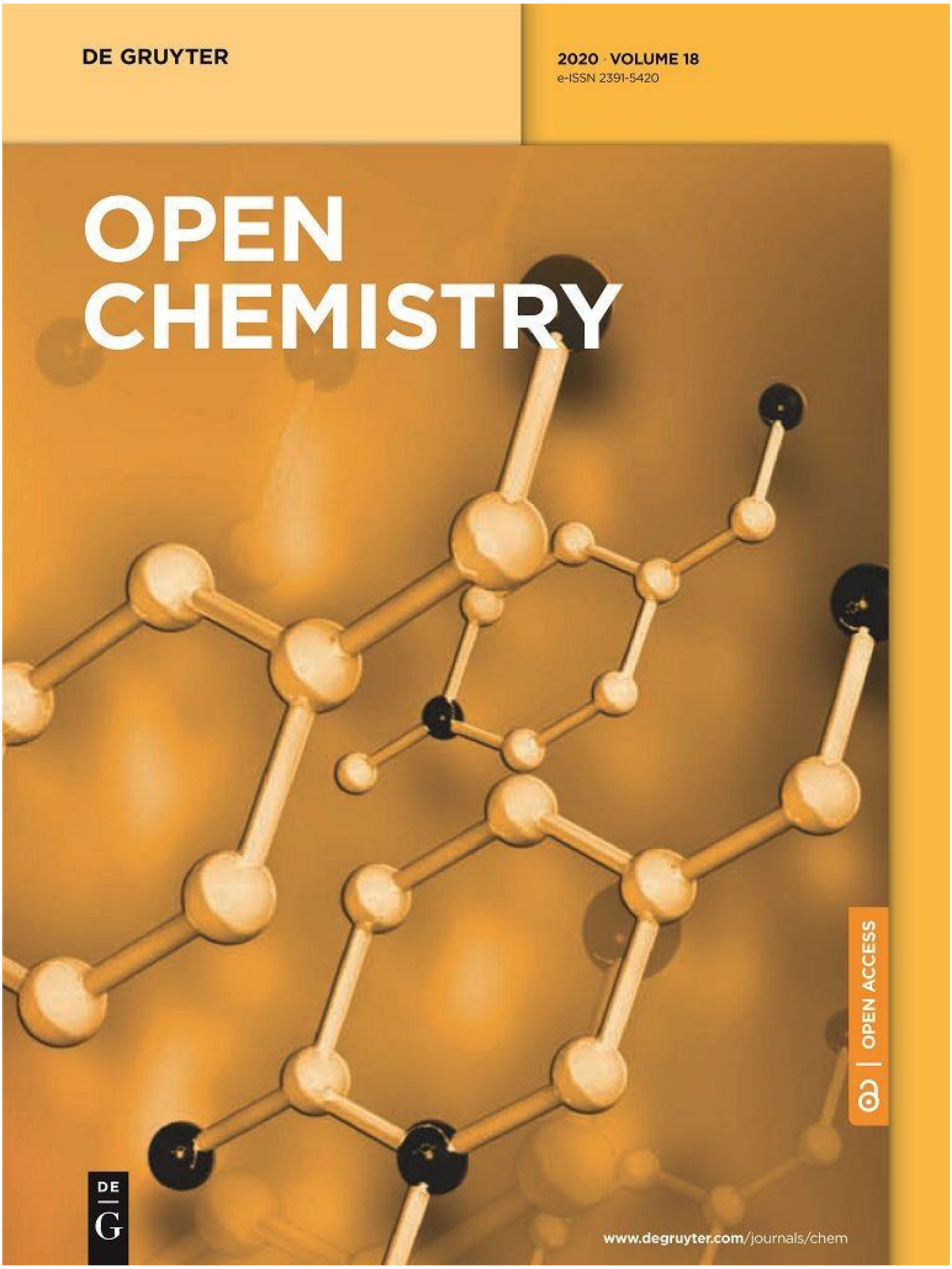
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Volume 18 (2020): Issue 1 (Jan 2020)

in Open Chemistry

REGULAR ARTICLES

Electrochemical antioxidant screening and evaluation based on guanine and chitosan immobilized MoS_2 nanosheet modified glassy carbon electrode (guanine/CS/MoS_2/GCE)

Ping Tang, Xiaosheng Tang, Shiyong Mei, Yixi Xie, Liangliang Liu, and Licheng Ren

Article Category: Research Article | Pages: 1–9 | Published online: 13 Feb 2020

ABSTRACT

In this study, an electrochemical biosensor based on guanine and chitosan immobilized MoS_2 nanosheet modified glassy carbon electrode (guanine/CS/Mo

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PDF

Kinetic models of the extraction of vanillic acid from pumpkin seeds

Milan Mitić, Sonja Janković, Pavle Mašković, Biljana Arsić, Jelena Mitić, and Jovana Ickovski

Article Category: Research Article | Pages: 22–30 | Published online: 30 Jan 2020

ABSTRACT

Vanillic acid is used in the food industry and perfumery, and the optimization of its extraction process from the natural source is important fo

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PDF

On the maximum ABC index of bipartite graphs without pendent vertices

Zehui Shao, Pu Wu, Huiqin Jiang, S.M. Sheikholeslami, and Shaohui Wang

Article Category: Research Article | Pages: 39–49 | Published online: 10 Mar 2020

ABSTRACT

For a simple graph *G*, the atom–bond connectivity index (*ABC*) of *G* is defined as *ABC*(*G*) = ∑uv∈E(G)d(u)+d(v)

−2d(u)d(v),where *d*(*v*) denotes the degr

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Estimation of the total antioxidant potential in the meat samples using thin-layer chromatography

Paweł Piszcz, Magdalena Tomaszewska, and Bronisław K. Głód

Article Category: Research Article | Pages: 50–57 | Published online: 28 Feb 2020

ABSTRACT

There is limited literature on the antioxidative properties of food of animal origin. Measurements of antioxidative properties are usually performe

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Molecular dynamics simulation of sI methane hydrate under compression and tension

Qiang Wang, Qizhong Tang, and Sen Tian

Article Category: Research Article | Pages: 69–76 | Published online: 20 Feb 2020

ABSTRACT

Molecular dynamics (MD) analysis of methane hydrate is important for the application of methane hydrate technology. This study investigated t

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Spatial distribution and potential ecological risk assessment of some trace elements in sediments and grey mangrove (Avicennia marina) along the Arabian Gulf coast, Saudi Arabia

Hameed Alsamadany, Hassan S. Al-Zahrani, El-Metwally M. Selim, and Mohsen M. El-Sherbiny

Article Category: Research Article | Pages: 77–96 | Published online: 10 Mar 2020

ABSTRACT

To assess trace element concentrations (Zn, Cu, Pb, Cr, Cd and Ni) in the mangrove swamps along the Saudi coast of the Arabian Gulf, thirteen sam

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Amino-functionalized graphene oxide for Cr(VI), Cu(II), Pb(II) and Cd(II) removal from industrial wastewater

Huayu Huang, Yang Wang, Yubin Zhang, Zhiying Niu, and Xinli Li

Article Category: Research Article | Pages: 97–107 | Published online: 10 Mar 2020

ABSTRACT

Amino-functionalized graphene oxide (GO-NH_2) was synthesized by grafting (3-aminopropyl) triethoxysilane on the graphene oxide (GO) surface. The GO

... Show More

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Chemical composition and in vitro activity of Origanum vulgare L., Satureja hortensis L., Thymus serpyllum L. and Thymus vulgaris L. essential oils towards oral isolates of Candida albicans and Candida glabrata

Tomasz Baj, Anna Biernasiuk, Rafał Wróbel, and Anna Malm

Article Category: Research Article | Pages: 108–118 | Published online: 10 Mar 2020

ABSTRACT

The purpose of this research was to investigate the chemical composition of essential oils (EOs) from: *Origanum vulgare* L., *Satureja hortensis* L.,

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PDF

Effect of excess Fluoride consumption on Urine-Serum Fluorides, Dental state and Thyroid Hormones among children in “Talab Sarai” Punjab Pakistan

Sadia Zulfiqar, Humayun Ajaz, Shafiq ur Rehman, Shan Elahi, Amer Shakeel, Farhat Yasmeen, and Shehnila Altaf

Article Category: Research Article | Pages: 119–128 | Published online: 18 Mar 2020

ABSTRACT

190 children aged 7-18 years from an endemic fluorotic village “Talab Sarai (n = 130) and a non-fluorotic, control, village “Ottawa” (n = 60)

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Design, Synthesis and Characterization of Novel Isoxazole Tagged Indole Hybrid Compounds

Raed A. Al-Qawasmeh, Louy A. Al-Nazer, Sarah A. Dawlat-Kari, Luay Abu-Qatouseh, Salim S. Sabri, Murad A. AlDamen, and Mutasem Sinnokrot

Article Category: Research Article | Pages: 138–148 | Published online: 25 Mar 2020

ABSTRACT

Sixteen new isoxazole tagged indole compounds have been synthesized *via* copper (I) catalyzed click chemistry of the aryl hydroxamoyl chloride

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Comparison of kinetic and enzymatic properties of intracellular phosphoserine aminotransferases from alkaliphilic and neutralophilic bacteria

Marianne Koivulehto, Natalia Battchikova, Saara Korpela, Elvira Khalikova, Anton Zavialov, and Timo Korpela

Article Category: Research Article | Pages: 149–164 | Published online: 24 Mar 2020

ABSTRACT

Intracellular pyridoxal 5´-phosphate (PLP) -dependent recombinant phosphoserine aminotransferases (PSATs; EC 2.6.1.52) from two alkaliphilic

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Green Organic Solvent-Free Oxidation of Alkylarenes with tert-Butyl Hydroperoxide Catalyzed by Water-Soluble Copper Complex

Abdelaziz Nait Ajjou and Ateeq Rahman

Article Category: Research Article | Pages: 165–174 | Published online: 24 Mar 2020

ABSTRACT

Different benzylic compounds were efficiently oxidized to the corresponding ketones with aqueous 70% *tert*-butyl hydroperoxide (TBHP) and the cata

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Ducrosia ismaelis Asch. essential oil: chemical composition profile and anticancer, antimicrobial and antioxidant potential assessment

Ramzi A. Mothana, Fahd A. Nasr, Jamal M. Khaled, Omar M. Noman, Nael Abutaha, Adnan J. Al-Rehaily, Omar M. Almarfadi, and Mine Kurkcuoglu

Article Category: Research Article | Pages: 175–184 | Published online: 02 Apr 2020

ABSTRACT

The essential oil of *Ducrosia ismaelis* Asch. (Apiaceae) that grows wild in Saudi Arabia was investigated utilizing gas chromatography (GC),

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DFT calculations as an efficient tool for prediction of Raman and infra-red spectra and activities of newly synthesized cathinones

Maja Vujović, Venkatesan Ragavendran, Biljana Arsić, Emilija Kostić, and Milan Mladenović

Article Category: Research Article | Pages: 185–195 | Published online: 07 Apr 2020

ABSTRACT

Initially made for medical treatment for Parkinsonism, obesity, and depression, cathinones have become illegal drugs for the “recreational use

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Influence of Chemical Osmosis on Solute Transport and Fluid Velocity in Clay Soils

Zhihong Zhang, Gailei Tian, and Lin Han

Article Category: Research Article | Pages: 232–238 | Published online: 07 Apr 2020

ABSTRACT

Solute transport through the clay liner is a significant process in many waste landfills or unmanaged landfills. At present, researchers mainly

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A New fatty acid and some triterpenoids from propolis of Nkambe (North-West Region, Cameroon) and evaluation of the antiradical scavenging activity of their extracts

Abakar Ali Mahamat, Jean Noël Nyemb, Isaac Silvère Gade, Alfred Tamfu Ngenge, Emmanuel Talla, Henoumont Céline, Laurent Sophie, and Joseph Tanyi Mbafor

Article Category: Research Article | Pages: 239–243 | Published online: 02 Apr 2020

ABSTRACT

The aim of this work was to evaluate *in vitro* antiradical scavenging activity of propolis from Nkambe (North-West, Cameroon). The polyphenol

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Antiplasmodial Activity of Stigmastane Steroids from Dryobalanops oblongifolia Stem Bark

Indriani Indriani, Nanik Siti Aminah, and Ni Nyoman Tri Puspaningsih

Article Category: Research Article | Pages: 259–264 | Published online: 07 Apr 2020

ABSTRACT

Three stigmastane steroids: 6-hydroxystigmast-4-en-3-one (1), stigmast-4-en-3-one (2), and 3-hydroxystigmast-5-en-7-one (3) were successfully i

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Rapid identification of direct-acting pancreatic protectants from Cyclocarya paliurus leaves tea by the method of serum pharmacochemistry combined with target cell extraction

Wei-hong Chen, Zhen Luo, Zi-Wan Ning, Jiao Peng, Xiao-peng Hu, Li-xiang Zhai, Bo Wen, Hai-tao Xiao, and Zhao-xiang Bian

Article Category: Research Article | Pages: 265–274 | Published online: 07 Apr 2020

ABSTRACT

Extracts of *Cyclocarya paliurus* (CP) leaves, a popular sweet tea, inhibit pancreatic β cell apoptosis and have potent hypoglycemic effects, but

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Immobilization of Pseudomonas aeruginosa static biomass on eggshell powder for on-line preconcentration and determination of Cr (VI)

Aamir Rasheed, Tahseen Ghous, Sumaira Mumtaz, Muhammad Nadeem Zafar, Kalsoom Akhter, Rabia Shabir, Zain-ul-Abdin, and Syed Salman Shafqat

Article Category: Research Article | Pages: 303–313 | Published online: 20 Apr 2020

ABSTRACT

In the present work, a novel continuous flow system (CFS) is developed for the preconcentration and determination of Cr (VI) using *Pseudomonas aeru*

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Assessment of methyl 2-({[(4,6-dimethoxypyrimidin-2-yl)carbamoyl] sulfamoyl}methyl)benzoate through biotic and abiotic degradation modes

Mahwash Mahar Gul and Khuram Shahzad Ahmad

Article Category: Research Article | Pages: 314–324 | Published online: 20 Apr 2020

ABSTRACT

Detoxification and management of environmental contaminants is an exigent issue of current times. Sulfonylurea herbicide, Bensulfuron-methyl was i

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Stability of natural polyphenol fisetin in eye drops Stability of fisetin in eye drops

Kristína Krajčíková, Mária Suváková, Gabriela Glinská, Jana Ohlasová, and Vladimíra Tomečková

Article Category: Research Article | Pages: 325–332 | Published online: 20 Apr 2020

ABSTRACT

Fisetin is a polyphenolic compound with anti-inflammatory and antioxidant properties. Inflammation and reactive oxygen species play a major role

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Production of a bioflocculant by using activated sludge and its application in Pb(II) removal from aqueous solution

Zibo Yan, Li Peng, Miao Deng, and Jinhui Lin

Article Category: Research Article | Pages: 333–338 | Published online: 04 May 2020

ABSTRACT

In this study, the characteristics of a bioflocculant produced by using activated sludge as raw materials were investigated. The performance

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Molecular Properties of Carbon Crystal Cubic Structures

Hong Yang, Muhammad Kamran Siddiqui, Muhammad Naeem, and Najma Abdul Rehman

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ABSTRACT

Graph theory assumes an imperative part in displaying and planning any synthetic structure or substance organizer. Chemical graph theory facilit

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Synthesis and characterization of calcium carbonate whisker from yellow phosphorus slag

Qiuju Chen, Wenjin Ding, Tongjiang Peng, and Hongjuan Sun

Article Category: Research Article | Pages: 347–356 | Published online: 21 Apr 2020

ABSTRACT

In this study, a procedure for producing calcium carbonate whisker through yellow phosphorus slag carbonation without adding any crystal control

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Two mixed-ligand coordination polymers based on 2,5-thiophenedicarboxylic acid and flexible N-donor ligands: the protective effect on periodontitis via reducing the release of IL-1β and TNF-α

Shao-Hsuan Wu and Jun-Hui Huang

Article Category: Research Article | Pages: 391–398 | Published online: 21 Apr 2020

ABSTRACT

Two novel mixed-ligand coordination polymers, $\{[Co(tdc)(btrp)]\cdot 0.67DMF\}_n$ (1) and $\{[Zn_2(bimb)_2(tdc)_2]\cdot 2H_2O\}_n$ (2) involving 2,5-thiophe

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Incorporation of silver stearate nanoparticles in methacrylate polymeric monoliths for hemeprotein isolation

Eman Alzahrani

Article Category: Research Article | Pages: 399–411 | Published online: 27 Apr 2020

ABSTRACT

A unique method was used to synthesize extremely stable silver stearate nanoparticles (AgStNPs) incorporated in an organic-based monolith. The

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Development of ultrasound-assisted dispersive solid-phase microextraction based on mesoporous carbon coated with silica@iron oxide nanocomposite for preconcentration of Te and Tl in natural water systems

Luthando Nyaba, Buyile Dubazana, Anele Mpupa, and Philiswa N. Nomngongo

Article Category: Research Article | Pages: 412–425 | Published online: 26 Apr 2020

ABSTRACT

The main objective of this study was to develop an ultrasound-assisted dispersive solid-phase microextraction (UADSPME) method for separa

