Cells	
	Hydroxy Urea	4TBPCB
250	84.79	76.15
500	83.21	71.02
750	80.51	52.29
1000	77.61	49.16
1500	76.21	39.53
2000	76.15	35.14

According to the data shown in table 3 for *N*-(4-*tert*-butylphenylcarbamoyl)benzamide compound and hydroxyurea, curve image on figure 2 and curve image on figure 3, it can be seen that *N*-(4-*tert*-butylphenylcarbamoyl)benzamide compound has higher cytotoxic activity compared to hydroxyurea. On a conducted regression analysis, the IC_{50} of *N*-(4-*tert*-butylphenylcarbamoyl)benzamide compound obtained is 9.1 mM. It can be inferred that *N*-(4-*tert*-butylphenylcarbamoyl)benzamide compound has far greater cytotoxicity compared to hydroxyurea.

CONCLUSION

N-(4-*tert*-butylphenylcarbamoyl)benzamide compound has been synthesized and has a great cytotoxic activity, allowing further study in drug development and serves as a new anticancer agent.

REFERENCES

1. M. Sidharta, G. R. Kumar, B. Prasanna and A. Thirupathiah, *Rasayan Journal Chemistry*, **11(2)**, 661(2018), **DOI:**10.37188/ RJC.2018.1122062
2. V.S. Talismanov, S.V. Popkov, S.S. Zykova, O.G. Karmanova, S.A. Bondarenko, *Journal of Pharmaceutical Scences and Research*, **10(1)**,152(2018).
3. P. Gummala, A. Annapura, P. Madhukiran, *International Journal of Green Chemistry*, **11(4)**, 230(2017).
4. Siswandono, Pengembangan Obat Baru, Surabaya: Airlangga University Press (2016)
5. D.Q. Song, N.N. Du, Y.M. Wang, W.Y. He, E.Z. Jiang, S.X. Cheng, Y.X. Wang, Y.H. Li, Y.P. Wang, X. Li, J.D. Jiang, *Bioorganic Medicinal Chemistry*, **17(11)**, 3873(2009), **DOI:**10.1016/j.bmc.2009.04.022
6. S. Krysztof and Joroslawinski, *Molecules*, **20**, 12029(2015), **DOI:**10.3390/molecules.200712029
7. W.M. Eldehna, H. Ghada, A. Rashad. T. Sora, A.W. Tarfah., A. Ahmed, A.K. Hamad, A.A. Abdulrahman., A.H.A. Abdel, *Journal of Enzyme Inhibition and Medicinal Chemistry*, **34(1)**, 322(2019), **DOI:**10.1080/14756366.2018.1547286
8. A. Hincliffe, Molecular Modelling for the beginner, 2nd Ed, Chichester: John Wiley and Sons., Ltd. (2008)

9. S. Hardjono, T. Widiandani, B.T. Purwanto, L.A. Nasyanka, *Research Journal Pharmaceutical and Technology*, **12(5)**, 2160(2019), **DOI:**10.5958/0974-360X.2019.00359.7
10. B.T. Purwanto, *International Journal of Pharmacy and Pharmaceutical Sciences*, **6(2)**, 452(2014).
11. K. Dini, Siswandono, B.T. Purwanto, M. Rudyanto, *Journal of Chinese Pharmaceutical Sciences*, **27(10)**, 665(2018), **DOI:**10.5246/jcps.2018.10.07
12. A.J. Jain, and A. Nicholls, *Journal Computational Aided Molecular*, **22**, 133(2008), **DOI:**10.1007/s. 10822-008-9196-5
13. Dassault Systèmes BIOVIA, 'Discovery Studio Modeling Environment, San Diego: Dassault Systèmes(2018)
14. G. Li, L.A. Hasvold, Z.F. Zao, G.T. Wang, S.L. Gwaltney, J. Patel, P. Kovar, R.B. Credo, Z. Chen, H. Zhang, C. Park, H. Sham, T. Sowin, S.H. Rosenberg, N.H. Lin, *Bioorganic* and *Medicinal Chemistry Letters*, **16**, 2293(2006), **DOI:**10.1016/j.bmc/ 2006.01.028
15. M.F. Sanner, *Journal of Molecular Graphics and Modelling*, **17**, 57(1999).
16. S.K. Burley, *et al*. *Nucleic Acids Research* **47**, D464(2019), **DOI:**10.1093/nar/gky1004
17. A. Yanuar*, Penambatan Molekular*: Praktek dan Aplikasi pada Virtual Screening'. Depok: Fakultas Farmasi Universitas Indonesia, p. 1-3(2012)
18. A. Fischer, M. Sellner, S. Neranjan, M.A. Lill, and M. Smieško, *ChemRxiv, Preprint* (2020), **DOI:**10.26434/CHEMRXIV. 11923239.V1
19. R. Salomon-Ferrer, D.A. Case and R.C. Walker, *Wiley Interdisciplinary Reviews: Computational Molecular Science*, **3(2)**, 198(2013), **DOI:**10.1002/wcms.1121
20. E.F. Pettersen, T.D. Goddard, C.C. Huang, G.S. Couch, D.M. Greenblatt, E.C. Meng and T.E. Ferrin, *Journal of Computational Chemistry*, **25(13)**, 1605(2004), **DOI:**10.1002/jcc.20084
21. J. Wang, W. Wang, P.A. Kollman, and D.A. Case, *Journal of Molecular Graphics and Modelling*, **25(2)**, 247(2006), **DOI:**10.1016/ j.jmgm.2005.12.005
22. A. Ghaleb, A. Aomdate, M. Bouachrine, T. Laklifi, A. Sbai, *Advance Pharmaceutical Bulletin*, **9(1)**, 84(2019), **DOI:**10.15171/apb.2019.011
23. S. Saeed, N. Rashid, P.G. Jones, M. Ali, and R. Hussain, *European Journal of Medicinal Chemistry*, **45**, 1323(2010), **DOI:**10.1016/j.ejmech.2009.12.06
24. J.M. Mc Murry, Organic Chemistry, 9th Ed., Belmont: Broke/Cole, pp 263-289; 779-851(2016).
25. D. Kesuma, Siswandono, B.T. Purwanto, R. Marcelino, *World Journal Pharmaceutical Research*, **7(7)**,70(2018), **DOI:**10.20959/WJPR 20187-11474
26. Siswandono, R. Widyowati, A. Suryadi, T. Widiandani, D. Prismawan, *Rasayan Journal of Chemistry*, **13(4)**, 2559(2020), **DOI:**10.31788/RJC.2020.1345749
27. B. Purwono, B.A. Nurohmah, P.Z. Fathurrohman, And J. Syahri, *Rasayan Journal of Chemistry*, **14(1)**, 94(2021), **DOI:** 10.31788/RJC.2021.1416088
28. R.M. Silverstein, F.X. Webster, and D.J. Kiemle, Spectrophotometric Identification of Organic Compound, 8th Ed, John Wiley and Sons, Inc., New York. (2015).
29. Ruswanto, A.M. Miftah, D.H. Tjahjono, Siswandono, *Proccellia Chemistry*, **17**, 157(2015). **DOI:**10.1016/j.proche.2015.12.105
30. C.A. Lipinski, F. Lombardo, B.W. Dominy, P.J. Feeney, *Advanced Drug Delivery Reviews*, **46(1-3)**, 3(2001), **DOI:**10.106/s0169-409x(00)00129
31. P. Imming, Medicinal Chemistry: Definitions and Objectives, Drug Activity Phases, Drug Classification Systems, in C.G. Wermuth, D. Aldous, P. Raboisson, D. Rognan, *The Practice of Medicinal Chemistry*, 4th ed., Amsterdam: Elsevier Ltd,.(2015), **DOI:**10.1016/s 0169-409 x(00)00129
32. D.E. Pires, T.L. Blundell, D.B. Asher, *Journal of Medicinal Chemistry*, **58(9)**, 4066(2015), **DOI:**10.1021/acs.j.med. chem.5600104

[RJC-6196/2020]

Volume 14 Number 2,

665-1440

April - June (2021)

Rasayan Journal of Chemistry

COUNTRY

India

Universities and research institutions in India

SUBJECT AREA AND CATEGORY

Biochemistry, Genetics and Molecular Biology
Biochemistry

Chemical Engineering
Chemical Engineering (miscellaneous)

Chemistry
Chemistry (miscellaneous)

Energy
Energy (miscellaneous)

Pharmacology, Toxicology and Pharmaceutics
Pharmacology, Toxicology and Pharmaceutics (miscellaneous)