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N,N′-Bis[2-hydroxynaphthylidene]/[2-methoxybenzylidene]amino]oxamides and their divalent manganese complexes: Isolation, spectral characterization, morphology, antibacterial and cytotoxicity against leukemia cells

Ayman H. Ahmed

Article Category: Research Article | Pages: 426–437 | Published online: 18 May 2020

ABSTRACT

Manganese(II) complexes of oxalic dihydrazones {*N*,*N*′-bis[2-hydroxynaphthylidene]amino]oxamide (BHO) and *N*,*N*′-bis[2-methoxybenzylidene]amino]oxamide

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Determination of the content of selected trace elements in Polish commercial fruit juices and health risk assessment

Grażyna Kowalska, Urszula Pankiewicz, Radosław Kowalski, and Artur Mazurek

Article Category: Research Article | Pages: 443–452 | Published online: 26 Apr 2020

ABSTRACT

The objective of the study was to determine the content of cadmium (Cd), lead (Pb), arsenic (As), aluminium (Al), thallium (Tl), antimony (Sb) and

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Diorganotin(IV) benzyldithiocarbamate complexes: synthesis, characterization, and thermal and cytotoxicity study

Jerry O. Adeyemi, Damian C. Onwudiwe, Nirasha Nundkumar, and Moganavelli Singh

Article Category: Research Article | Pages: 453–462 | Published online: 18 Jun 2020

ABSTRACT

Ammonium benzyldithiocarbamate, represented as NH_4L, was prepared and used in the complexation reaction involving three organotin(IV)

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Keratin 17 is induced in prurigo nodularis lesions

Li-Li Yang, Hai-Yan Huang, Zhen-Zhen Chen, Ran Chen, Rong Ye, Wei Zhang, and Bo Yu

Article Category: Research Article | Pages: 463–471 | Published online: 18 Jun 2020

ABSTRACT

Prurigo nodularis (PN) is a highly pruritic chronic inflammatory dermatosis with unknown pathogenesis. It is characterized by the existenc

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Anticancer, antioxidant, and acute toxicity studies of a Saudi polyherbal formulation, PHF5

Nael Abutaha, Mohammed Al-zharani, Amin A. Al-Doaiss, Almohannad Baabbad, Ahmed Mfreh Al-malki, and Hafedh Dekhil

Article Category: Research Article | Pages: 472–481 | Published online: 18 May 2020

ABSTRACT

A popular polyherbal formulation prepared from five plants (PHF5) may have anticancer effects. However, there is a lack of adequate scientific ev

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$LaCoO_3$ perovskite-type catalysts in syngas conversion

Gulim Danebaevna Jetpisbayeva, Eugene Vladimirovich Dokuchits, Angelina Nikolaevna Tafilevich, Tatyana Petrovna Minyukova, Bakytgul Kabykenovna Massalimova, and Vladislav Aleksandrovich Sadykov

Article Category: Research Article | Pages: 482–487 | Published online: 26 May 2020

ABSTRACT

$LaCoO_3$ samples were obtained by the hydrothermal and citrate methods. The dynamics of the phase transformations of the initial hydroxo compounds i

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Comparative studies of two vegetal extracts from Stokesia laevis and Geranium pratense: polyphenol profile, cytotoxic effect and antiproliferative activity

Lucia Pirvu, Georgeta Neagu, Iulian Terchescu, Bujor Albu, and Amalia Stefaniu

Article Category: Research Article | Pages: 488–502 | Published online: 02 Jun 2020

ABSTRACT

In this study, two ethanolic extracts, from *Stokesia aster* (Slae26) and *Geranium pratense* (Gpre36) respectively, were evaluated in order to ass

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Fragmentation pattern of certain isatin-indole antiproliferative conjugates with application to identify their in vitro metabolic profiles in rat liver microsomes by liquid chromatography tandem mass spectrometry

Maha S. Almutairi, Adnan A. Kadi, Reem I. Al-Wabli, Mohamed W. Attwa, and Mohamed I. Attia

Article Category: Research Article | Pages: 503–515 | Published online: 09 Jun 2020

ABSTRACT

The fragmentation pattern of certain isatin-based compounds was carried out using collision-induced dissociation inside the triple quadrupole mass

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Investigation of polyphenol profile, antioxidant activity and hepatoprotective potential of Aconogonon alpinum (All.) Schur roots

Muhammad Zakryya Khan, Muhammad Imran Shabbir, Zafeer Saqib, Syed Aneel Gilani, Naqeeb Ullah Jogezai, Mubin Mustafa Kiyani, and Muhammad Arshad Malik

Article Category: Research Article | Pages: 516–536 | Published online: 02 Jun 2020

ABSTRACT

Liver plays vital role in detoxification of exogenous and endogenous chemicals. These chemicals as well as oxidative stress may cause liver disor

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Lead discovery of a guanidinyl tryptophan derivative on amyloid cascade inhibition

Piyapan Suwanttananuruk, Jutamas Jiaranaikulwanitch, Pornthip Waiwut, and Opa Vajragupta

Article Category: Research Article | Pages: 546–558 | Published online: 09 Jun 2020

ABSTRACT

Amyloid cascade, one of pathogenic pathways of Alzheimer's disease (AD), was focused as one of drug discovery targets. In this study, β-secretase

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Physicochemical evaluation of the fruit pulp of Opuntia spp growing in the Mediterranean area under hard climate conditions

Mohammed Bourhia, Hamza Elmahdaoui, Riaz Ullah, Samir Ibenmoussa, and Abdelaaty Abdelaziz Shahat

Article Category: Research Article | Pages: 565–575 | Published online: 02 Jun 2020

ABSTRACT

Barbary fig called prickly pear is a plant belonging to family Cactaceae growing under hard climate conditions. A spiny variety of prickly pear

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Electronic structural properties of amino/hydroxyl functionalized imidazolium-based bromide ionic liquids

Xiaoling Hu, Xingang Jia, Kehe Su, and Xuefan Gu

Article Category: Research Article | Pages: 576–583 | Published online: 09 Jun 2020

ABSTRACT

Electronic structural properties of the three different imidazolium-based ionic liquids, namely, 1-butyl-3-methyl imidazolium bromide (C_4mimBr

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New Schiff bases of 2-(quinolin-8-yloxy)acetohydrazide and their Cu(II), and Zn(II) metal complexes: their in vitro antimicrobial potentials and in silico physicochemical and pharmacokinetics properties

Hanan A. Althobiti and Sami A. Zabin

Article Category: Research Article | Pages: 591–607 | Published online: 09 Jun 2020

ABSTRACT

The purpose of this work was to prepare Schiff base ligands containing quinoline moiety and using them for preparing Cu(II) and Zn(II) complexes.

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Treatment of adhesions after Achilles tendon injury using focused ultrasound with targeted bFGF plasmid-loaded cationic microbubbles

Yuzhou Shen, Jiancheng Ma, Junsheng Jiang, Zhilin Chen, Wenzhu Yan, Yue Wang, Feng Wang, and Li Liu

Article Category: Research Article | Pages: 608–619 | Published online: 13 Jun 2020

ABSTRACT

Nonviral targeting technology has become promising as a form of gene therapy for diseases and injuries, such as Achilles tendon injuries. In this s

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Synthesis of orotic acid derivatives and their effects on stem cell proliferation

Saeed Ali Syed, Amer Mahmood, Musaad Alfayez, Eric C. Hosten, Richard Betz, Abdulrahman M. Al-Obaid, Abdulrahman Ghadeer, and Ahmed Bari

Article Category: Research Article | Pages: 620–627 | Published online: 20 Jun 2020

ABSTRACT

Orotic acid, a natural product, is involved in many biological processes. Human mesenchymal stem cells (hMSCs) have the potential of self-

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PDF

Chirality of β_2-agonists. An overview of pharmacological activity, stereoselective analysis, and synthesis

Čižmáriková Ružena, Valentová Jindra, and Horáková Renáta

Article Category: Review Article | Pages: 628–647 | Published online: 18 Jun 2020

ABSTRACT

β_2-Agonists (β_2-adrenergic agonists, bronchodilatants, and sympathomimetic drugs) are a group of drugs that are mainly used in asthma and obstruct

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Fe_3O_4@urea/HITh-SO_3H as an efficient and reusable catalyst for the solvent-free synthesis of 7-aryl-8H-benzo[h]indeno[1,2-b]quinoline-8-one and indeno[2′,1′:5,6]pyrido[2,3-d]pyrimidine derivatives

Shenghao Jiang, Macheng Shen, and Fatima Rashid Sheykhahmad

Article Category: Research Article | Pages: 648–662 | Published online: 18 Jun 2020

ABSTRACT

In this study, Fe_3O_4@urea/HITh-SO_3H MNPs as a new, efficient, and recyclable solid acid magnetic nano

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Adsorption kinetic characteristics of molybdenum in yellow-brown soil in response to pH and phosphate

Zhaojun Nie, Jinfeng Li, Haiyang Liu, Shiliang Liu, Daichang Wang, Peng Zhao, and Hongen Liu

Article Category: Research Article | Pages: 663–668 | Published online: 18 Jun 2020

ABSTRACT

Molybdenum (Mo) adsorption by acidic yellow-brown soil was investigated as a function of a pH (1–13) and the equilibrium of P solution (0, 3.1, a

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Enhancement of thermal properties of bio-based microcapsules intended for textile applications

Virginija Skurkytė-Papievienė, Aušra Abraitienė, Audronė Sankauskaitė, Vitalija Rubežienė, and Kristina Dubinskaitė

Article Category: Research Article | Pages: 669–680 | Published online: 23 Jun 2020

ABSTRACT

The thermal properties of bio-based phase change material (PCM) microcapsules and their separate components, core and shell, were investigated c

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Exploring the effect of khat (Catha edulis) chewing on the pharmacokinetics of the antiplatelet drug clopidogrel in rats using the newly developed LC-MS/MS technique

Hassan A. Alhazmi, Adnan A. Kadi, Mohamed W. Attwa, Waquar Ahsan, Manal Mohamed Elhassan Taha, and Asaad Khalid

Article Category: Research Article | Pages: 681–690 | Published online: 23 Jun 2020

ABSTRACT

Clopidogrel (CLOP) is widely used worldwide for cardiovascular complications. CLOP is highly metabolized in the liver to its active me

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A green strategy for obtaining anthraquinones from Rheum tanguticum by subcritical water

Guoying Zhang and Xiaofeng Chi

Article Category: Research Article | Pages: 702–710 | Published online: 23 Jun 2020

ABSTRACT

Rheum tanguticum is a traditional Chinese herbal medicine, which contains abundant anthraquinones. In this study, anthraquinones were efficie

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Cadmium (Cd) chloride affects the nutrient uptake and Cd-resistant bacterium reduces the adsorption of Cd in muskmelon plants

Jian Zhang, Pengcheng Wang, and Qingqing Xiao

Article Category: Research Article | Pages: 711–719 | Published online: 30 Jun 2020

ABSTRACT

This study investigated the effect of cadmium (Cd) chloride on the uptake of N, P, and K and evaluate the effect of Cd-resistant bacterium “N3” on

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Removal of H_2S by vermicompost biofilter and analysis on bacterial community

Weiping Tian, Xuemin Chen, Peng Zhou, Xiaoyong Fu, and Honghua Zhao

Article Category: Research Article | Pages: 720–731 | Published online: 02 Jul 2020

ABSTRACT

The vermicompost collected from dewatered domestic sludge as packing material in biofilter was investigated for hydrogen sulfide (H_2S) removal. No

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Structural cytotoxicity relationship of 2-phenoxy(thiomethyl)pyridotriazolopyrimidines: Quantum chemical calculations and statistical analysis

Hatem A. Abuelizz, El Hassane Anouar, Nasser S. Al-Shakliah, Mohamed Marzouk, and Rashad Al-Salahi

Article Category: Research Article | Pages: 740–751 | Published online: 30 Jun 2020

ABSTRACT

Previously, a series of pyridotriazolopyrimidines (**1–6**) were synthesized and fully described. The target compounds (**1–6**) were evaluated

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A self-breaking supramolecular plugging system as lost circulation material in oilfield

Hanshi Zhang and Guancheng Jiang

Article Category: Research Article | Pages: 757–763 | Published online: 29 Jun 2020

ABSTRACT

Lost circulation is a frequently encountered problem during workover operations of a low-pressure reservoir. Many lost circulation materials (LCM)

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Synthesis, characterization, and pharmacological evaluation of thiourea derivatives

Sumaira Naz, Muhammad Zahoor, Muhammad Naveed Umar, Saad Alghamdi, Muhammad Umar Khayam Sahibzada, and Wasim UlBari

Article Category: Research Article | Pages: 764–777 | Published online: 29 Jun 2020

ABSTRACT

Thioureas and their derivatives are organosulfur compounds having applications in numerous fields such as organic synthesis and pharmaceutical in

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Application of drug-metal ion interaction principle in conductometric determination of imatinib, sorafenib, gefitinib and bosutinib

Hassan A. Alhazmi, AbdulRhman Ali Bokar Nasib, Yasser Ali Musleh, Khaled Qassim Hijri, Zia ur Rehman, Gulrana Khuwaja, Mohammed Al-Bratty, Sadique A. Javed, and Ismail A. Arbab

Article Category: Research Article | Pages: 798–807 | Published online: 02 Jul 2020

ABSTRACT

An analytical method for the quantification of anticancer agents such as imatinib, sorafenib, gefitinib and bosutinib using conductometry was de

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Synthesis and characterization of a novel chitosan-grafted-polyorthoethylaniline biocomposite and utilization for dye removal from water

Mirza Nadeem Ahmad, Arif Hussain, Muhammad Naveed Anjum, Tajamal Hussain, Adnan Mujahid, Muhammad Hammad Khan, and Toheed Ahmed

Article Category: Research Article | Pages: 843–849 | Published online: 03 Aug 2020

ABSTRACT

Chitosan was grafted with polyorthoethylaniline through oxidative polymerization using ammonium persulfate as oxidant, resulting in the format

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Optimisation of urine sample preparation for shotgun proteomics

Soňa Tkáčiková, Ivan Talian, and Ján Sabo

Article Category: Research Article | Pages: 850–856 | Published online: 07 Aug 2020

ABSTRACT

Urine reflects the renal function and urinary and kidney systems, but it may also reflect the presence of cancer in other parts of the body. Ur

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DFT investigations on arylsulphonyl pyrazole derivatives as potential ligands of selected kinases

Kornelia Czaja, Jacek Kujawski, Radosław Kujawski, and Marek K. Bernard

Article Category: Research Article | Pages: 857–873 | Published online: 03 Aug 2020

ABSTRACT

Using the density functional theory (DFT) formalism, we have investigated the properties of some arylsulphonyl indazole derivatives that we studied

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Treatment of Parkinson's disease using focused ultrasound with GDNF retrovirus-loaded microbubbles to open the blood-brain barrier

Feng Wang, Nana Li, Ruanling Hou, Lu Wang, Libin Zhang, Chenzhang Li, Yu Zhang, Yaling Yin, Liansheng Chang, Yuan Cheng, Yongling Wang, and Jianping Lu

Article Category: Research Article | Pages: 882–889 | Published online: 03 Aug 2020

ABSTRACT

This study aims to prepare ultrasound-targeted glial cell-derived neurotrophic factor (GDNF) retrovirus-loaded microbubbles (M pLXSN-GDNF) t

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PDF

New derivatives of a natural nordentatin

Tin Myo Thant, Nanik Siti Aminah, Alfinda Novi Kristanti, Rico Ramadhan, Hnin Thanda Aung, and Yoshiaki Takaya

Article Category: Research Article | Pages: 890–897 | Published online: 03 Aug 2020

ABSTRACT

New derivatives were obtained from natural nordentatin (**1**) previously isolated from the methanol fraction of *Clausena excavata* by an acylation

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Fluorescence biomarkers of malignant melanoma detectable in urine

Ivana Špaková, Katarína Dubayová, Vladimíra Nagyová, and Mária Mareková

Article Category: Research Article | Pages: 898–910 | Published online: 07 Aug 2020

ABSTRACT

Malignant melanoma (MM) is a cancerous transformation of melanocytes. It is a disease with the worst response to therapy and, compared to other

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Shu-Xuan Liang, Xiao-Can Xi, and Yu-Ru Li

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Saliva proteomic analysis reveals possible biomarkers of renal cell carcinoma

Xiao Li Zhang, Zheng Zhi Wu, Yun Xu, Ji Guo Wang, Yong Qiang Wang, Mei Qun Cao, and Chang Hao Wang

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ABSTRACT

Early diagnosis is a key to improve the prognosis of renal cell carcinoma (RCC); however, reliable RCC biomarkers are lacking in clinical practic

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Withania frutescens: Chemical characterization, analgesic, anti-inflammatory, and healing activities

Abdelfattah EL Moussaoui, Fatima Zahra Jawhari, Mohammed Bourhia, Imane Maliki, Fatiha Sounni, Ramzi A. Mothana, Dalila Bousta, and Amina Bari

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ABSTRACT

Withania frutescens (*W. frutescens*) is a medicinal plant that is largely used in the Morrocan pharmacopeia for disease treatment. This