PUBLISHER

Rasayan Journal

H-INDEX

22

PUBLICATION TYPE

Journals

ISSN

09741496, 09760083

COVERAGE

2008-2020

INFORMATION

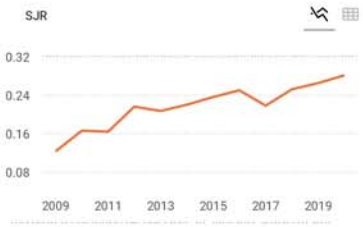
Homepage

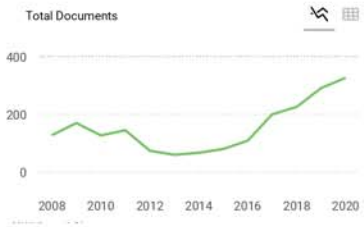
How to publish in this journal

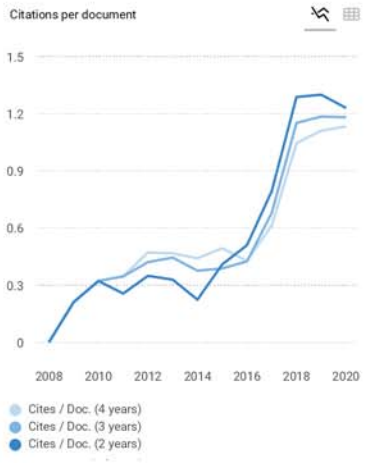
editor@rasayanjournal.co.in

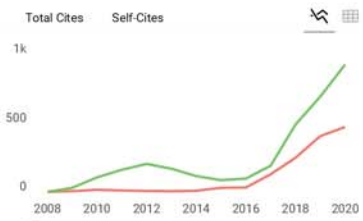
SCOPE

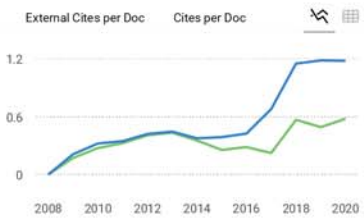
RASĀYAN Journal of Chemistry (RJC) signifies a confluence of diverse streams of Chemistry to stir up the cerebral powers of its contributors and readers. By introducing the journal by this name, we humbly intend to provide an open platform to all researchers, academicians and readers to showcase their ideas and research findings among the people of their fraternity and to share their vast repository of knowledge and information. The journal seeks to embody the spirit of inquiry and innovation to augment the richness of existing chemistry literature and theories. We also aim towards making this journal an unparalleled reservoir of information and in process aspire to inculcate and expand the research aptitude. RASĀYAN Journal of Chemistry (RJC) widely covers all branches of Chemistry including: Organic, Inorganic, Physical, Analytical, Biological, Pharmaceutical, Industrial, Environmental, Agricultural & Soil, Petroleum, Polymers, Nanotechnology, Green Chemistry, Forensic, Phytochemistry, Synthetic Drugs, Computational, as well as Chemical Physics and Chemical Engineering.

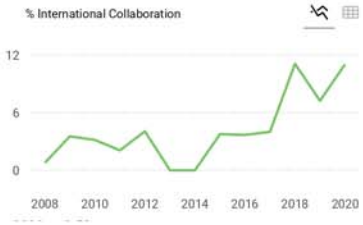


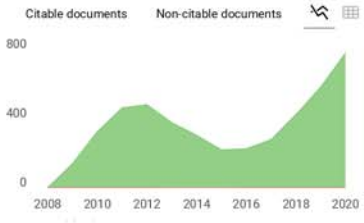


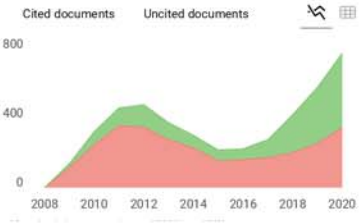












← Show this widget in your own website

Just copy the code below and paste within your html code:

<a href="https://www.scim

Metrics based on Scopus® data as of April 2021

C **C. VEERAVEL** 8 months ago

DEAR SIR,
I HAVE SUBMITTED A MANUSCRIPT BEFORE 20 DAYS . KINDLY GIVE ME STATUS OF MANUSCRIPT.

THANK YOU

reply

SCImago Team

Melanie Ortiz 7 months ago

Dear Veeravel,
thank you for contacting us.
We are sorry to tell you that SCImago Journal & Country Rank is not a journal. SJR is a portal with scientometric indicators of journals indexed in Elsevier/Scopus.
Unfortunately, we cannot help you with your request, we suggest you contact the journal's editorial staff , so they could inform you more deeply.
Best Regards, SCImago Team

S **SANTOSO** 2 years ago

I want to publish my paper in your journal.

Source details

Rasayan Journal of Chemistry

Scopus coverage years: from 2008 to Present

Publisher: Rasayan Journal

ISSN: 0974-1496 E-ISSN: 0976-0083

Subject area: Biochemistry, Genetics and Molecular Biology: Biochemistry | Chemical Engineering: General Chemical Engineering | Chemistry: General Chemistry | Energy: General Energy | View all

Source type: Journal

CiteScore 2020
2.1

SJR 2020
0.281

SNIP 2020
0.880

View all documents > | Set document alert | Save to source list

¡ Improved CiteScore methodology

CiteScore value counts the citations received in the last 4 years to articles, reviews, conference papers, book chapters and data papers published in the last 4 years, and divides this by the number of publications published in the last 4 years.

Current source has not enough data to display citescore value. Learn more >

=

View CiteScore methodology > | CiteScore FAQ >

Editorial Board

Ishmael MASESANE

Professor, Department of Chemistry, University of Botswana, Botswana

Contact: 26772874348

Email: MASESANE@UB.AC.BW

Research Interest: Organic synthesis, Natural product Chemistry, Medicinal Chemistry

Ime Bassey OBOT

Center of Research Excellence in Corrosion Research Institute, King Fahd University of Petroleum and Minerals (KFUPM), P.O. Box 489, Dhahran, 31262, Saudi Arabia

Contact: +966 13 860-8283

Email: obot@kfupm.edu.sa

Research Interest: Corrosion and Scale Inhibition, Chemo-informatics, Computational Chemistry.