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Design, synthesis and pharmacological profile of (−)-verbenone hydrazones

Mariia Nesterkina, Dmytro Barbalat, and Iryna Kravchenko

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ABSTRACT

A series of novel (−)-verbenone hydrazones was designed and synthesized via condensation of terpenoid with hydrazides derived from phenoxyacetic ac

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Synthesis of magnesium carbonate hydrate from natural talc

Qiuju Chen, Tao Hui, Hongjuan Sun, Tongjiang Peng, and Wenjin Ding

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ABSTRACT

Various morphologies of magnesium carbonate hydrate had been synthesized without using any organic additives by carefully adjusting the reaction tem

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Stability-indicating HPLC-DAD assay for simultaneous quantification of hydrocortisone 21 acetate, dexamethasone, and fluocinolone acetonide in cosmetics

Saira Arif and Sadia Ata

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ABSTRACT

A rapid and specific method was developed for simultaneous quantification of hydrocortisone 21 acetate (HCA), dexamethasone (DEX), and fluocinolo

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A novel lactose biosensor based on electrochemically synthesized 3,4-ethylenedioxythiophene/thiophene (EDOT/Th) copolymer

Songul Sen Gursoy, Abdulkerim Yildiz, Gamze Celik Cogal, and Oguz Gursoy

Article Category: Research Article | Pages: 974–985 | Published online: 11 Aug 2020

ABSTRACT

In this study, a new lactose biosensor has been developed in which the 3,4-ethylenedioxythiophene/thiophene (EDOT/Th) copolymer is used as a transdu

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Citrullus colocynthis (L.) Schrad: Chemical characterization, scavenging and cytotoxic activities

Mohammed Bourhia, Mouhcine Messaoudi, Hanane Bakrim, Ramzi A. Mothana, Nasir A. Sddiqui, Omer M. Almarfadi, Mohammed El Mzibri, Said Gmouh, Amin Laglaoui, and Laila Benbacer

Article Category: Research Article | Pages: 986–994 | Published online: 07 Aug 2020

ABSTRACT

Citrullus colocynthis (L.) Schrad (*C. colocynthis)* called colocynth is a wild species that belongs to the family cucurbitaceae. The present r

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Development and validation of a high performance liquid chromatography/diode array detection method for estrogen determination: Application to residual analysis in meat products

Sadeem S. Alqahtani, Deema M. Bin Humaid, Sabreen H. Alshail, Dalal T. AlShammari, Hessa Al-Showiman, Nourah Z. Alzoman, and Hadir M. Maher

Article Category: Research Article | Pages: 995–1010 | Published online: 07 Aug 2020

ABSTRACT

In this work, an HPLC-DAD method was developed for the residual analysis of some estrogens such as estrone (E1), 17-β estradiol (E2), estriol

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PCSK9 concentrations in different stages of subclinical atherosclerosis and their relationship with inflammation

Štefan Tóth, Peter Olexa, Zdenka Hertelyová, Peter Štefanič, Ivan Kopolovets, Peter Berek, Vladimir Filip, Ryan Chakravarty, Monika Široká, and Daniel Pella

Article Category: Research Article | Pages: 1011–1019 | Published online: 07 Aug 2020

ABSTRACT

The aim of this study was to detect the concentrations of PCSK9 in various subclinical stages of atherosclerosis and to highlight its relationshi

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PCSK9 concentrations in different stages of subclinical atherosclerosis and their relationship with inflammation

Štefan Tóth, Peter Olexa, Zdenka Hertelyová, Peter Štefanič, Ivan Kopolovets, Peter Berek, Vladimir Filip, Ryan Chakravarty, Monika Široká, and Daniel Pella

Article Category: Research Article | Pages: 1011–1019 | Published online: 07 Aug 2020

ABSTRACT

The aim of this study was to detect the concentrations of PCSK9 in various subclinical stages of atherosclerosis and to highlight its relationship with inflammation. One hundred and fifty-nine healthy patients were divided into three groups, based on the extent of atherosclerotic changes in the carotid artery: a group without identifiable atherosclerosis, $cIMT_{>75‰}$ and an asymptomatic plaque group. The PCSK9 was measured by ELISA and hsCRP by the immunoturbidimetric method. Vascular changes were identified by a carotid ultrasound. PCSK9 was elevated, when comparing the healthy group with the $cIMT_{>75‰}$ group; however, no significant increase was detected between $cIMT_{>75‰}$ and the asymptomatic plaque group. A positive linear correlation of the PCSK9 concentration and atherosclerotic changes was found; however, after the re-analysis in each group, this correlation persisted only in the group with still normal values. Additionally, a significant linear correlation was found between the PCSK9 concentrations and lipid parameters. However, no significant association was found with hsCRP. PCSK9 was found to be elevated only in $cIMT_{>75‰}$, but not in the later plaque stage. A linear correlation of PCSK9 values was detected only in the group with still reference values. Based on this fact, we assumed the direct linear role of PCSK9 in initiating atherosclerosis; however, in the later phases, the relationship, which highlights other risk factors such as inflammation, is not linear.

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Development of trace analysis for alkyl methanesulfonates in the delgocitinib drug substance using GC-FID and liquid-liquid extraction with ionic liquid

Shinkichi Nomura, Yoshiharu Ito, Shigehiko Takegami, and Tatsuya Kitade

Article Category: Research Article | Pages: 1020–1029 | Published online: 11 Aug 2020

ABSTRACT

Alkyl methanesulfonates are genotoxic impurities that should be limited to an intake of not more than 1.5 μg/day, as regulated by the International

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Electrochemical evaluation of the antioxidant capacity of natural compounds on glassy carbon electrode modified with guanine-, polythionine-, and nitrogen-doped graphene

Yafen Fu, Zongyi You, Aiping Xiao, Liangliang Liu, and Weien Zhou

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ABSTRACT

An electrochemical sensor based on guanine-, polythionine-, and nitrogen-doped graphene modified glassy carbon electrode (G/PTH/NG/GCE) was fabric

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A Dy(III)-organic framework as a fluorescent probe for highly selective detection of picric acid and treatment activity on human lung cancer cells

Shi-Jie Fan, Ren Sun, Yu-Bo Yan, Hao-Bo Sun, Sai-Nan Pang, and Shi-Dong Xu

Article Category: Research Article | Pages: 1105–1116 | Published online: 29 Aug 2020

ABSTRACT

A dysprosium(III) organic framework, $\{[Dy(H_2O)(BTCTB)]\cdot 2H_2O\}_n$ (**1**, H_3BTCTB = 3,3′,3″-[1,3,5-benzenetriyltris(carbonylimino)]tr

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A Zn(II)-organic cage with semirigid ligand for solvent-free cyanosilylation and inhibitory effect on ovarian cancer cell migration and invasion ability via regulating mi-RNA16 expression

Yan Yin, Hong Mai, Li-Ying Zhang, Yan Liao, Xu-Peng Liu, and Ye-Ping Wei

Article Category: Research Article | Pages: 1117–1124 | Published online: 29 Aug 2020

ABSTRACT

$[Zn_6(L)_4(DMF)_2(H_2O)_4](1,4\text{-Dioxane})_2(DMF)_{10}(H_2O)_4$ (**1**, L = 4

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ABSTRACT

The aim of the study was to compare the content of selected phytochemicals as well as the antioxidant and antimicrobial potential of the leaves of

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This study aims to compare the quality of fat extracted from different priced dry pet food for adult cats through classical and instrumental methods

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MALDI-TOF MS profiling in the discovery and identification of salivary proteomic patterns of temporomandibular joint disorders

Galina Laputková, Ivan Talian, Vladimíra Schwartzová, and Zuzana Schwartzová

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This research aimed to identify differences in polypeptide/protein profiles of the unstimulated whole saliva between patients with tem

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Concentrations of dioxins, furans and dioxin-like PCBs in natural animal feed additives

Mateusz Ossowski, Łukasz Wlazło, Bożena Nowakowicz-Dębek, Anna Chmielowiec-Korzeniowska, and Hanna Bis-Wencel

Article Category: Research Article | Pages: 1181–1187 | Published online: 26 Sep 2020

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The study aimed to assess the concentration of dioxins, furans, and dioxin-like polychlorinated biphenyls (PCBs) in natural feed additives used

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Structure and some physicochemical and functional properties of water treated under ammonia with low-temperature low-pressure glow plasma of low frequency

Aleksandra Ciesielska, Wojciech Ciesielski, Henryk Kołoczek, Damian Kulawik, Joanna Kończyk, Zdzislaw Oszczęda, and Piotr Tomasik

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ABSTRACT

Deionized, tap and two kinds of commercially available mineralized water, after supplementation with ammonia, were treated with low-pressure,

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Mesoscale nanoparticles encapsulated with emodin for targeting antifibrosis in animal models

Lishan Tan, Xiulong Deng, Xuandi Lai, Tao Zeng, Aiqing Li, Jianqiang Hu, and Zuying Xiong

Article Category: Research Article | Pages: 1207–1216 | Published online: 26 Sep 2020

ABSTRACT

The aim of this study is to explore the kidney-targeting capability of mesoscale nanoparticles (MNPs)-emodin (Em-MNPs) and its potential antifi

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Amine-functionalized magnetic activated carbon as an adsorbent for preconcentration and determination of acidic drugs in environmental water samples using HPLC-DAD

Mpingana Ndilimeke Akawa, Kgogobi Mogolodi Dimpe, and Philiswa Nosizo Nomngongo

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ABSTRACT

In the present study, a convenient and highly effective method was developed for the quantification of acidic drugs in wastewater and river wat

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Antioxidant activity as a response to cadmium pollution in three durum wheat genotypes differing in salt-tolerance

Jakub Pastuszak, Przemysław Kopeć, Agnieszka Płażek, Krzysztof Gondek, Anna Szczerba, Marta Hornyák, and Franciszek Dubert

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Durum wheat is commonly used in various food industry industries and cultivated worldwide. A serious problem with the species cultivation is

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ERRATUM

Erratum to: A one-step incubation ELISA kit for rapid determination of dibutyl phthalate in water, beverage and liquor

Qing Sun, Yanli Chen, Fuxue Li, Minghong Jia, and Guoqing Shi

Article Category: Erratum | Pages: 1217 | Published online: 26 Sep 2020

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REVIEW ARTICLES

Sinoporphyrin sodium, a novel sensitizer for photodynamic and sonodynamic therapy

Han-Qing Liu, Ya-Wen An, Zhi-Wen Li, Wei-Xin Li, Bo Yuan, Jian-Chun Wang, Hong-Tao Jin, and Cheng Wang

Article Category: Review Article | Pages: 691–701 | Published online: 23 Jun 2020

ABSTRACT

Sinoporphyrin sodium (DVDMS) is a novel sensitizer discovered by Professor Fang Qi-Cheng and widely used in photodynamic (PDT) and sonody

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Natural products isolated from Casimiroa

Khun Nay Win Tun, Nanik Siti Aminah, Alfinda Novi Kristanti, Hnin Thanda Aung, and Yoshiaki Takaya

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ABSTRACT

About 140 genera and more than 1,600 species belong to the Rutaceae family. They grow in temperate and tropical zones on both hemispheres, as tre

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Plant description, phytochemical constituents and bioactivities of Syzygium genus: A review

Ei Ei Aung, Alfinda Novi Kristanti, Nanik Siti Aminah, Yoshiaki Takaya, and Rico Ramadhan

Article Category: Review Article | Pages: 1256–1281 | Published online: 13 Oct 2020

ABSTRACT

This article attempts to report native growth, plant description, phytochemical constituents and bioactivities of *Syzygium aqueum*, *S. aromat*

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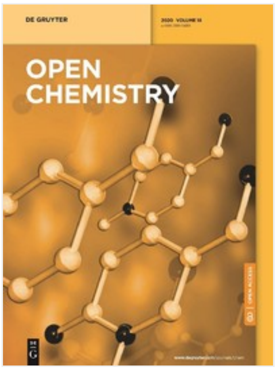

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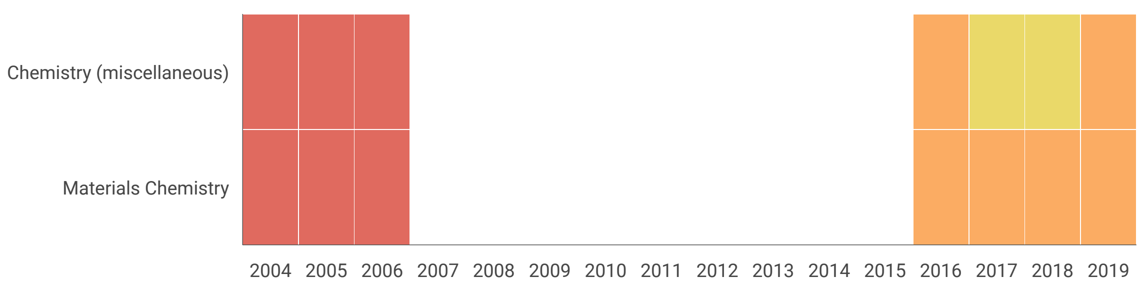

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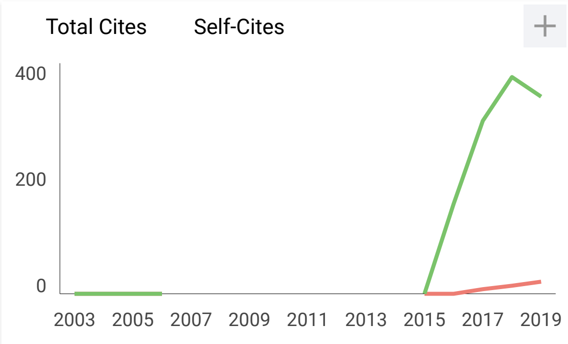

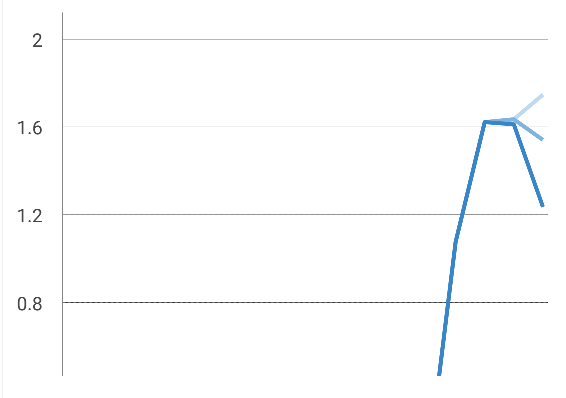

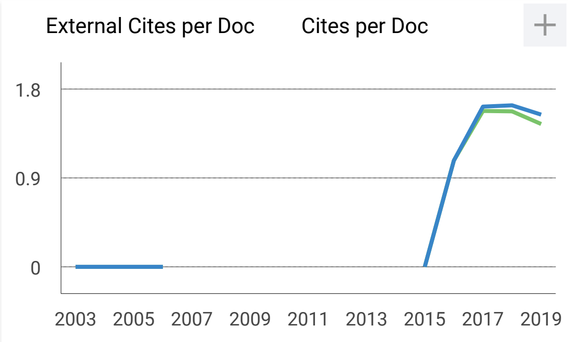

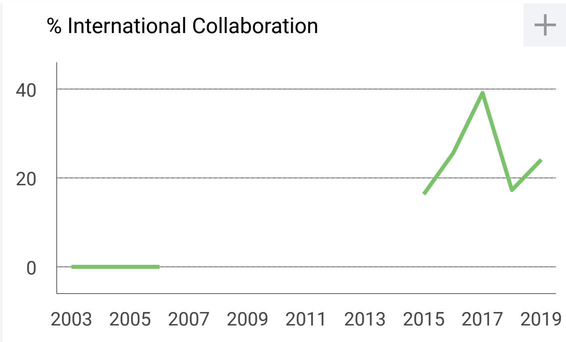

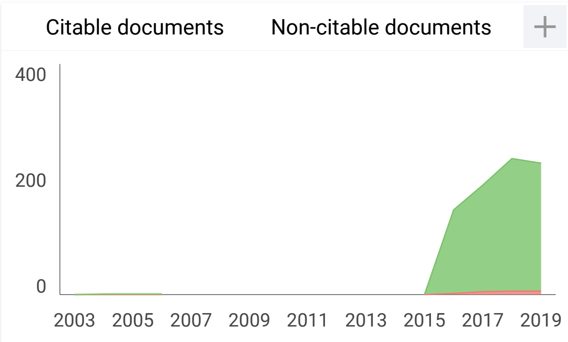

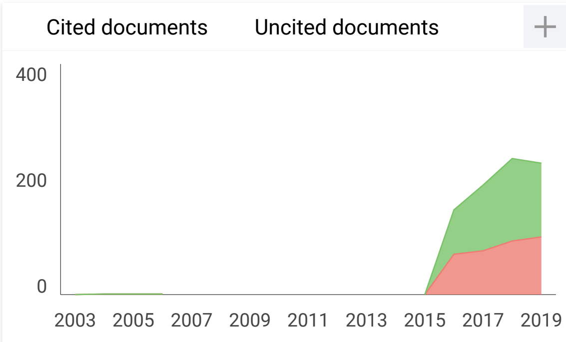

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Review Article

Ei Ei Aung, Alfinda Novi Kristanti*, Nanik Siti Aminah, Yoshiaki Takaya, Rico Ramadhan

Plant description, phytochemical constituents and bioactivities of *Syzygium* genus: A review

https://doi.org/10.1515/chem-2020-0175
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Abstract: This article attempts to report native growth, plant description, phytochemical constituents and bioactivities of *Syzygium aqueum*, *S. aromaticum*, *S. cumini*, *S. guineense* and *S. samarangense*. Those are the large public species in the *Syzygium* genus and some of them have been used as traditional medicines. Different parts (leaves, seeds, fruits, barks, stem barks and flower buds) of each species plant are rich in phytochemical constituents such as flavonoids, terpenoids, tannins, glycosides and phenolics. Antioxidant, antidiabetic, anticancer, toxicity, antimicrobial, anti-inflammatory and anthelmintic activities are reported in various extracts (methanol, ethanol and aqueous) from different parts of *Syzygium* sp. The bioactivities were studied by using 1,1-diphenyl-2-picrylhydrazyl and ferric reducing antioxidant power assays for antioxidant, 5-(3-carboxymethoxyphenyl)-2-(4,5-dimethylthiazoly)-3-(4-sulfophenyl) tetrazolium and 3-(4,5-dimethylthiazol-2-yl)-2-5-diphenyltetrazolium bromide assays for anticancer, α-glucosidase and α-amylase inhibition assays for antidiabetic, agar well diffusion method for antimicrobial and brine shrimp lethality assay for toxicity. Moreover, this review shows that phytochemical constituents of each species significantly presented various bioactivities. Therefore, this review suggests that there is great potential for obtaining the lead drug from these species.

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Keywords: Myrtaceae, *Syzygium aqueum*, *S. aromaticum*, *S. cumini*, *S. guineense*, *S. samarangense*, flavonoid, chromone, terpenoid, steroid, tannin, phenol, acylphloroglucinol

1 Introduction

Natural products are resources derived from living organisms, such as plants, animals and microorganisms. The chemicals produced by plants may be defined as "phytochemicals" [1,2]. Phytochemicals in plants have undoubtedly been a resource of medicinal treatment for human diseases for a long time. They played a key role in primary health care of nearly 75–80% of the world's population according to the World Health Organization [3]. Phytochemicals in a plant can be explored by using various methods such as extraction, separation, purification, identification, structure elucidation, determination of physical and chemical properties, biosynthesis and quantification [4]. The phytochemicals could be classified as primary and secondary metabolites. Primary metabolites involved natural sugars, amino acids, proteins, purines and pyrimidines of nucleic acids and chlorophyll. Secondary metabolites are the remaining plant chemicals such as glycosides, alkaloids, terpenoids, flavonoids, lignans, steroids, curcumines, saponins and phenolics [5].

The secondary metabolites are primary for plants to protect themselves from environmental hazards such as pollution, UV exposure, stress, drought and pathogenic attack, as well as researchers have reported that phytochemicals can protect them from human diseases [5,6]. The secondary metabolites have biological properties such as antioxidant activity, anticancer property, antimicrobial effect, anti-inflammatory and stimulant to the immune system [7]. Bioactive secondary metabolites, more than a thousand known and many unknown, come from all parts of plants such as stems, fruits, roots, flowers, seeds, barks and pulps. [7,8]

The eighth-largest family in herbal plants is Myrtaceae that comprised about 140 genera and 3,800–5,800 species [9]. *Syzygium* is the 16th largest genus of flowering plants in Myrtaceae family [10] that includes high diversity cultivated for many purposes such as colorful, edible and fleshy fruits [11,12]. There are 1,100–1,200 species of *Syzygium* [13–16]. Species of *Syzygium* are distributed in the tropical and sub-tropical regions of the world [17,18]. They have a native range that extends from Africa and Madagascar through southern East Asia and the Pacific [13,17]. The enormous diversity of species takes place in South East Asia such as Indonesia, Malaysia, East India [11], Myanmar, Philippines and Thailand [13]. The *Syzygium* genus is widely grown in rainforests such as coastal forests, swamp forests, resembled monsoons, bamboo forests and peat swamp forests [14].

Syzygium genus contains abundant secondary metabolites such as terpenoids, chalcones, flavonoids, lignans, alkyl phloroglucinols, hydrolysable tannins and chromone derivatives [19], which exhibits bioactivities such as antidiabetic, antifungal, anti-inflammatory, antibacterial, antioxidant, cytotoxic [20], anti-HIV, antidiarrheal, anthelmintic and antivirus activities [16]. *S. aqueum*, *S. aromaticum*, *S. cumini*, *S. guineense* and *S. samarangense* are five large public species in this genus [14]. Some of them have been used as a traditional medicine to treat several disorders (such as hemorrhage, dysentery and gastrointestinal disorders), diabetes, inflammation such as antifungal, antimicrobial, antihypertensive, analgesic and antiviral [15] bronchitis, thirst, dysentery and ulcers [16].

Most researchers have reported their rich sources of phytochemical constituents and bioactivities. Native growth and plant description of five species have been already reviewed by many reviewers [21–25]. *S. cumini*, one known species, has been overviewed by some authors [26,27]. And then, phytochemical constituents and bioactivities of both *S. aromaticum* [28,29] and *S. cumini* [30,31] have been already reported in review articles. However, phytochemical constituents and bioactivities of *S. aqueum*, *S. guineense* and *S. samarangense* have not yet been discussed by any reviewers. Moreover, most of the authors have reviewed only phytochemicals or bioactivities of one species in each review article.

Therefore, this review aims to provide detailed reports of five large public species in *Syzygium* genus. Rich phytochemicals and bioactivities of five species have been recorded by reviewing many international public articles and most of the review articles by authors. All of native growths, plant descriptions, phytochemical constituents and bioactivities from different parts of plants (five species) are studied in this review article (Table 1).

Table 1: Common name and distribution of five *Syzygium* species

Species name	Family	Genus	Common name	Distribution	Ref.
S. aqueum	Myrtaceae	*Syzygium*	Water apple, bell fruit, water cherry and water rose apple	India, Malaysia, Asia and Philippines	[13,32,33]
S. samarangense	Myrtaceae	*Syzygium*	Java apple, markopa, Java rose apple, Samarang apple, wax jambu and wax apple	Malaysia, Indonesia, Thailand, Cambodia, Laos, Vietnam, India, Australia and Taiwan	[13,34,35]
S. aromaticum	Myrtaceae	*Syzygium*	Clove, Lavang and Laung (Hindi)	Indonesia, Madagascar, Pakistan, India, Sri Lanka and China	[13,28,36]
S. cumini	Myrtaceae	*Syzygium*	Jambul, Jambolan, black plum, duhat plum and Java plum	India, Malaysia, Myanmar, Philippines, Sri Lanka and Thailand	[13,30,37]
S. guineense	Myrtaceae	*Syzygium*	Water berry, water boom and woodland Roof of Africa	Australia, Asia and Horn of Africa	[13,38]

2 Description of plants

2.1 Syzygium aqueum

The tree of *S. aqueum* is cultivated well in heavy and fertile soils and is sensitive to frost. It grows up to a height of 8–10 m with branching near the base. Leaves are 4.5–23 cm long, 1.5–11 cm wide and oblong to elliptic. The leafstalk is 1–5 mm long. Flowers are yellowish-white or pinkish and are 2–3 cm long. They produced terminal or axillary cymes and moreover the flowering season occurs in February–March and fruits mature during May–June. Fruits are pale rose or white. They are watery, small bell-shaped with shinning skin, spongy and slightly fragrant. They are about 1 inch long and are ½ inch wide [39–41].

2.2 Syzygium samarangense

The tree of *S. samarangense* is grown in a rather long dry period and relatively moist tropical sea level area up to 1,200 m. It grows up to a height of 3–15 m with branching near the base. Leaves are 10–25 cm × 5–12 cm, petiole is thick and the shape of leaves is opposite and oblong to elliptic. Flowers are white to yellowish-white, 2.5 cm in diameter and the flowering season is early or late in the dry period. Fruits are bell-shaped, oval and their sizes are 3.5–5.5 cm × 4.5–5.5 cm. The skin color of fruits splits from white to pale green to dark green, from pink to red to pink-red [21,22].

2.3 Syzygium aromaticum

S. aromaticum is also known as clove, which is an aromatic dried flower bud of a plant in the Myrtaceae family. The clove is composed of buds and leaves (the commercial part of the plant). The flowering bud production begins 4 years after plantation, and they are collected by hand or using a natural phytohormone in the pre-flowering period [29,42].

2.4 Syzygium cumini

S. cumini is an evergreen tree and the height is 25 m. Leaves are slightly leathery and from oblong-ovate to elliptical or obovate-elliptic. The length of leaf is 6–12 cm long and the stalk of a leaf is 3 cm long. Flowers are fragrant, white to pink or greenish-white, about 1 cm in cross, branched clusters at the stem tips. The calyx is about 4 mm long, four toothed and funnel-shaped. The very numerous stamens are as long as the calyx. The ovoid fruits are 1.5–3.5 cm long berries, dark purple or nearly black, dark purplish-red, shiny, with white to lavender flesh. The fruit contains a single large seed, 2 cm long [17,23,37].

2.5 Syzygium guineense

S. guineense prefers moist soils on high water tables in lowland riverine forest or wooded grassland and lower montane forests, from sea level to 2,100 m. It is a sizeable evergreen tree in the forest and the height is from 10 to 15 m or 25 m. It has a broad trunk and fluted with dense rounded thick crown, branches drooping. The more the age of the plant, the more the bark is rough and flaking. Leaves are opposite, smooth on both surfaces, shiny and with short stalks. The color of leaves is from purple-red to dark green. Flowers have white, showy stamens, with fragrant smell and in dense clusters. Fruits are oval shaped, 3 cm long, shiny, purple-black in color and one-seeded [24].

3 Phytochemical constituents

3.1 Flavonoids

Phloretin (**1**), myrigalone-G (**2**), myrigalone B (**3**) [43], 2′,4′-dihydroxy-6′-methoxy-3′-methyldihydrochalcone (**4**), 2′-hydroxy-4′,6′-dimethoxy-3′-methyldihydrochalcone (**5**), 2′,4′-dihydroxy-6′-methoxy3′,5′-dimethyldihydrochalcone (**6**) [46,47], 2′,4′-dihydroxy-6′-methoxy-3′-methylchalcone or stercurensin (**7**), 2′-hydroxy-4′,6′-dimethoxy-3′-methylchalcone (**8**) [46,47], 2′,4′-dihydroxy-6′-methoxy-3′,5′dimethylchalcone (**9**) [44], 2′,4′-dihydroxy-3′,5′-dimethyl-6′-methoxychalcone (**10**), 2′,4′-dihydroxy-6′-methoxchalcone or cardamonin (**11**) [51], pinocembrin (**12**), (−)-strobopinin (**13**), 8-methylpinocembrin (**14**), demethoxymatteutcinol (**15**), 7-hydroxy-5-methoxy-6,8-dimethylfoavanone (**16**) [48], 7,8,3′,4′-tetrahydroxy-3,5-dimethoxyflavone (**17**) [45], 7-hydroxy-5-methoxy-6,8-dimethylflavanone (**18**), quercetin (**19**) [49,50], kaempferol (**20**) [54], gallocatechin (**21**), myricetin (**22**) [51], (−)-epigallocatechin (**23**), (−)-epigallocatechin 3-*O*-gallate (**24**), samarangenin A (**25**), samarangenin B (**26**),

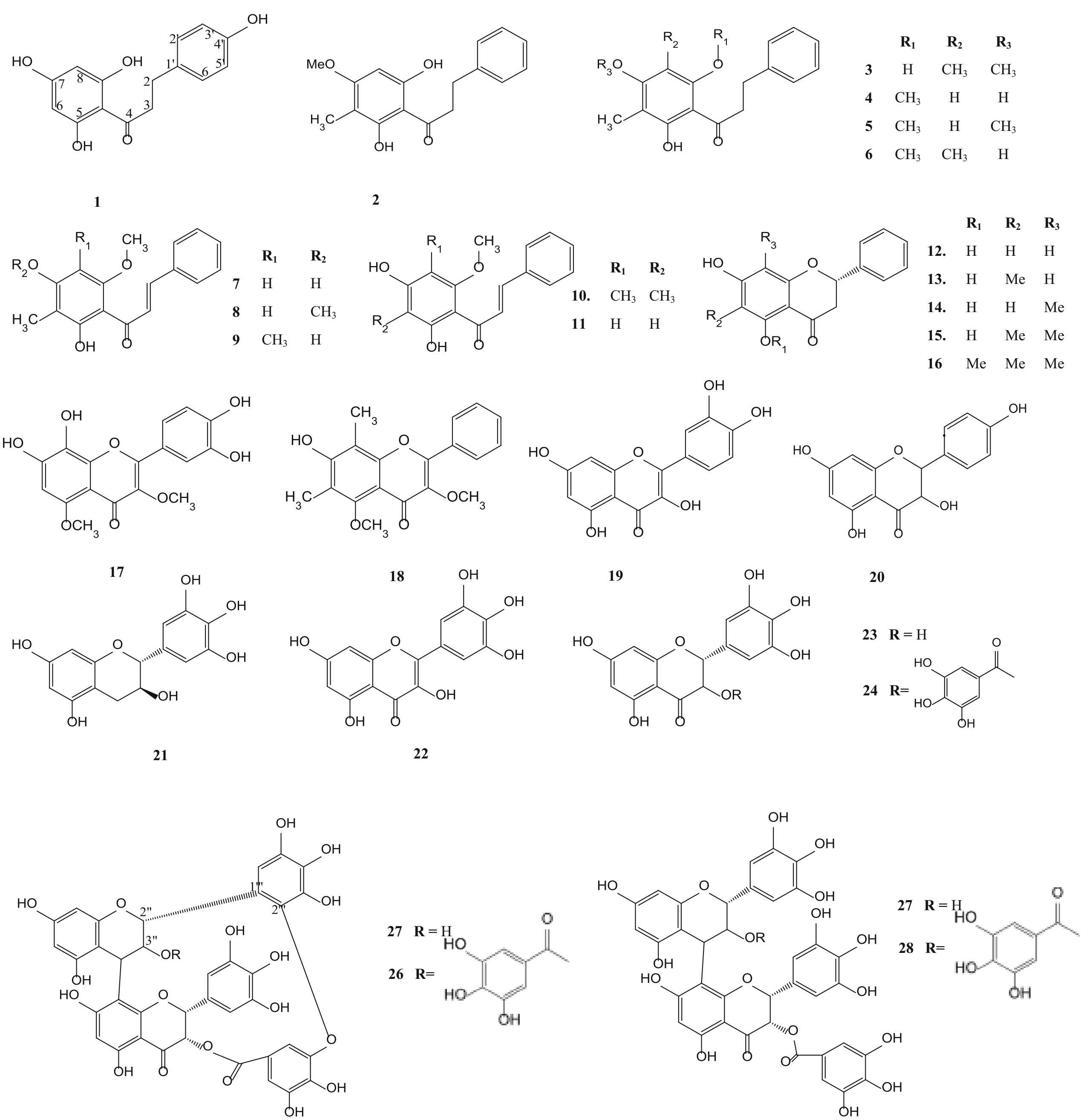


Figure 1: Flavonoids from various parts of *S. aqueum*, *S. samarangense*, *S. aromaticum*, *S. cumini* and *S. guineense*.

prodelphinidin B-2 3″-*O*-gallate (**27**) and prodelphinidin B-2 3,3″-*O*-gallate (**28**) [52] are presented in Figure 1.

3.2 Flavonoid glycosides

Myricetin-3-*O*-rhamnoside (**29**) [43,45], europetin-3-rhamnoside (**30**) [43], mearnsitrin (**31**) [53], reynoutrin (**32**), hyperin (**33**), quercitrin (**34**), guaijaverin (**35**) [49], tamarixetin 3-*O*-β-D-glucopyranoside (**36**), ombutin 3-*O*-β-D-glucopyranoside (**37**) [50], quercetin 3-*O*-α-L-rhamnopyranoside (**38**), kaempferol 3-*O*-β-D-glucuronopyranoside (**39**), myricetin 3-*O*-β-D-glucuronopyranoside (**40**), mearnsetin 3-*O*-(4″-*O*-acetyl)-α-L-rhamnopyranoside (**41**), myricetin 3-*O*-(4″-*O*-acetyl)-α-L-rhamnopyranoside (**42**), myricetin 4′-methyl ether 3-*O*-α-L-rhamnopyranoside (**43**), myricetrin 4″-*O*-acetyl-2″-*O*-gallate (**44**) [54], myricetin-3-*O*-glucoside (**45**), myricetin-3-*O*-rhamnoside (**46**), myricetin-3-*O*-glucoronide (**47**) and myricetin-3-*O*-β-D-(6″-galloyl) galactoside (**48**) [51] are shown in Figure 2.