Marei Mailoud EL-AJAILY

University of Benghazi, Faculty of Science , Department of Chemistry, Benghazi, Libya

Contact: 00218918315683

Email: melajaily@gmail.com

Research Interest: Mixed ligand complexes, Drugs, Applications, Corrosion inhibition, Molecular docking, DFT studies

Man SINGH

Professor and Dean, school of Chemical sciences, Gujrat central University, Gandhinagar, Gujrat, India

Contact: +91 9408635094

Email: mansingh50@hotmail.com

Research Interest: Surface Chemistry, Physical Chemistry

Mika SILLANPÄÄ

Department of Chemical Engineering, School of Mining, Metallurgy and Chemical Engineering, University of Johannesburg, Doornfontein 2028, South Africa

Contact: +358400205215

Email: mikaesillanpaa@gmail.com

Research Interest: Water treatment

Nnabuk Okon EDDY

Professor, Department of Chemistry, Ahmadu Bello University, Zaria, Kaduna State, Nigeria

Contact: +2348038198753

Email: nabukeddy@yahoo.com

Research Interest: Physical Chemistry, Computational Chemistry, Nanochemistry, Industrial Chemistry, Environmental Chemistry

Pankaj KUMAR

Professor and Head, Department of Chemistry, University of Energy and Petrolium studies, Dehradun, India

Contact: +917351958165

Email: pkumar@ddn.upes.ac.in

Research Interest: Biofuels and Bioenergy, Chemical sensors, Nano-materials, Minimization of industrial wastes

R.V. SINGH

Ex Professor, Department iof Chemistry, University of Rajasthan, Jaipur,India

Contact: +91 941406975

Email: rvsjpr@hotmail.com

Research Interest: Inorganic Chemistry

Archive Issue

Volume 14 Number 2, 665-1440, April - June (2021)

AMYLASE, PROTEASE, AND LIPASE ACTIVITY OF BUTTERFLY OF Junonia almana AND Junonia atlites

— N. M. Saptarini, D. Rahayu, and N. Yesita

SYNTHESIS AND CHARACTERIZATION OF ASTAXANTHINMETAL IONS (Cu2+ and Zn2+) COMPLEX

— S. Wibowo, B. D. Prakoso, S. Najihah, Z. H. Fajar, S. Widyarti, A. Sabarudin, D. W. Soeatmadji and S. B. Sumitro

MICROWAVE ASSISTED CATALYST AND SOLVENT FREE EFFICIENT SYNTHESIS OF QUINOLINE DERIVATIVES BY THREE COMPONENT ONE POT AZA-DIELS-ALDER REACTION STRATEGY

— Debajyoti Bhuyan

SYNTHESIS AND SPECTRAL CHARACTERIZATION OF MIXED LIGAND COMPLEXES: ALUMINIUM(III) CHELATES OF ORGANIC ACIDS WITH 1-NITROSO-2-NAPHTHOL

— Ratnesh Kumar Singh , Anju Kumari Gupta, Sachin Prakash and D. Prakash

Morinda citrifolia LEAF EXTRACT MEDIATED GREEN SYNTHESIS OF COPPER OXIDE NANOPARTICLES AND IT'S POTENTIAL AND ANTIBACTERIAL STUDIES

— K. Sofiya Dayana, R. Jothi Mani and S.C. Vella Durai

FABRICATION OF CERITINIB COCRYSTALS WITH IMPROVED SOLUBILITY: PREPARATION, SOLID-STATE CHARACTERIZATION, SOLUBILITY STUDIES, AND MOLECULAR DOCKING STUDIES

— Ankit Awasthi, H. M. Dheeraj, Sumit Birangal, Aravind Pai, Girish Pai and Muddukrishna Badamane Sathyanarayana

A SIMPLE GAS CHROMATOGRAPHY METHOD FOR THE QUANTITATIVE DETERMINATION OF RELATED IMPURITY (1,4-BUTANEDIOL) IN BUSULFAN DRUG

— H. Ramakrishna Reddy, S.R. Pratap, N. Chandrasekhar and S.Z.M. Shamshuddin

MOLECULAR DOCKING ANALYSIS OF Azadirachta indica CONSTITUENTS AS INHIBITORS OF AFLATOXIN POLYKETIDE SYNTHASE (APKS)

— Solomon Abrehame ,Merry Hailu, Valsa Remony Manoj , Yen-Po Chen , Radhakrishnan Narayanaswamy

ELECTRO-ANALYTICAL STUDIES OF FORMATION CONSTANTS OF MIXED-LIGANDS COMPLEXES OF CADMIUM(II) WITH SOME BIO-POTENTIALLY IMPORTANT AMINO ACIDS (L-GLYCINE, DL-THREONINE) AND "4,4,4- TRIFLUORO-1- (2-NAPHTHYL)BUTANE-1,3-DIONE" IN 60% ACETONITRILE MEDIUM

— Laksh Choudhary and C. P. Singh Chandel

STUDIES ON BIOSORPTION OF Pb(II) BY MAIZE STEM AND RICEHUSK POWDER

— Anjana Kumari, Ashok KumarJha and Kiran Kumari

SYNTHESIS OF ANTIBACTERIAL ACTIVE SUBSTANCES 1- METHYL-2-PHENYL/O-TOLYL-6-SUBSTITUTEDPHENYL 1HBENZO[d]-IMIDAZOLE DERIVATIVES

— Havale Shrikant Hanumantappa, Bhavani Singh , Dharma Kishore , S. Venkat Rao and Jaya Dwivedi

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY METHOD DEVELOPMENT AND VALIDATION FOR DETECTION AND QUANTIFICATION OF SUBSTANCES RELATED TO ALPHA KETO VALINE CALCIUM SALT

— Rajesh A. Jadav , Mrunal Ambasana and A. H. Bapodra

SYNTHESIS, CHARACTERIZATION AND BIOLOGICAL SCREENING OF LIGAND 2-{[2-(5-BENZOYL-1H-1,2,3- BENZOTRIAZOLE-1-YL)-2-OXOETHYL]AMINO} PROPIONIC ACID

— P. S. Desai and D. V. Parekh

ISOLATION AND CHARACTERIZATION OF THERMOPHILIC BACTERIA AS AMYLASE ENZYME PRODUCED BY HOTS SPRING IN RIANIATE SAMOSIR, INDONESIA

— S. Silaban , N. I. Y. Sihotang and K. Gurning

ONE-POT SYNTHESIS OF SPIRO-3,4-DIHYDRO-2HPYRROLES THROUGH TANDEM NUCLEOPHILIC CYCLISATION REACTION

— Nandkishor Chandan

NANOEMULSIFYING OF ETHANOLIC PAITAN LEAF EXTRACT (Tithonia Diversifolia (Hemsley) A. Gray) TO ENHANCED ANTIOXIDANT AND ANTIDIABETIC PROPERTIES

— A. Setyawati, N.C. Rizqi and C.A. Putri

A SPECTROPHOTOMETRIC ANALYSIS BY SYNTHESIZED NOVEL QUATERNARYPHOTOCATALYST ZrCdPbO4 FOR MINERALIZATION OF COLOURED POLLUTANT

— S. Lohar and S. Bhardwaj

REVIEW OF TECHNOGENIC WASTE AND METHODS OF ITS PROCESSING FOR THE PURPOSE OF COMPLEX UTILIZATION OF TAILINGS FROM THE ENRICHMENT OF NON-FERROUS METAL ORES AS A COMPONENT OF THE RAW MATERIAL MIXTURE IN THE PRODUCTION OF CEMENT CLINKER

— A.S. Kolesnikov, B. Ye Zhakipbaev, N.N. Zhanikulov, O.G. Kolesnikova, ?.K. ?khmetova, R.M. Kuraev and A.L. Shal

NANO-HYDROXYAPATITE AND ITS COMPOUNDS AND THEIR POTENTIAL IN THE FIGHT AGAINST COVID-19: A REVIEW

— A. R. Noviyanti, D. R. Eddy, Rukiah and Y. Deawati

THE EFFECT OF POTENTIAL AND TDS TO CURRENT EFFICIENCY IN MINERAL WATER ELECTROLYSIS WITH SOLAR ENERGY SOURCE FOR PRODUCING ALKALINE AND ACIDIC WATER

— Ekki Kurniawan , Husein Bahti , Anni Anggraeni and Iman Rahayu

EFFECT OF Sr2+DOPING ON THE STRUCTURAL, THERMAL, DIELECTRIC AND ELECTRICAL PROPERTIES OF La1-xSrxCo0.50Fe0.50 O3 {0.1≤ x≤ 0.4}CATHODE FOR SOFCS

— Manokamna, Surinder Paul, A. Singh, K. L. Singh, G. Bhargava and A. P. Singh

HIBRID MULTILAYER OF ZnO-SiO2/CHITOSAN NANORODS BY POLY(DIALLYLDIMETHYLAMMONIUM CHLORIDE) (PDDA) AND POLY(SODIUM 4-STYRENESULFONATE) (PSS)

— Yetria Rilda, Prima Vidya Puti Ayuni, Irianti Sabda Tursiah , Syukri Syukri , Refinel , Yulia Eka Putri , Anthoni Agustien and Hilfi Pardi

A GREEN, LARGE SCALE SYNTHESIS OF FENOPROFEN CALCIUM DIHYDRATE WITH SIMPLE CALCIUM (II) CARBONATE AND WATER

— S. Venkat Rao , Vamsi Krishna Potluri and Rameshbabu Potluri

SPREADSHEET AND ITERATION DEAD TIMES OF 2- ALKANONES HOMOLOGUES SERIES ELUTED BY ACETONITRILE/WATER IN REVERSED PHASE HIGHPERFORMANCE LIQUID CHROMATOGRAPHY

— R. Idroes, M. Mahmudi, S. Saiful, M. Muslem, G.M. Idroes, A. Rusyana , R. Suhendra and I. Irvanizam

CONVERSION OF POLYSTYRENE PLASTIC WASTE AND USED PALM OIL CO-REACTANT INTO LIQUID FUEL USING AL-MCM-41/CERAMICS CATALYST

— H. Juwono, W. Trisunaryanti, L. Efiyanti, S.I Bahri, K. Amri, A. Assari S. Suprapto and Y. L. Ni'mah