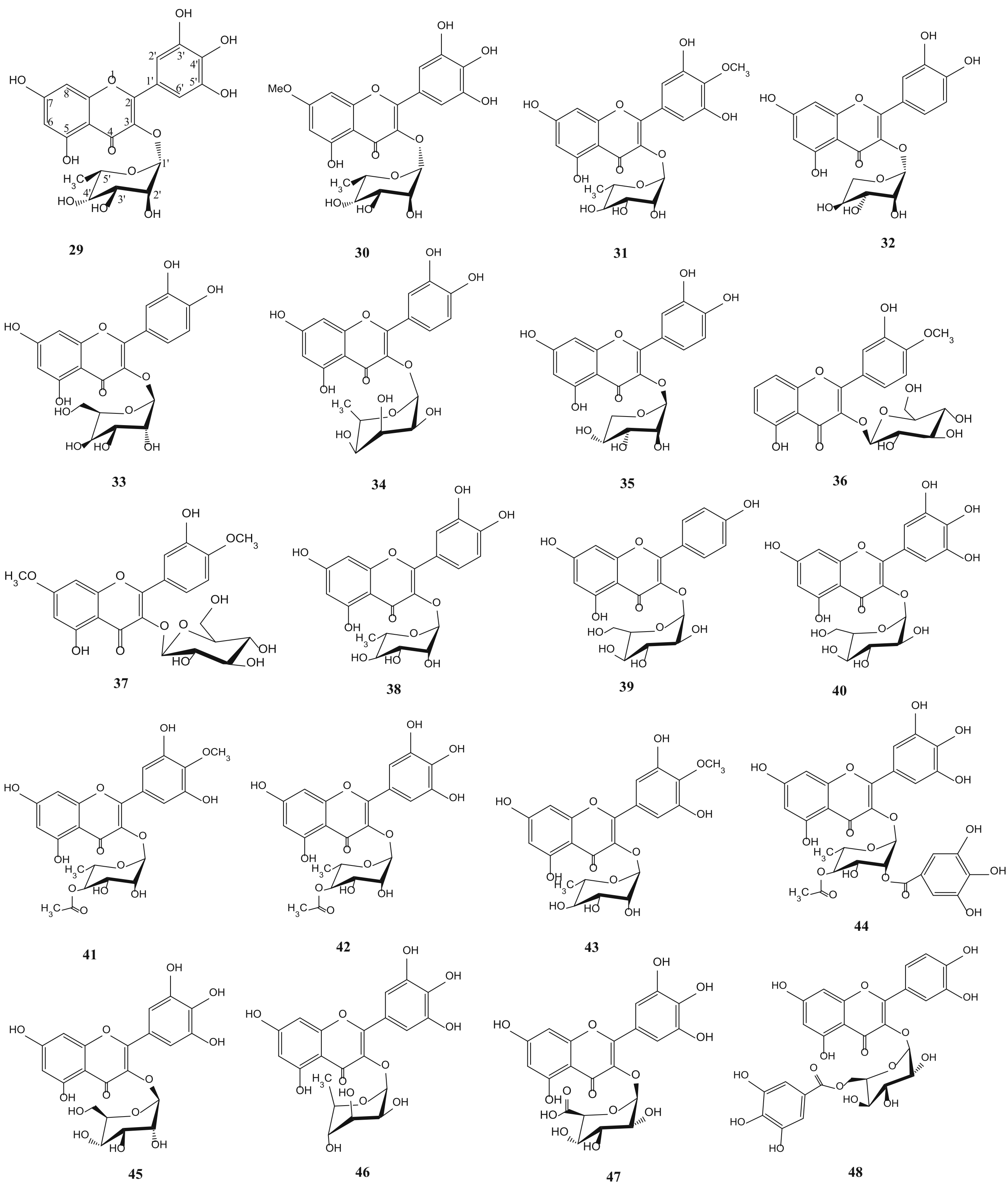


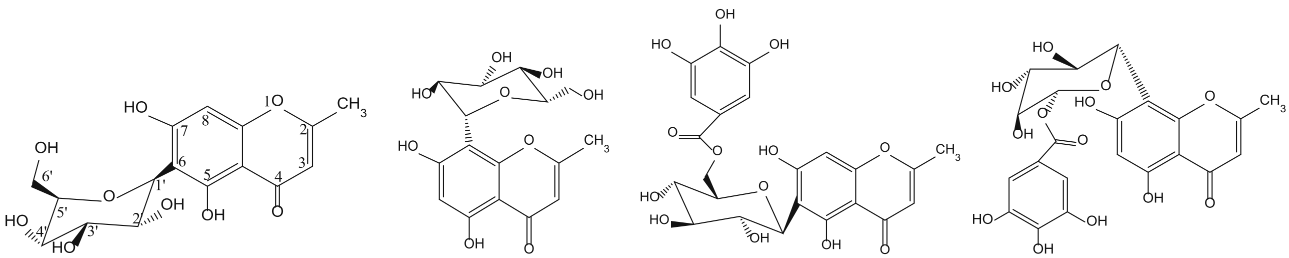
Figure 2: Flavonoid glycosides from various parts of *S. aqueum*, *S. samarangense*, *S. aromaticum*, *S. cumini* and *S. guineense*.

3.3 Chromone glycosides

Biflorin (**49**), isobiflorin (**50**), 6-*C*-*β*-D-(6′-*O*-galloyl) glucosylnoreugenin (**51**) and 8-*C*-β-D-(6′-*O*-galloyl)glucosylnoreugenin (**52**) [55] are shown in Figure 3.

3.4 Terpenoids

Sysamarin A (**53**), sysamarin B (**54**), sysamarin C (**55**), sysamarin D (**56**), sysamarin E (**57**) [56], lupenyl stearate (**58**) [57], lupeol (**59**) [46,57], betulin (**60**), betulinic acid



49 50 51 52

Figure 3: Chromone glycosides from various parts of *S. aromaticum*.

(**61**) [46,63], oleanolic acid (**62**) [55,58,59], arjunolic acid (**63**) [58,61,62], corosolic acid (**64**) [58] asiatic acid (**65**) [58,61,62], maslinic acid (**66**) [55], 12-oleanen-3-ol-3β acetate (**67**) [60], 2-hydroxyoleanolic acid (**68**), 2-hydroxyursolic acid (**69**), terminolic acid (**70**), 6-hydroxy asiatic acid (**71**) [61,62], limonin (**72**) [50], caryolane-1,9β-diol (**73**), clovane-2,9β-diol (**74**), α-humulene (**75**), humulene epoxide α (**76**), β-caryophyllene (**77**) and β-caryophyllene oxide (**78**) [55] are shown in Figure 4.

3.5 Steroids

Lupenyl stearate cycloartenyl stearate (**79**), β-sitosteryl stearate (**80**), 24-methylenecycloartenyl stearate (**81**) [57], β-sitosterol (**82**) [57,59] and stigmasterol (**83**) [60] are shown in Figure 5.

3.6 Steroid glycoside and terpenoid glycosides

β-Sitosterol-3-*O*-β-D-glucoside (**84**) [55], arjunolic acid 28-β-glycopyranosyl ester (**85**) and asiatic acid 28-β-glycopyranosyl ester (**86**) [61,62] are displayed in Figure 6.

3.7 Tannins

3,3′,4′-Tri-*O*-methylellagic acid (**87**) [55], ellagic acid (**88**) [49,64], ellagitannin-3-*O*-methylellagic acid 3′-*O*-β-D-glucopyranoside (**89**), ellagic acid 4-*O*-α-L-2″-acetylhamnopyranoside (**90**) [64], 3-*O*-methylellgic acid 3′-*O*-α-L-rhamnopyranoside (**91**), gallotannins 1,2,3,6-tetra-*O*-galloyl-β-D-glucose (**92**), 1,2,3,4,6-penta-*O*-galloyl-β-D-glucose (**93**), casuarictin (**94**) and casuarinin (**95**) [51] are depicted in Figure 7.

3.8 Phenols

Hydroxybenzaldehyde (**96**) [43], gallic acid (**97**) [49,64], ferulic aldehyde (**98**) [50], eugenol (**99**), eugenyl acetate (**100**), trans-coniferylaldehyde (**101**), 3-(4-hydroxy-3-methoxy-phenyl) propane-1,2-diol (**102**), 1-*O*-methyl-guaiacylglycerol (**103**), epoxiconiferyl alcohol (**104**) [55], 7-hydroxycalamenene (**105**) and methyl-β-orsellinate (**106**) [59] are shown in Figure 8.

3.9 Phenyl glycosides

2,4,6-Trihydroxy-3-methylacetophenone-2-*O*-β-D-glycoside (**107**) and 2,4,6-trihydroxy-3-methylaceto-phenone-2-*C*-β-D-glycoside (**108**) [55] are shown in Figure 9.

3.10 Acylphloroglucinol derivatives

Samarone A (**109**), samarone B (**110**), samarone C (**111**), jambone G (**112**), samarone D (**113**), jambone E (**114**), jambone F (**115**), jamunone B (**116**) and 2-pentadecyl-5,7-didydroxychromone (**117**) [65] are illustrated in Figure 10.

4 Bioactivities

4.1 Antioxidant activity

Antioxidant activity of methanol extract of *S. aqueum* leaves was investigated by using β-carotene bleaching and 2,2′-azinobis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) free radical scavenging assays. Fresh and dried leaves of sample were extracted with methanol: water (1:10). The percentage of antioxidant activity of the

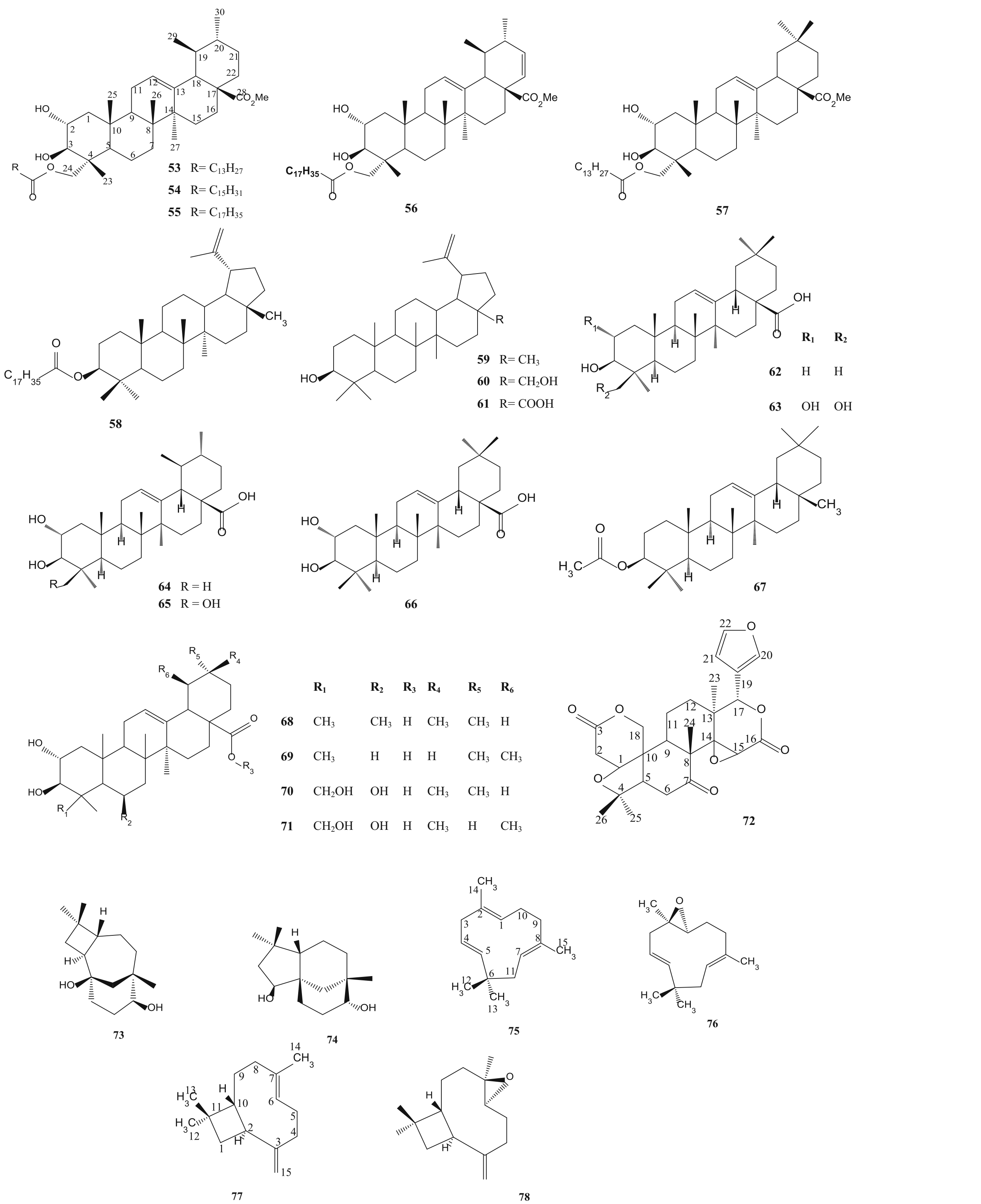
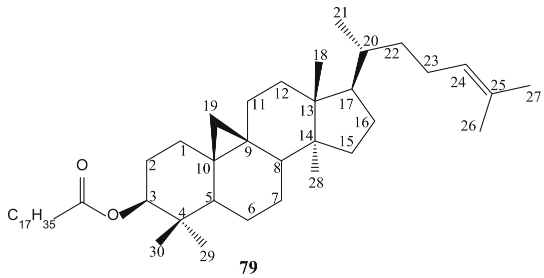


Figure 4: Terpenoids and steroids from various parts of *S. samarangense*, *S. aromaticum*, *S. cumini* and *S. guineense*.



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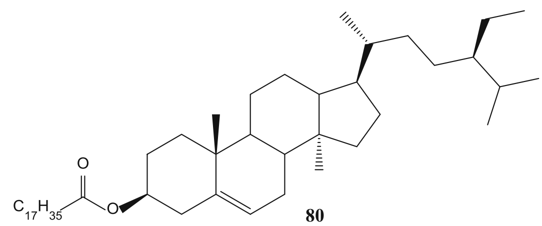

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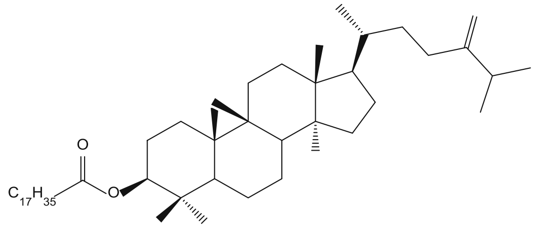

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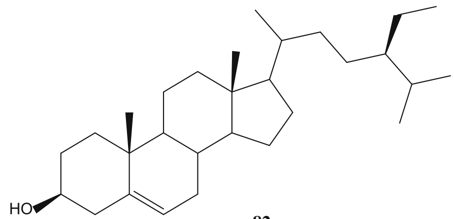

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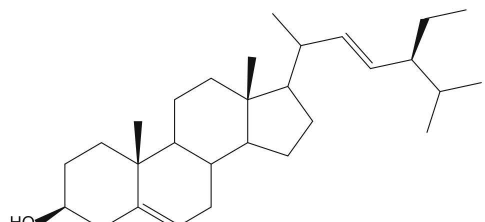

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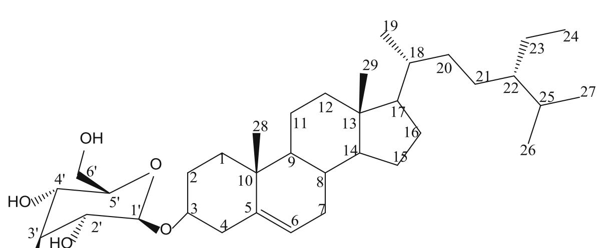
Figure 5: Steroids from various parts of *S. aromaticum* and *S. cumini*.



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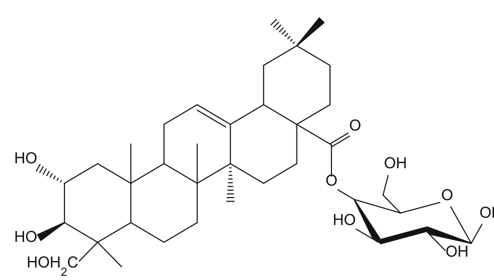

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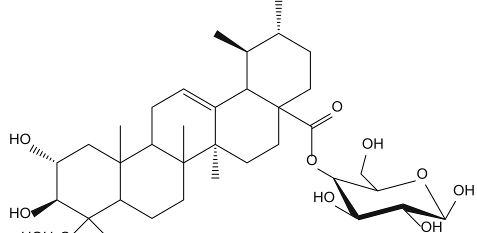

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Figure 6: Steroid glycosides and terpenoid glycosides from various parts of *S. aromaticum* and *S. guineense*.

fresh sample was higher than that of the dried sample for both β-carotene bleaching and ABTS assays [32].

Fruits of *S. aqueum* were mashed with citrate buffer, pH 4.2. Then, the extract was investigated using 1,1-diphenyl-2-picrylhydrazyl (DPPH) assay. Vitamin C was used as a positive control. The absorbance was measured at 517 nm. IC_{50} (μg/mL) values of both standard and sample were nearly the same, and they had powerful antioxidant activity because the IC_{50} value was less than 50 μg/mL [66].