ADSORPTION OF Pb2+ USING HYDROXYAPATITE FROM TUNA BONES

— Rizki Amalia Herawati , Mahidin and Muhammad Faisal

OPTIMIZATION OF THE OXIDATIVE CRACKING OF FUEL OIL ON CATALYSTS OBTAINED FROM KAZAKHSTAN RAW MATERIALS

— T.V. Shakiyeva, L.R. Sassykova, U. N. Dzhatkambayeva , A.A. Khamlenko , N.K. Zhakirova , A.A. Batyrbayeva , R. N. Azhigulova , Sh. N. Kubekova , Zh. M. Zhaxibayeva , M. A. Kozhaisakova , L. A. Zhusupo

REMOVAL OF As(III) WITH (CYNODON DACTYLON) GREEN DUB AND ORANGE PEEL FROM AQUEOUS MEDIUM

— Kiran Kumari, Ashok Kumar Jha, Pranita, Anjana Kumari and Usha Sharma

ANALYZING THREE GENOTOXIC IMPURITIES OF ATORVASTATIN CALCIUM EMPLOYING GC-MS SINGLE QUAD DETECTOR WITH ELECTRON IMPACT TECHNOLOGY

— Mohinish Sahai , Nayakanti Devanna and Rahul Kumar Rajput

ESTIMATION OF GUAIFENESIN FROM EXTENDED RELEASE DOSAGE FORM BY STABILITY INDICATING METHOD USING RP-HPLC TECHNIQUE

— Emmanuel Madugula and Harikrishna Erothu

FORMULATION AND EVALUATION OF GRANULE OF CRUDE BROMELAIN OF PINEAPPLE (Ananas comosus (L.) Merr) CROWN OF SUBANG DISTRICT, INDONESIA

— N. M. Saptarini and D. Rahayu

SYNTHESIS OF Scylla Serrata SHELL DERIVED CHITOSAN- COATED MESOPOROUSMAGNETIC NANO ADSORBENT FOR Cr(VI) REMOVAL FROM AQUEOUS SOLUTIONS

— T. Ravi and Sathish Sundararaman

CHARACTERIZATION OF DSSCS USING NATURAL COLORANTS AS SENSITIZERS

— M. Devi , R. K. Sainiand S. Shrivastava

DETERMINATION OF MELATONIN IN BATS GUANO SEDIMENTS BY HPLC COUPLED WITH FLUORESCENCE DETECTION: MELATONIN AS AN ADJUVANT TREATMENT OF COVID-19

— A. H. Hamdani, H. Johanes, M. Faisal and NH. Rina

SYNTHESIS, CHARACTERIZATION OF 2-[4-(4,5-DIPHENYL1H-IMIDAZOL-2-YL)PHENYL]ISOINDOLINE-1,3-DIONE DERIVATIVES AND THEIR BIOLOGICAL ACTIVITY EVALUATION

— S. S. Sankhe and N. R. Chindarkar

STUDY ON COMPLEX EQUILIBRIA BETWEEN DIVALENT TRANSITION METALS (Co, Ni AND Cu) AND L-METHIONINE IN A MEDIUM OF SLS-WATER MIXTURE

— R. Neeraja, G. H. Bindu, M. Ramanaiah and Y. V. Kumar

STUDY ON ENRICHMENT AND GEO-ACCUMULATION OF SOME TOXIC METALS IN SOILS OF INDUSTRIAL VICINITY, CHHATTISGARH, INDIA

— Simpal Tamrakar , Sumita Nair and S. K. Chatterjee

HYDROXYL FUNCTIONALIZED GRAPHENE AS A SUPERIOR ANODE MATERIAL FOR ELECTROCHEMICAL OXIDATION OF METHYLENE BLUE

— Yusbarina Yusbarina , Roto Roto and Kuwat Triyana

INFLUENCE OF CATIONIC AND ANIONIC POLYMERS ON STRENGTH AND SWELL BEHAVIOR OF EXPANSIVE SOIL

— Prashanta Poudel and S. Srividhya

CHEMICAL COMPOSITION, PHENOLIC, TANNIN AND ANTIOXIDANT ACTIVITY IN WATER AND METHANOL EXTRACT FROM MARINE MICROALGAE Oscillatoria sp.

— Nurhasanah , Ratnawati Lilasari Djanis and Askal Maimulyanti

THE EFFECT OF FUNCTIONAL GROUP IN POLYEUGENOL FOR UREA, CREATININE AND VITAMIN B12 TRANSPORT

— M.C. Djunaidi and I.G. Wenten

PHOTOVOLTAIC ANALYSIS OF FABRICATED DSSCs BASED ON NATURAL COLORANTS

— M. Devi, R. K. Saini and S. Shrivastava

SYNTHESIS AND CHARACTERIZATION OF NOVEL TRIAZINE COMPOUND AND THEIR BIOLOGICAL STUDIES

— Jayesh M. Pandya , Jyotindra Mahyavanshi and Smita Bakshi

PHYTOTOXIC INFLUENCE OF Tectona grandis L. ON GERMINATION, GROWTH AND BIOCHEMICAL CHANGES OF Solanum lycopersicum L. AND Solanum melongena L.