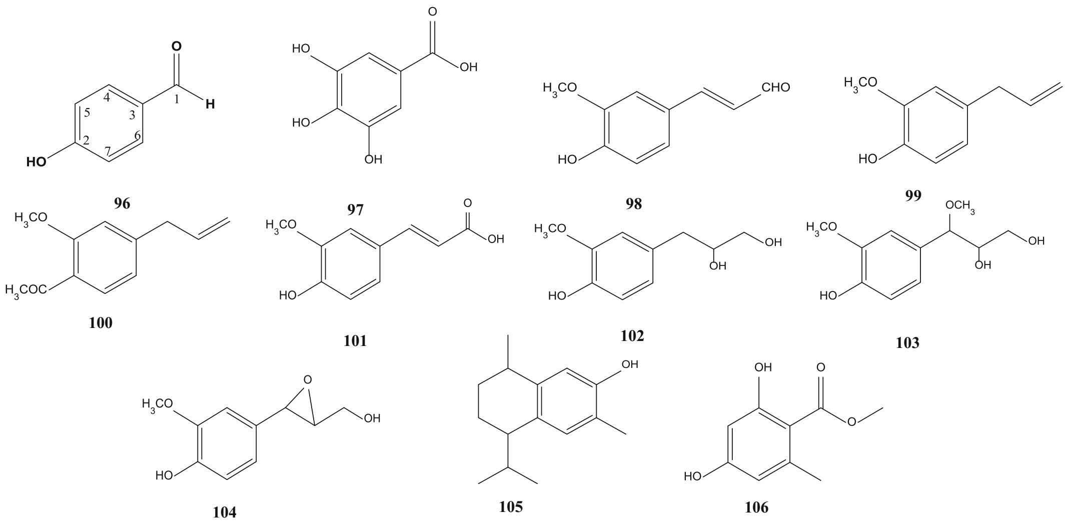


Figure 8: Phenyls of *S. aqueum*, *S. samarangense* and *S. aromaticum*.

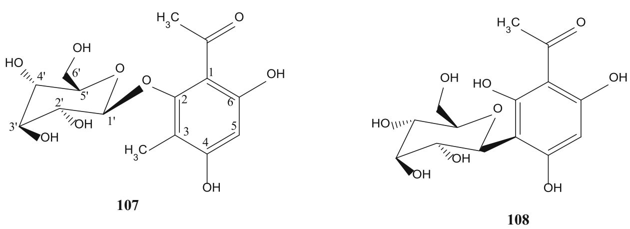


Figure 9: Phenyl glycosides of *S. aromaticum*.

S. aqueum leaves were extracted with 50% acetone (v/v). The extract was investigated by using DPPH radical scavenging and ferric reducing antioxidant power (FRAP) assays. In the DPPH assay, the percentage scavenging of acetone extract was higher than that of water extract. In the FRAP assay, μM Fe(ɪɪ)/g of water extract was higher than that of acetone extract [67].

Leaves of *S. aqueum* were extracted with 100% methanol. The antioxidant activity of the extract was investigated using DPPH radical scavenging, FRAP, ABTS radical scavenging and total antioxidant capacity assays. (epi) Gallocatechin gallate (EGCG) and vitamin C were used as standards when compared with the sample for all assay methods. Radical scavenging activity (μg/mL) of the extract is nearly the same as standards for all methods [33].

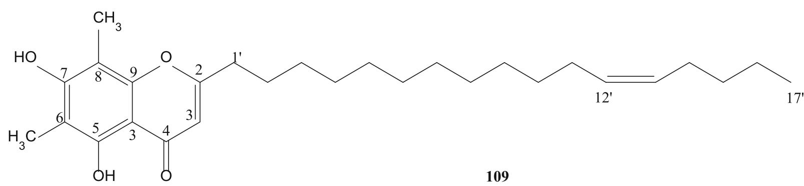
S. samarangense seeds were extracted with methanol, and then the antioxidant activity of the extract was determined using DPPH and FRAP assays. Gallic acid was selected as a positive control. The methanol extract showed moderate activity by the DPPH assay as well as by the FRAP assay [49].

The antioxidant activity of fruits of each *S. samarangense* tree cultivar (red, pink and green) was studied using DPPH radical scavenging. Ascorbic acid was used as a standard. The red cultivar showed the highest antioxidant activity and the green cultivar exhibited the lowest antioxidant activity [68].

Extraction of the roots of *S. samarangense* was carried out with three kinds of solvents (ethyl acetate, methanol and water) using the Soxhlet extraction method. The antioxidant activity of root extracts was evaluated using DPPH radical scavenging and ascorbic acid was used as a standard. The highest percentage of scavenging was shown by the methanol extract [69].

S. aromaticum (clove) was extracted with methanol and distilled water. The antioxidant activity of two extracts was determined using the DPPH assay and quercetin was chosen as a positive control. The highest percent scavenging was shown by quercetin, followed by the distilled water extract and the methanol extract was the lowest. [70].

S. aromaticum flower buds were extracted with ethanol and distilled water. The sample was also extracted to obtain the essential oil. Different percentages of oil (0.1%, 0.5% and 1%) and dried ethanol extract (5.0%) were dissolved in aqueous ethanol solution (1:1). The antioxidant activities of ethanol extract, distilled water extract and three different percentages of essential oil in aqueous ethanol were determined using the DPPH assay. Ascorbic acid was used as a standard. The best inhibition was presented by the ethanol extract which had the EC_{50} (μg/mL) value nearly the same as that of the standard [71].



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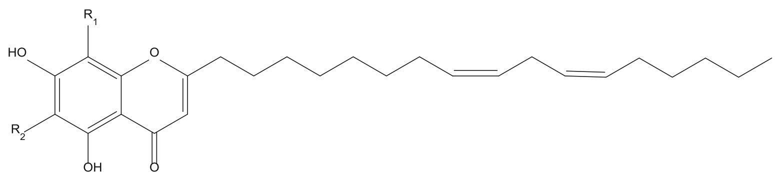
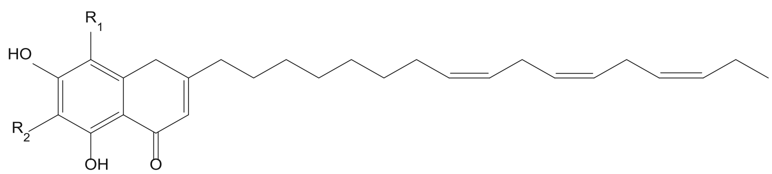
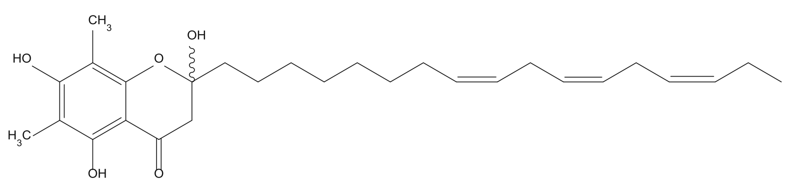


	R_1	R_2
110	CH_3	CH_3
111	CH_3	H
112	H	H



	R_1	R_2
113	CH_3	CH_3
114	H	H
115	H	CH_3



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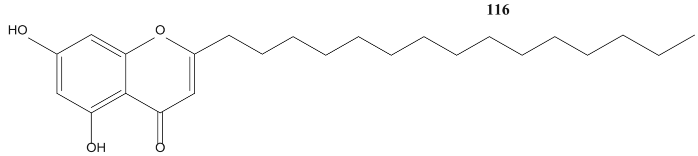

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Figure 10: Acylphloroglucinol derivatives from *S. samarangense*.

S. cumini leaves were extracted with ethanol. The antioxidant activity of the extract was determined using the DPPH assay, and the result showed that $IC_{50} = 9.85 \pm 0.51\ \mu g/mL$. Ascorbic acid was used as a positive control [72].

S. cumini seeds were extracted with methanol. The antioxidant activity of the extract was determined using DPPH and FRAP assays. Vitamin C, butylated hydroxyanisole (BHA) and quercetin were used as positive controls. This methanol extract expressed strong antioxidant activity. At certain concentration, this extract showed a stronger percentage of DPPH scavenging than that of BHA. Likewise with the reducing power in the FRAP assay, vitamin C showed weaker antioxidant activity than the methanol extract. The authors stated that the high tannins present in the methanol extract contributed to the strong antioxidant activity [73].

S. cumini leaves were extracted with methanol. The antioxidant activity of the extract was determined using the DPPH assay. Butyl hydroxyl toluene (BHT) and ascorbic acid were used as standards. The IC_{50} value of the extract obtained showed a potent scavenging activity when compared with BTH and ascorbic acid [74].

S. guineense leaves were extracted with 80% methanol. The antioxidant activity of the extract was determined using the DPPH assay. The leaf extract did not show the antioxidant activity [75].

The essential oil was extracted from *S. guineense* leaves by using the hydro-distillation method. The antioxidant activity of essential oil was determined using the DPPH radical scavenging assay. BHT was used as a standard. The authors reported that this essential oil exhibited the high antioxidant activity [76].

4.2 Anticancer activity

S. aqueum leaves were extracted with methanol for the determination of cytotoxicity using sulforhodamine B (SRB) assay. The activity was tested on human breast cancer cell (MDA-MB-231) and compared with that of doxorubicin (standard cytotoxic drug). The extract was less toxic on cancer cell line (IC_{50} > 100 µg/mL) [86].

Pulp of *S. samarangense* was extracted with methanol and then the extract was tested on SW-480 human colon cancer cell line using the MTT (3-(4,5-dimethylthiazol-2-yl)-2-5-diphenyltetrazolium bromide) assay. EGCG was treated as a positive control. Methanolic extract and EGCG were highly toxic on cancer cell line according to data [49].

S. cumini seeds were extracted with ethyl acetate. The extract was separated using column chromatography with an eluent mixture of chloroform:ethyl acetate:methanol (30:50:20) to obtain a single compound, flavopiridol. The anticancer activity of the isolated compound was evaluated on MCF7, A2780, PC-3 and H460 cell lines using the MTS (5-(3-carboxymethoxyphenyl)-2-(4,5-dimethyl-thiazoly)-3-(4-sulfophenyl) tetrazolium) assay. Flavopiridol was used as a positive control. The *S. cumini* seed extract proved the highest activity against A2780 cell line (IC_{50} = 49 µg/ml), whereas showed the least activity against H_{460} cell line [77].

S. guineense's leaves and bark were extracted with ethanol, water and the mixture of ethanol–water. All extracts were tested on HeLa cell line and SiHa cell line for anticancer activity using the SRB assay. Adriamycin was used as a positive control on both cell lines. The aqueous extract of bark showed the best inhibition of cancer cell growth on both cell lines. The ethanol extract of leaves exhibited more efficient inhibition than other leaf extracts on both cell lines [78].

The ethanol leaf extract of *S. cumini* was tested on human keratinocyte cells (HaCaT cell line) by using the MTT assay. From this study, it was known that the ethanol extract was not toxic at concentrations of 500–250 µg/mL [72].

S. aqueum leaves were extracted with methanol. The cytotoxicity of the extract was detected on breast cancer cell line MCF-7 using the SRB assay. Doxorubicin was used as the standard. The results showed that the extract had high activity against MCF-7 cell line (IC_{50} < 100 µg/mL). This activity is caused by the content of phenolic compounds which act as phytoestrogens in the *Syzygium* extract under study [86].

4.3 Antimicrobial activity

S. samarangense fruits were extracted by using three solvents (petroleum ether, ethyl acetate and methanol). All extracts were tested against certain bacterial and fungal strains using the disc diffusion method. Gram-positive bacteria (*Bacillus cereus*, *Staphylococcus aureus* and *Candida albicans*) and Gram-negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*) were used in this study. Ampicillin, kanamycin, tetracycline and vancomycin were used as standards. The method used was a microdilution using a 96-well microtiter plate. The result of this study showed that the Gram-positive and Gram-negative bacteria were sensitive to fruit extracts. Among the three extracts, the methanol extract showed a higher activity than other extracts [79].

The ethanol extract of *S. samarangense* leaves was examined for antibacterial activity by using the broth microdilution method. The extract was tested against *E. coli*, *B. cereus*, *Enterobacter aerogenes*, *Salmonella enterica* and *Kocuria rhizophila*. The minimum inhibitory concentration (MIC) value was determined to be the lowest concentration of the extract capable of inhibiting microorganism growth. The leaf extract of the sample was more effective against *B. cereus* and *S. enterica* than others when compared with chloramphenicol [35].

Leaves, bark and fruits of *S. samarangense* tree cultivars (red, pink and green) were extracted with methanol and ethanol. All extracts were evaluated against four bacteria, including two Gram-positive (*B. cereus* and *S. aureus*) and two gram-negative bacteria (*E. coli* and *P. aeruginosa*), by using the disc diffusion method. *Tetracycline* was used as a positive control. All the extracts showed the antimicrobial activity. However, the ethanolic extracts showed higher antimicrobial activities than the methanolic extracts. All the bark extracts of three cultivars exhibited higher antimicrobial activities followed by fruit and leaf extracts [68].

S. samarangense root was extracted by using three kinds of solvents (ethyl acetate, methanol and water) by using the Soxhlet extraction method. The root extracts were evaluated against *Salmonella typhi*, *E. coli*, *P. aeruginosa* and *Bacillus subtilis* by using the agar well diffusion method. The methanolic extract presented high inhibitory effect on *S. typhi*, the ethyl acetate extract showed potent inhibitory effect on *P. aeruginosa* and the aqueous extract exhibited strong inhibitory effect on *S. typhi* [69].

The antibacterial and antifungal activities of *S. aromaticum* oil were determined by using the agar well diffusion method against *S. aureus*, *E. coli* and *P. aeruginosa* bacteria and *C. albicans*, *Aspergillus flavus* and *Penicillium*. Ciprofloxacin and ketoconazole were used as positive controls. *S. aromaticum* oil had a high inhibitory effect on bacteria and fungi when compared with positive control [70].

S. aromaticum (clove) was extracted with 70% ethanol and 80% methanol. The two extracts were tested on *S. aureus*, *P. aeruginosa* and *E. coli* in comparison with the selected antibiotic (tetracycline) using the agar well diffusion method. The highest activity against *P. aeruginosa* was presented by the ethanol extract and against *S. aureus* was shown by the methanol extract. [80].

S. aromaticum (cloves) was extracted with 80% methanol. The 1% of six metals (Zn^{++}, Cu^{++}, Pb^{++}, Ca^{++}, Mg^{++} and Fe^{++}) was added in the extract and the antibacterial properties were tested using the agar well diffusion method. For *S. aureus*, the maximum zone of inhibition was presented by zinc, for *E. coli* by magnesium and for *P. aeruginosa* by lead [80].

S. cumini seeds were extracted with ethyl acetate. The extract was separated and purified to obtain a single compound. This compound showed antibacterial activity against *E. coli*, *P. aeruginosa*, *S. aureus* and *B. subtilis* using the agar cup method. The largest zone of inhibition was observed in *E. coli* [77].

S. cumini (leaves, pulps and seeds) was extracted with methanol. The extract was examined against *E. coli* and *S. aureus* using the agar well diffusion assay. Leaf extract exhibited antibacterial activity both on *E. coli* and *S. aureus*, whereas pulp and seed extracts did not show any antibacterial activity [81].

The essential oil was isolated from *S. guineense* leaves by using the hydrodistillation method. The MIC of essential oil on microorganisms (*P. aeruginosa*, *K. pneumonia*, *E. coli*, *S. aureus*, *C. albicans* and *Mycobacterium bovis* [BCG]) was determined using the microbroth dilution method. Essential oil of *S. guineense* exhibited strong antimicrobial activities against the tested microorganisms when compared with ciprofloxacin, fluconazole and isoniazid [76].

S. guineense seeds were extracted with ethanol. The MIC on microorganisms (*E. coli*, *K. pneumonia*, *S. typhi*, *S. aureus* and *C. albicans*) of the extract was determined by using the broth microdilution method. Gentamicin sulfate and fluconazole were used as standard drugs. The extract showed weak to moderate antibacterial activity and lower than standard drugs [82].

4.4 Antidiabetic activity

S. samarangense root was extracted by using three kinds of solvents (ethyl acetate, methanol and water) by using the Soxhlet extraction method. The antidiabetic activity of all extracts was determined using alpha-amylase inhibition. Water extract showed the highest percentage of alpha-amylase inhibition, followed by methanol and ethyl acetate extracts [69].

S. cumini seeds were extracted with methanol. The antidiabetic activity of extract was determined by using alpha-amylase enzyme. The percentage of inhibition varied from 38.6% to 95.4%. It was concluded that the sample possessed significant antidiabetic activity [84].

S. guineense leaves were extracted with 80% methanol. The antidiabetic activity of the extract was determined using alpha-glucosidase enzyme. IC_{50} obtained from that study was 6.15 μg/mL, which was the best inhibition for antidiabetic activity [75].

4.5 Toxicity

The toxicity of the ethanolic leaf extract of *S. cumini* was tested by using the brine shrimp lethality assay. Thymol was used as a standard. Ten brine shrimp larvae were added in each concentration of extract (1,000–10 μg/mL). The absence of brine shrimp death in the sample was calculated to obtain the LC_{50} value. The result of the test showed that the extract did not have high toxicity compared to thymol as a standard [72].

S. guineense seeds were extracted with ethanol and the toxicity of the obtained was tested using the brine shrimp lethality assay. Cyclophosphamide was used as a standard. Ten brine shrimps larvae were added in different concentrations of extract (240, 120, 80, 40 and 24 μg/mL). The absence of brine shrimp death in the sample was calculated to obtain the LC_{50} value. The extract did not have the toxicity (LC_{50} value was above100 μg/mL) [85].

4.6 Anti-inflammatory activity

The anti-inflammatory activity of the methanolic extract of *S. aqueum* leaves was determined. For this study, the ability of the extract to inhibit lipoxygenase (LOX) using an LOX inhibitor screening assay kit was established as well as ovine COX-1 and COX-2 inhibition using an enzyme immunoassay kit. Celecoxib, indomethacin and diclofenac were used as standards. The extract showed more potent inhibitory effect than diclofenac on COX-2 as well as on LOX. Celecoxib was less active than the extract on COX-1 [33].

Table 2: Isolated compounds and their bioactivities reported from *Syzygium* genus

No	Compound name	Bioactivities	Plant species (parts of plant)	Ref.
1	Phloretin	Antidiabetic activity (EC_{50} μM) (20 ± 2.2) for α-glucosidase inhibition and (31 ± 5.5) for α-amylase inhibition, positive control (acarbose)-(43 ± 1.6) for α-glucosidase and (19 ± 1.6) for α-amylase	*S. aqueum* (leaves)	[43,83]
2	Myrigalone-G	Antidiabetic activity (EC_{50} μM) (7 ± 1.4) for α-glucosidase inhibition and (33 ± 6.6) for α-amylase inhibition, positive control (acarbose)- ((43 ± 1.6) for α-glucosidase and (19 ± 1.6) for α-amylase	*S. aqueum* (leaves)	[43,83]
3	Myrigalone B	Antidiabetic activity (EC_{50} μM) (19 ± 1.0) for α-glucosidase inhibition and (8.3 ± 1.3) for α-amylase inhibition, positive control (acarbose) – ((43 ± 1.6) for α-glucosidase and (19 ± 1.6) for α-amylase	*S. aqueum* (leaves)	[43,83]
4	2′,4′-Dihydroxy-6′-methoxy-3′-methyldihydrochalcone	Trypsin inhibition assay IC_{50} 31.9 ± 0.25 mM to compared with Leupeptin (IC_{50} 0.026 ± 0.001 μM) Thrombin inhibition assay IC_{50} 14.9 ± 0.25 mM to compared with Leupeptin (IC_{50}0.045 ± 0.003 μM) Prolyl endopeptidase inhibition assay IC_{50} 12.5 ± 0.2 μM to compared with Bacitracin (IC_{50} 129.26 ± 3.28 μM)	*S. samarangense* (leaves)	[46,47]
5	2′-Hydroxy-4′,6′-dimethoxy-3′-methyldihydrochalcone	Trypsin inhibition assay IC_{50} 2.7 ± 0.5 mM to compared with Leupeptin (IC_{50} 0.026 ± 0.001 μM) Thrombin inhibition assay IC_{50} 10.0 ± 0.5 mM to compared with Leupeptin (IC_{50}0.045 ± 0.003 μM) Prolyl endopeptidase inhibition assay IC_{50} 158.5 ± 0.1 μM to compared with Bacitracin (IC_{50} 129.26 ± 3.28 μM)	*S. samarangense* (leaves)	[46,47]
6	2′,4′-Dihydroxy-6′-methoxy3′,5′-dimethyldihydrochalcone	Trypsin inhibition assay IC_{50} 38.2 ± 0.25 mM to compared with Leupeptin (IC_{50}0.045 ± 0.003 μM) Thrombin inhibition assay IC_{50} 62.1 ± 0.25 mM to compared with Leupeptin (IC_{50} 0.026 ± 0.001 μM) Prolyl endopeptidase inhibition assay IC_{50} 98.3 ± 0.8 μM to compared with Bacitracin (IC_{50} 129.26 ± 3.28 μM)	*S. samarangense* (leaves)	[46,47]
7	2′,4′-Dihydroxy-6′-methoxy-3′-methylchalcone or stercurensin	Trypsin inhibition assay IC_{50} 5.6. ± 0.125 mM to compared with Leupeptin (IC_{50} 0.026 ± 0.001 μM) Prolyl endopeptidase inhibition assay IC_{50} 37.5 ± 1.0 μM to compared with Bacitracin (IC_{50} 129.26 ± 3.28 μM) Anticancer activity (MTT assay) IC_{50} 35 μM for compound and IC_{50} 50 μM for EGCG as positive control on SW-480 human colon cancer cell line Antioxidant activity	*S. samarangense* (fruit and leaves)	[46,47,49]

Table 2: Continued

No	Compound name	Bioactivities	Plant species (parts of plant)	Ref.
		(IC_{50} 141 ± 2.3 μM) by DPPH assay and (IC_{50} 191 ± 0.1 μM) by FRAP assay IC_{50} 25.0 ± 0.1 μM for gallic acid (positive control) by DPPH		
8	2′-Hydroxy-4′,6′-dimethoxy-3′-methylchalcone	Trypsin inhibition assay IC_{50} 15.8 ± 0.25 mM to compared with Leupeptin (IC_{50} 0.026 ± 0.001 μM) Thrombin inhibition assay IC_{50} 30.7 ± 0.25 mM to compared with Leupeptin (IC_{50}0.045 ± 0.003 μM) Prolyl endopeptidase inhibition assay IC_{50} > 200 μM to compared with Bacitracin (IC_{50} 129.26 ± 3.28 μM)	*S. samarangense* (leaves)	[46,47]
9	2′,4′-Dihydroxy-6′-methoxy-3′,5′ dimethylchalcone	Anticancer activity (IC_{50} μM) Inhibition of the proliferation of the breast cancer (MCF-7) cell lines by using MTT assay, IC_{50} values 270 μM (24 h) and 250 μM (48 hr) Thrombin inhibition assay IC_{50} 1.8 ± 0.25 mM to compared with Leupeptin (IC_{50}0.045 ± 0.003 μM) Prolyl endopeptidase inhibition assay IC_{50} 149.8 ± 7.1 μM to compared with Bacitracin (IC_{50} 129.26 ± 3.28 μM)	*S. aqueum* (leaves) and *S. samarangense* (leaves)	[44,46,47]
10	2′,4′-Dihydroxy-3′,5′-dimethyl-6′-methoxychalcone	Anticancer activity (MTT assay) IC_{50}10 μM for compound and IC_{50} 50 μM for EGCG as positive control on SW-480 human colon cancer cell line Antioxidant activity (IC_{50} 205 ± 1.2 μM) by DPPH assay and (IC_{50} 196 ± 0.0 μM) by FRAP assay IC_{50} 25.0 ± 0.1 μM for gallic acid (positive control) by DPPH	*S. samarangense* (fruits)	[49]
11	2′,4′-Dihydroxy-6′-methoxchalcone or cardamonin	Anticancer activity (MTT assay) IC_{50} 35 μM for compound and IC_{50} 50 μM for EGCG as positive control on SW-480 human colon cancer cell line Antioxidant activity (IC_{50} 141 ± 3.4 μM) by DPPH assay and (IC_{50} 173 ± 0.0 μM) by FRAP assay IC_{50} 25.0 ± 0.1 μM for gallic acid (positive control) by DPPH	*S. samarangense* (fruits)	[49]
12	Pinocembrin	Anticancer activity (MTT assay) IC_{50} 60 μM for compound and IC_{50} 50 μM for EGCG as positive control on SW-480 human colon cancer cell line Antioxidant activity (IC_{50} 199 ± 0.8 μM) by DPPH assay and (IC_{50} 196 ± 0.0 μM) by FRAP assay IC_{50} 25.0 ± 0.1 μM for gallic acid (positive control) by DPPH	*S. samarangense* (fruit and leaves)	[48,49]
13	(—)-Strobopinin	—	*S. samarangense* (leaves)	[48]
14	8-Methylpinocembrin	—	*S. samarangense* (leaves)	[48]
15	Demethoxymatteutcinol	—	*S. samarangense* (leaves)	[48]

Table 2: Continued

No	Compound name	Bioactivities	Plant species (parts of plant)	Ref.
16	7-Hydroxy-5-methoxy-6,8-dimethyl-foavanone	—	*S. samarangense* (leaves)	[48]
17	7,8,3′,4′-Tetrahydroxy-3,5-dimethoxyflavone	Antioxidant activity (EC_{50} µg/mL) (3.89 µg/mL) for DPPH assay whenby compareding with ascorbic acid (2.94 µg/mL) (21.08 µg/mL) for FRAP assay whenby compareding with quercetin (23.18 µg/mL)	*S. samarangense* (leaves)	[45]
18	7-Hydroxy-5-methoxy-6,8-dimethylflavanone	Trypsin inhibition assay IC_{50} 7.4 ± 0.1 mM to compared with Leupeptin (IC_{50} 0.026 ± 0.001 µM) Prolyl endopeptidase inhibition assay 13.9% inhibition at 0.5 mM to compared with Bacitracin (IC_{50} 129.26 ± 3.28 µM)	*S. samarangense* (leaves)	[46,47]
19	Quercetin	—	*S. samarangense* (fruits) and *S. aromaticum* (flower buds)	[49,50]
20	Kaempferol	—	*S. cumini* (leaves)	[54]
21	Gallocatechin	Antioxidant (DPPH) IC_{50} 17 ± 3 µM for compound and IC_{50} 12± 0.2 µM for quercetin (positive control) 15-lipoxygenase (15-LO) inhibition IC_{50} 112 ± 4 µM for compound and IC_{50} 72±7 µM for quercetin (positive control) Xanthine oxidase (OX) inhibition IC_{50}>167 µM for compound and IC_{50} 3.0±0.6 µM for quercetin (positive control)	*S. guineense* (leaves)	[51]
22	Myricetin	Antioxidant (DPPH) IC_{50} 41±6 µM for compound and IC_{50} 12±0.2 µM for quercetin (positive control) 15-Lipoxygenase (15-LO) inhibition IC_{50}>83 µM for compound and IC_{50} 72±7 µM for quercetin (positive control) Xanthine oxidase (OX) inhibition IC_{50} 8±1 µM for compound and IC_{50} 3.0±0.6 µM for quercetin (positive control)	*S. guineense* (leaves)	[51]
23	(—)-Epigallocatechin	—	*S. aqueum* (leaves) and *S. samarangense* (leaves)	[52]
24	(—)-Epigallocatechin 3-*O*-gallate	—	*S. aqueum* (leaves) and *S. samarangense* (leaves)	[52]
25	Samarangenins A	—	*S. aqueum* (leaves) and *S. samarangense* (leaves)	[52]
26	Samarangenins B	—	*S. aqueum* (leaves) and *S. samarangense* (leaves)	[52]
27	Prodelphinidin B-2 3″-*O*-gallate	—	*S. aqueum* (leaves) and *S.*	[52]

Table 2: Continued

No	Compound name	Bioactivities	Plant species (parts of plant)	Ref.
			samarangense (leaves)	
28	Prodelphinidin B-2 3,3″-*O*-gallate	—	*S. aqueum* (leaves) and *S. samarangense* (leaves)	[52]
29	Myricetin-3-*O*-rhamnoside	Antidiabetic activity (EC_{50} μM) (1.1 ±0.06 μM) for compound and (43±1.6 μM) for acarbose by using α-glucosidase (1.9 ± 0.02 μM) for compound and (19± 1.6 μM) for acarbose by using α-amylase Antioxidant activity (EC_{50} μg/mL) (3.21 μg/mL) for DPPH assay whenby compareding with ascorbic acid (2.94 μg/mL), (22.9 μg/mL) for FRAP assay bywhen compareding with quercetin (23.18 μg/mL)	*S. aqueum* (leaves) and *S. samarangense* (leaves)	[43,45,83]
30	Europetin-3-Orhamnoside	Antidiabetic activity (EC_{50} μM) (1.9 ± 0.06) for α-glucosidase inhibition and (2.3 ± 0.04) for α-amylase inhibition, (43 ± 1.6) for α-glucosidase inhibition and (19± 1.6) for α-amylase inhibition in the positive control (acarbose)	*S. aqueum* (leaves)	[43,84]
31	Mearnsitrin	—	*S. samarangense* (leaves)	[53]
32	Reynoutrin	—	*S. samarangense* (fruits)	[49]
33	Hyperin	—	*S. samarangense* (fruits)	[49]
34	Quercitrin	—	*S. samarangense* (fruits)	[49]
35	Guaijaverin	—	*S. samarangense* (fruits)	[49]
36	Tamarixetin 3-*O*-β-D-glucopyranoside	—	*S. aromaticum* (flower buds)	[50]
37	Ombutin 3-*O*-β-D glucopyranoside	—	*S. aromaticum* (flower buds)	[50]
38	Quercetin 3-*O*-α-L-rhamnopyranosiderhamnopyr-onside	—	*S. cumini* (leaves)	[54]
39	Kaempferol 3-*O*-β-D-glucuronopyranoside	—	*S. cumini* (leaves)	[54]
40	Myricetin 3-*O*-β-D-glucuronopyranoside	—	*S. cumini* (leaves)	[54]
41	Mearnsetin 3-*O*-(4″-*O*-acetyl)-α-L-rhamnopyranoside	—	*S. cumini* (leaves)	[54]
42	Myricetin 3-*O*-(4″-*O*-acetyl) -α-L-rhamnopyranoside	—	*S. cumini* (leaves)	[54]
43	Myricetin 4′-methyl ether 3-*O*-α-L-rhamnopyranoside	—	*S. cumini* (leaves)	[54]
40	Myricetrin 4″-*O*-acetyl-2″-*O*-gallate	—	*S. cumini* (leaves)	[54]
45	Myricetin-3-*O*-glucoside	Antioxidant (DPPH) IC_{50} 11±2 μM for compound and IC_{50} 12±0.2 μM for quercetin (positive control) 15-Lipoxygenase (15-LO) inhibition	*S. guineense* (leaves)	[51]

Table 2: Continued

No	Compound name	Bioactivities	Plant species (parts of plant)	Ref.
		IC_{50} 42±4 μM for compound and IC_{50} 72± 7 μM for quercetin (positive control) Xanthine oxidase (OX) inhibition IC_{50} 38 ± 4 μM for compound and IC_{50} 3.0 ± 0.6 μM for quercetin (positive control)		
46	Myricetin-3-*O*-rhamnoside	Antioxidant (DPPH) IC_{50} 28 ± 3 μM for compound and IC_{50} 12 ± 0.2 μM for quercetin (positive control) 15-Lipoxygenase (15-LO) inhibition IC_{50} 138 ± 11 μM for compound and IC_{50} 72± 7 μM for quercetin (positive control) Xanthine oxidase (OX) inhibition IC_{50} > 167 μM for compound and IC_{50} 3.0 ± 0.6 μM for quercetin (positive control)	*S. guineense* (leaves)	[51]
47	Myricetin-3-*O*-glucoronide	Antioxidant (DPPH) IC_{50} 85 ± 33 μM for compound and IC_{50} 12 ± 0.2 μM for quercetin (positive control) 15-lipoxygenase (15-LO) inhibition IC_{50} > 83 μM for compound and IC_{50} 72 ± 7 μM for quercetin (positive control) Xanthine oxidase (OX) inhibition IC_{50} > 83 μM for compound and IC_{50} 3.0 ± 0.6 μM for quercetin (positive control)	*S. guineense* (leaves)	[51]
48	Myricetin-3-*O*-β-D-(6″-galloyl) galactoside	Antioxidant (DPPH) IC_{50} 10 ± 3 μM for compound and IC_{50} 12 ± 0.2 μM for quercetin (positive control) 15-Lipoxygenase (15-LO) inhibition IC_{50} 75 ± 7 μM for compound and IC_{50} 72 ± 7 μM for quercetin (positive control) Xanthine oxidase (OX) inhibition IC_{50} > 167 μM for compound and IC_{50} 3.0 ± 0.6 μM for quercetin (positive control)	*S. guineense* (leaves)	[51]
49	Biflorin	Cytotoxicity (MTT assay) IC_{50} > 100 μM against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 μM) as positive control	*S. aromaticum* (cloves)	[55]
50	Isobiflorin	Cytotoxicity (MTT assay) (IC_{50} > 100 μM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 μM) as positive control	*S. aromaticum* (cloves)	[55]
51	6-*C*-β-D-(6′-*O*-galloyl) glucosylnoreugenin	Cytotoxicity (MTT assay) (IC_{50} 66.78 ± 5.49 μM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 μM) as positive control	*S. aromaticum* (cloves)	[55]
52	8-*C*-*β*-D-(6′-*O*-galloyl) glucosylnoreugenin	Cytotoxicity (MTT assay) (IC_{50} 87.50 ± 1.56 μM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 μM) as positive control	*S. aromaticum* (cloves)	[55]
53	Sysamarin A	—	*S. samarangense* (leaves)	[56]
54	Sysamarin B	—	*S. samarangense* (leaves)	[56]
55	Sysamarin C	—	*S. samarangense* (leaves)	[56]
56	Sysamarin D	—		[56]