— K. Edwina and P. Leela

SULFUR-DOPED-TITANIA COATED ON MAGNETITE AS MAGNETICALLY RECOVERABLE PHOTOCATALYST FOR THE UV-VISIBLE LIGHT-ASSISTED-DEGRADATION OF CONGO RED SOLUTION

— E.S. Kunarti, I. Kartini, M.I.D. Mardjan and E.H. Prameswari

OBTAINING ENVIRONMENTALLY SAFE MIXED FERTILIZERS CONTAINING TRACE ELEMENTS BASED ON CARBONATE-SILICEOUS DOLOMITIZED PHOSPHATE RAW MATERIALS AND WASTES CHP

— K.T. Zhantasov, A. M. Kozhakhmetova, O. B. Dormeshkin ,N. K. Sarypbekova , M. K. Zhantasov , O. P. Baiysbay and A. M. Dosbayeva

UNDERSTANDING PHYTOCHEMICAL ROLES ON α-GLUCOSIDASE INHIBITORY ACTIVITY BASED ON METABOLOMIC APPROACH OF Premna serratifolia LEAVES FROM WEST BORNEO, INDONESIA

— D. Hadiarti, W. Haryadi , S. Matsjeh and R. T. Swasono

HYDROGENATION OF AROMATIC NITRO COMPOUNDS TO AMINES ON NICKEL AND IRON-CONTAINING CATALYSTS

— L.R. Sassykova , A.R. Sassykova, Sh. N. Kubekova , A.A. Batyrbayeva, R. N. Azhigulova , Zh. M. Zhaxibayeva , M. A. Kozhaisakova ,L. A. Zhusupova , S. Sendilvelan and O.I. Ponomarenko

SYNTHESIS, CHARACTERISATION MOLECULAR DOCKING WITH DENGUE AND HUMAN DNA OF ANTIPYRINE BASED TRANSITION METAL COMPLEXES

— K.N. Gita , V. Chanrasekaran and P. Akilan

SYNTHESIS, SPECTROSCOPIC CHARACTERIZATION, AND ANTIMICROBIAL STUDIES OF SOME N/O DONAR LIGAND COMPLEXES OF Sn(IV) DERIVED FROM ISATINO-3- BENZHYDRAZONE

— Punit Yadav ,Ramhari Meena and Bidya S. Joshi

PHOTOLYSIS OF NAPHTHOL BLUE-BLACK FROM KUBANG WEAVING WASTE USING TiO2/ZEOLITE AS A CATALYST

— Zilfa , Rahmayeni , B. Arifin , V. Sisca and E.S. Putri

ADSORPTION OF CITRIC ACID ON IRON (III) HYDROXIDE: MECHANISMS AND STABILITY CONSTANTS OF SURFACE COMPLEXES

— M. Hmamou , F. Maarouf , B. Ammary, and A. Bellaouchou

PREPARATION OF PAHAE NATURAL ZEOLITE NANOPARTICLES USING HIGH ENERGY MILLING AND ITS POTENTIAL FOR BIOETHANOL PURIFICATION

— Susilawati , Nasruddin M. N., Yuan Alfinsyah Sihombing, Sri Ningsih Yazana Pakpahan , and Bonar Ferdiansyah

KINETIC RELEASE STUDY OF DIABETES MELLITUS DRUG ENCAPSULATED ON CHITOSAN ALGINATE MATRIX

— S. E. Cahyaningrum, Amaria and A. M. Sholikhah

GREEN PLASTICS BASED ON THERMOPLASTIC STARCH AND STEAM-EXPLODED NANOFIBER CELLULOSE

— E. Zaidar, S. Lenny, S.A. Amaturrahim, S.A. Situmorang, J.N. Sari, S.U. Rahayu and S. Gea

ZnO CO-DOPED WITH Ni AND Mg: PREPARATON BY COPRECIPITATION, CHARACTERISATION AND EFFECT OF AMOUNT OF THE CO-DOPANTS ON THE BANDWIDTH OF ZnO

— K. M. Sreedhar, Sangeeth Sivan, Karthik Raja, Kirti Suresh, R. Sreelekshmi, Appu Palat and K. M. Sreekanth

PROSPECTS OF NANOTECHNOLOGY AS A TOOL TO MITIGATE COVID-19

— G. Pandey, S. Bajpai and S. Tripathi

SYNTHESIS OF CURCUMIN FROM PIPERONAL AND ITS SPECTROMETRIC CHARACTERIZATION USING DFTB3LYP/6-31G(d) METHOD

— M. R. Sohilait , H. D. Pranowo and W. Haryadi

CHEMICAL PROFILE AND BIOLOGICAL ACTIVITY OF ESSENTIAL OILS FROM Psidium guajava GROWN IN TIMOR ISLAND-EASTERN INDONESIA

— Antonius R. B. Ola , Yosefa Cysilia Bheku Oje, Agustina E Nahas , Petronela Nenotek, Theo Da Cunha , Dodi Darmakusuma, Henderiana L. L. Belli and Herianus J. D. Lalel.