Table 2: Continued

No	Compound name	Bioactivities	Plant species (parts of plant)	Ref.
			S. samarangense (leaves)	
57	Sysamarin E	—	*S. samarangense* (leaves)	[56]
58	Lupenyl stearate	—	*S. samarangense* (leaves)	[57]
57	Lupeol	Thrombin inhibition assay IC_{50} 49.2 ± 0.2 mM to compared with Leupeptin (IC_{50} 0.026 ± 0.001 μM) Prolyl endopeptidase inhibition assay IC_{50} 65.0 ± 3.2 μM to compared with Bacitracin (IC_{50} 129.26 ± 3.28 μM)	*S. samarangense* (leaves) and *S. cumini* (leaves)	[46,57,60]
60	Betulin	Trypsin inhibition assay IC_{50} 24.4 ± 0.125 mM to compared with Leupeptin (IC_{50}0.045 ± 0.003 μM) Prolyl endopeptidase inhibition assay IC_{50} 101.6 3.2 μM to compared with Bacitracin (IC_{50} 129.26 ± 3.28 μM) Antibacterial activityMinimum Inhibition Concentration	*S. samarangense* (leaves) and *S. guineense* (stem bark)	[46,57,63]
61	Betulinic acid	(Prolyl endopeptidase inhibition assay 64.4% inhibition at 0.5 mM to compared with Bacitracin (IC_{50} 129.2 6 ± 3.28 μM) Antibacterial activity Minimum Inhibition Concentration	*S. samarangense* (leaves) and *S. guineense* (stem bark)	[46,63]
62	Oleanolic acid	(Cytotoxicity (MTT assay) (IC_{50} 24.30 ± 0.30 μM) against on human ovarian cancer cells (A2780) by when compareding with Cisplatin (IC_{50} 6.96 ± 2.60 μM) as positive control	*S. aromaticum* (flower buds) and *S. cumini* (seeds)	[55,58,59]
63	Arjunolic acid	Antibacterial activity (IC_{50} 3 μg/mL) against *Escherichia coli*, (IC_{50} 0.5 μg/mL) against *Bacillus subtilis*, and (IC_{50} 30 μg/mL) against *Shigella saonnei* Chloramphenicol as Ppositive control against *Escherichia coli* (IC_{50} 0.3 μg/mL), *Bacillus subtilis* (IC_{50}0.1 μg/mL) and *Shigella soannei* (IC_{50} 2 μg/mL)	*S. aromaticum* (flower buds) and *S. guineense* (leaves and roots)	[58,61,62]
64	Corosolic acid	—	*S. aromaticum* (flower buds)	[58]
65	Asiatic acid	Antibacterial activity (IC_{50} 5 μg/mL) against *Escherichia coli*, (IC_{50} 0.75 μg/mL) against *Bacillus subtilis*, and (IC_{50} 30 μg/mL) against *Shigella saonnei* Chloramphenicol as Ppositive control against *Escherichia coli* (IC_{50} 0.3 μg/mL), *Bacillus subtilis* (IC_{50}0.1 μg/mL) and *Shigella saonnei* (IC_{50} 2 μg/mL)	*S. aromaticum* (flower buds) and *S. guineense* (leaves and roots)	[58,61,62]
66	Maslinic acid	Cytotoxicity (MTT assay) (IC_{50} 29.61 ± 4.68 μM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 μM) as positive control	*S. aromaticum* (flower buds)	[55]
67	12-Oleanen-3-ol-3β acetate	—	*S. cumini* (leaves)	[60]
68	2-Hydroxyoleanolic acid	Not observed Aantibacterial activity (*Escherichia coli* and *Bacillus subtilis*)	*S. guineense* (leaves and roots)	[61,62]
69	2-Hydroxyursolic acid	Not observed Aantibacterial activity (*Escherichia coli* and *Bacillus subtilis*)	*S. guineense* (leaves and roots)	[61,62]

Table 2: Continued

No	Compound name	Bioactivities	Plant species (parts of plant)	Ref.
70	Terminolic acid	Antibacterial activity (IC_{50} 6 µg/mL) against *Escherichia coli*, (IC_{50} 3 µg/mL) against *Bacillus subtilis*, and (IC_{50} 50 µg/mL) against *Shigella saonnei* Chloramphenicol as Ppositive control against *Escherichia coli* (IC_{50} 0.3 µg/mL), *Bacillus subtilis* (IC_{50}0.1 µg/mL) and *Shigella saonnei* (IC_{50} 2 µg/mL)	*S. guineense* (leaves and roots)	[61,62]
71	6-Hydroxy asiatic acid	—	*S. guineense* (leaves and roots)	[61,62]
72	Limonin	—	*S. aromaticum* (flower buds)	[50]
73	Caryolane-1,9β-diol	Cytotoxicity (MTT assay) (IC_{50} > 100 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
74	Clovane-2,9-β-diol	Cytotoxicity (MTT assay) (IC_{50} > 100 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
75	α-Humulene	Cytotoxicity (MTT assay) (IC_{50} 21.03 ± 5.53 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
76	Humulene epoxide α	Cytotoxicity (MTT assay) (IC_{50} > 100 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
77	β-Caryophyllene	Cytotoxicity (MTT assay) (IC_{50} 60.70 ± 1.44 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
78	β-Caryophyllene oxide	Cytotoxicity (MTT assay) (IC_{50} > 100 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
79	Lupenyl stearate cycloartenyl stearate	—	*S. samarangense* (leaves)	[57]
80	β-Sitosteryl stearate	—	*S. samarangense* (leaves)	[57]
81	24-Methylenecycloartenyl stearate	—	*S. samarangense* (cloves)	[57]
82	β-Sitosterol	—	*S. samarangense* and *S. cumini* (leaves and seeds)	[57,59,60]
83	Stigmasterol	—	*S. cumini* (leaves)	[60]
84	β-Sitosterol-3-*O*-β-D-glucoside	Cytotoxicity (MTT assay) (IC_{50} > 100 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (flower buds)	[55]
85	ArjunolicArjulonic acid 28-β-glycopyranosyl ester	Not observed Aantibacterial activity (*Escherichia coli* and *Bacillus subtilis*)	*S. guineense* (leaves and roots)	[61,62]
86	Asiatic acid 28-β-glycopyranosyl ester	Not observed Aantibacterial activity (*Escherichia coli* and *Bacillus subtilis*)	*S. guineense* (leaves and roots)	[61,62]
87	3,3′,4′-Tri-*O*-methylellagic acid	Cytotoxicity (MTT assay)	*S. aromaticum* (flower buds)	[55]

Table 2: Continued

No	Compound name	Bioactivities	Plant species (parts of plant)	Ref.
		(IC_{50} 87.64 ± 1.70 μM) against human ovarian cancer cells (A2780) by when compareding with Cisplatin (IC_{50} 6.96 ± 2.60 μM) as positive control		
88	Ellagic acid	—	*S. samarangense* (fruits) and *S. cumini* (stem bark)	[49,64]
89	Ellagitannin-3-*O*-methylellagic acid 3′-*O*-β-D-glucopyranoside	—	*S. cumini* (stem bark)	[64]
90	Ellagic acid 4-*O*-α-L-2″-acetylhamnopyranoside	—	*S. cumini* (stem bark)	[64]
91	3-*O*-Methylellgic acid 3′-*O*-α-L-rhamnopyranoside	—	*S. cumini* (stem bark)	[64]
92	Gallotannins 1,2,3,6-tetra-*O*-galloyl-β-D-glucose	—	*S. guineense* (leaves)	[51]
93	1,2,3,4,6-Penta-*O*-galloyl-β-D-glucose	Antioxidant (DPPH) IC_{50} 5 ± 1 μM for compound and IC_{50} 12 ± 0.2 μM for quercetin (positive control) 15-lipoxygenase (15-LO) inhibition IC_{50} 25 ± 4 μM for compound and IC_{50} 72 ± 7 μM for quercetin (positive control) Xanthine oxidase (OX) inhibition IC_{50} 8 ± 1 μM for compound and IC_{50} 3.0 ± 0.6 μM for quercetin (positive control)	*S. guineense* (leaves)	[51]
94	Casuarictin	Antioxidant (DPPH) IC_{50} 3.9 ± 0.1 μM for compound and IC_{50} 12 ± 0.2 μM for quercetin (positive control) 15-lipoxygenase (15-LO) inhibition IC_{50} 36 ± 3 μM for compound and IC_{50} 72 ± 7 μM for quercetin (positive control) Xanthine oxidase (OX) inhibition IC_{50} 86 ± 3 μM for compound and IC_{50} 3.0 ± 0.6 μM for quercetin (positive control)	*S. guineense* (leaves)	[51]
95	Casuarinin	Antioxidant (DPPH) IC_{50} 4.5 ± 0.3 μM for compound and IC_{50} 12 ± 0.2 μM for quercetin (positive control) 15-lipoxygenase (15-LO) inhibition IC_{50} 39 ± 2 μM for compound and IC_{50} 72 ± 7 μM for quercetin (positive control) Xanthine oxidase (OX) inhibition IC_{50} 105 ± 3 μM for compound and IC_{50} 3.0 ± 0.6 μM for quercetin (positive control)	*S. guineense* (leaves)	[51]
96	4-Hydroxybenzaldehyde	Antidiabetic activity (EC_{50} μM) (9 ± 4.9) for α-glucosidase inhibition and (20 ± 8.2) for α-amylase inhibition, (43 ± 1.6) for α-glucosidase inhibition and (19 ± 1.6) for α-amylase inhibition in the positive control (acarbose)	*S. aqueum* (leaves)	[43,83]
97	Gallic acid	—	*S. cumini* (stem bark) and *S. samarangense* (fruits)	[49,64]
98	Ferulic aldehyde	—	*S. aromaticum* (cloves)	[50]
99	Eugenol	Cytotoxicity (MTT assay)	*S. aromaticum* (cloves)	[55]

Table 2: Continued

No	Compound name	Bioactivities	Plant species (parts of plant)	Ref.
		(IC_{50} > 100 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control		
100	Eugenyl acetate	Cytotoxicity (MTT assay) (IC_{50} > 100 µM) against human ovarian cancer cells (A2780) bywhen compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
101	trans-Coniferylaldehyde	Cytotoxicity (MTT assay) (IC_{50} 78.45 ± 5.01 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
102	3-(4-Hydroxy-3-methoxy-phenyl) propane-1,2-diol	Cytotoxicity (MTT assay) (IC_{50} > 100 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
103	1-*O*-Methyl-guaiacylglycerol	Cytotoxicity (MTT assay) (IC_{50} > 100 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
104	Epoxy iconiferyl alcohol	Cytotoxicity (MTT assay) (IC_{50} > 100 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
105	7-Hydroxycalamenene	—	*S. cumini* (seeds)	[59]
106	Methyl-β-orsellinate	—	*S. cumini* (seeds)	[59]
107	2,4,6-Trihydroxy-3-methylacetophenone-2-*O*-β-D-glycoside	Cytotoxicity (MTT assay) (IC_{50} > 100 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
108	2,4,6-Trihydroxy-3-methylacetophenone-2-*C*-β-glycoside	Cytotoxicity (MTT assay) (IC_{50} > 100 µM) against human ovarian cancer cells (A2780) whenby compareding with Cisplatin (IC_{50} 6.96 ± 2.60 µM) as positive control	*S. aromaticum* (cloves)	[55]
109	Samarone A	Cytotoxicity (MTT assay) (IC_{50} 32.90 ± 3.17 µM) against HepG2 whenby compareding with Doxorubicin (IC_{50} 0.30 ± 0.023 µM) as positive control (IC_{50} 26.57 ± 2.16 µM) against on MDA-MB-231 whenby compareding with Doxorubicin (IC_{50} 1.53 ± 0.13 µM) as positive control	*S. samarangense* (leaves)	[65]
110	Samarone B	Cytotoxicity (MTT assay) (IC_{50} 3.9 ± 3.17 µM) against HepG2 whenby compareding with Doxorubicin (IC_{50} 0.30 ± 0.023 µM) as positive control (IC_{50} 27.57 ± 4.76 µM) against on MDA-MB-231 whenby compareding with Doxorubicin (IC_{50} 1.53 ± 0.13 µM) as positive control	*S. samarangense* (leaves)	[65]
111	Samarone C	Cytotoxicity (MTT assay) (IC_{50} 5.56 ± 1.17 µM) against HepG2 by when compareding with Doxorubicin (IC_{50} 0.30 ± 0.023 µM) as positive control (IC_{50} 28.26 ± 4.52 µM) against on MDA-MB-231 bywhen compareding with Doxorubicin (IC_{50} 1.53 ± 0.13 µM) as positive control	*S. samarangense* (leaves)	[65]
112	Jambones G	Cytotoxicity (MTT assay)		[65]

Table 2: Continued

No	Compound name	Bioactivities	Plant species (parts of plant)	Ref.
		(IC_{50} 1.73 ± 0.66 μM) against HepG2 whenby compareding with Doxorubicin (IC_{50} 0.30 ± 0.023 μM) as positive control (IC_{50} 4.02 ± 0.87 μM) against on MDA-MB-231 whenby compareding with Doxorubicin (IC_{50} 1.53 ± 0.13 μM) as positive control	*S. samarangens*e (leaves)	
113	Samarone D	—	*S. samarangens*e (Leaves)	[65]
114	Jambone E	Cytotoxicity (MTT assay) (IC_{50} 7.78 ± 1.78 μM) against HepG2 by when comparing compared with Doxorubicin (IC_{50} 0.30 ± 0.023 μM) as positive control (IC_{50} 28.26 ± 3.15 μM) against on MDA-MB-231 by when comparing compared with Doxorubicin (IC_{50} 1.53 ± 0.13 μM) as positive control	*S. samarangens*e (leaves)	[65]
115	Jambone F	Cytotoxicity (MTT assay) (IC_{50} 7.70 ± 1.78 μM) against HepG2 by when comparing compared with Doxorubicin (IC_{50} 0.30 ± 0.023 μM) as positive control (IC_{50} 12.01 ± 1.31 μM) against on MDA-MB-231 by when comparing compared with Doxorubicin (IC_{50} 1.53 ± 0.13 μM) as positive control	*S. samarangens*e (leaves)	[65]
116	Jamunone B	Cytotoxicity (MTT assay) (IC_{50} 13.55 ± 2.33 μM) against HepG2 by when comparing compared with Doxorubicin (IC_{50} 0.30 ± 0.023 μM) as positive control (IC_{50} 37.83 ± 3.42 μM) against on MDA-MB-231 by when comparing compared with Doxorubicin (IC_{50} 1.53 ± 0.13 μM) as positive control	*S. samarangens*e (leaves)	[65]
117	2-Pentadecyl-5,7-didydroxychromone	Cytotoxicity (MTT assay) (IC_{50} 14.00 ± 1.68 μM) against HepG2 by when comparing compared with Doxorubicin (IC_{50} 0.30 ± 0.023 μM) as positive control (IC_{50} 7.196 ± 1.75 μM) against on MDA-MB-231 by when comparing compared with Doxorubicin (IC_{50} 1.53 ± 0.13 μM) as positive control	*S. samarangens*e (leaves)	[65]

Different kinds of solvents (ethyl acetate, methanol and water) were used for extraction of *S. samarangense* root. All extracts of root were evaluated for anti-inflammatory activity by the albumin denaturation assay. The methanol extract showed the highest percentage of albumin denaturation, followed by water and ethyl acetate extracts [69].

4.7 Anthelmintic activity

S. guineense seeds were extracted with ethanol. The anthelmintic activity of the extract was tested on adult roundworms (*Ascaris suum*) by using the protocol described by Nilani's team. Albendazole was received as a standard drug. All tested concentrations of the extract required a longer time to cause paralysis and death than albendazole. To give the 100% death effect, the time requirement of the extract was slightly higher than that of negative control (normal saline) at concentrations of 50 and 30 mg/mL, but at a concentration of 100 mg/mL, the time requirement was 6% higher than that of the standard drug. This study resulted in a conclusion that at higher concentration, the extract exhibits reasonably high anthelmintic activity compared to albendazole [82]. Another paper gave a similar result (Table 2) [85].

5 Conclusion

The information of *Syzygium* species was collected from global publication papers and review articles. *S. aqueum*, *S. aromaticum*, *S. cumini*, *S. guineense* and *S. samarangense* are rich sources of phytochemical constituents. Various parts (leaves, seeds, fruits, barks, stem barks and flower buds) of *Syzygium* species are reported for the treatment of antioxidant, anticancer, toxicity, antimicrobial and antidiabetic activities. The review highlights on the information about plant native growth, botanical description, phytochemical constituents and bioactivities of five known species of *Syzygium* genus. According to the literature, *Syzygium* genus is a source of bioactivity in the Myrtaceae family. Therefore, this review suggests that there is great potential for obtaining the lead drug from phytochemical constituents with various bioactivities from those species, whose benefits have been widely used since ancient times without knowing their chemical components.

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