SYNTHESIS AND CHARACTERIZATION OF SCHIFF BASE AND ITS TRANSITION METAL COMPLEXES DERIVED FROM 3-ETHOXYSALICYLALDEHYDE AND P-TOLUIDINE

— E. Sirumalar, M. Paul Johnpeter, R. Manikandan, A. P. Mary Sri Archana and A. Paulraj

ANNEALING TEMPERATURE AND COCATALYST EFFECTS TO THE PHOTOELECTROCHEMICAL PROPERTY OF CuInS2 THIN FILM SEMICONDUCTOR

— Gunawan , A. Haris, H. Widiyandari, D. S. Widodo, W. Septina and S. Ikeda

IDENTIFICATION OF THE COMPONENTS BY LCMS/MSQTOF AND TOXICITY OF ETHANOL EXTRACTS OF Musa paradisiaca L. STEMS

— Mayang Sari and Erni Misran

CYTOTOXIC CONSTITUENT IN THE FRUIT PEEL OF Lansium domesticum

— Q. Labibah, K. N. W. Tun, N. S. Aminah, A. N. Kristanti, R. Ramadhan , Y. Takaya , C. A. C. Abdullah and M. J. Masarudin

MOLECULAR MODELING, ADMET PREDICTION, SYNTHESIS AND THE CYTOTOXIC ACTIVITY FROM THE NOVEL N-(4-tert-BUTYLPHENYLCARBAMOYL)BENZAMIDE AGAINST HELA

— E.T. Purwanto, Siswandono, D. Kesuma, T. Widiandani and I. Siswanto

ANTIOXIDANTS ACTIVITIES OF SECONDARY METABOLITE COMPOUNDS FROM BUNI FRUIT (Antidesmabunius L.) SEED EXTRACT

— M. Yasser , A.M.I.A Asfar and S.E. Widiyanti

CHARACTERIZATION OF UREA ANALYTE SOLUTION AND ELECTROLYTE SOLUTION USING NON-IMMOBILIZED ELECTRODE INDICATORS AND PVA-ENZYME COATED PVC-KTpClPB IMMOBILIZATION

— A. Hakim S, M. Situmorang, K. Sebayang, T. Sembiring, K.Tarigan, S. Mihardi, N. M. Noor and J. Elnovreny

POTENT INHIBITION OF Peperomia pellucida EXTRACTS TOWARDS RANKL-INDUCED OSTEOCLAST FORMATION THROUGH M1 MACROPHAGE POLARIZATION

— I.G.A.A. Kartika, C. Riani, M. Insanu , K. Paiboonsukwong, N. Charoenphandhu, A. Tubsuwan and I.K. Adnyana

PHYTOCHEMICALS ANALYSIS AND IMMUNOMODULATORY ACTIVITY OF Saurauia vulcani Korth. LEAVES EXTRACTS TOWARDS RAW 264.7 CELL

— Rosidah, Yuandani, S.S. Widjaja, N. Auliafendri , M.F. Lubis, M. Muhammad, and D. Satria

DEVELOPMENT AND VALIDATION OF NOVEL RP-UHPLC/ DAD METHODS FOR SIMULTANEOUS QUANTIFICATION OF REMOGLIFLOZIN AND METFORMIN IN BULK AND FORMULATION

— V. A. Patel, C. V. Pandya, Z. J. Patel, D. R. Patel and A. C. Pandya

SCREENING OF SOME SELECTED COMPOUNDS IN ROSELLA (Hibiscus sabdariffa L.) TARGETING OF COMPLEX HUMAN PROGRAMMED DEATH-1 AND ITS LIGAND-1 (hPD1/PD-L1) AS IMUNOMODULATORY ACTIVITY: In silico APPROACH

— Wa Ode Yuliastri, Ajeng Diantini, Mohammad Ghozali, I. sahidin and Dwi Syah Fitra Ramadhan

Senna FLOWER EXTRACT AS AN INDICATOR FOR ACID-BASE TITRATION

— N. Pattarapongdilok, P. Malichim, N. Simmee and J. Sichaem

SYNTHESIS, CHARACTERISATION AND BIOLOGICAL EVALUATION OF NEW MIXED LIGAND COMPLEX (DERIVED FROM SCHIFF BASE)

— P. Shabana, B.R. Chaitantya Kumar and K. Sudhakar Babu

A NOVEL, GREEN AND HETEROGENEOUS CERIA-BASED SOLID LEWIS ACID CATALYST ASSISTED ONE-POT MULTICOMPONENT SYNTHESIS OF DIHYDROPYRANO[2,3-C]PYRAZOLES

— Nilam D. Bansode, Vaishali N. Rathod, Sachin P. Gadekar and M. K. Lande

PHYTOCHEMICAL AND QUALITATIVE CHARACTERIZATION OF LEAVES OF SOME NOTEWORTHY MEDICINAL PLANTS OF CHHATTISGARH, INDIA

— Reena V. Mathai, Jayati Chatterjee Mitra and Santosh Kumar Sar

DETERMINATION OF TRICLOSAN IN INDONESIAN HOUSEHOLD, PERSONAL CARE, AND COSMETIC PRODUCTS BY ISOCRATIC REVERSED-PHASE HIGHPERFORMANCE LIQUID CHROMATOGRAPHY

— N. Rusdiana , M.S. Wibowo and R.E. Kartasasmita