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Editorial

Special Issue: Synthesis, Application, and Biological Evaluation of Chemical Organic Compounds

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This Special Issue of *Processes*, entitled "Synthesis, Application, and Biological Evaluation of Chemical Organic Compounds", gathers the most recent work of leading researchers in a single forum. The contents include a broad range of synthesized or new organic compounds and nanostructures, the extraction of active components of plant and animal origin, the in silico analysis of such compounds, and biological assessment using various methodologies. In one of the presented studies, the authors [1] report the synthesis of chitosan/Fe(III)/deferoxamine nanoparticles. The developed nanoparticles have demonstrated exceptional antibacterial activity in vivo and in vitro, outperforming the conventional drugs ampicillin and gentamicin. Furthermore, the authors assert that the nanoparticles are risk-free regarding their potential toxicity. They discovered that adding iron ions to the chitosan matrix improves the ability of the resultant nanoparticles to damage the integrity of microbe membranes when compared to pure chitosan. The addition of deferoxamine to the produced nanoparticles significantly increases their ability to destroy the bacterial membrane. Ahmad and co-workers [2] reported the synthesis of poly(*o*-anisidine)/$BaSO_4$ nanocomposites via the oxidative polymerization of *o*-anisidine monomer with $BaSO_4$ filler for the composite materials' possible antibacterial capabilities. To attain optimal and controllable characteristics in the nanocomposites, the $BaSO_4$ filler ratio was varied between 1% and 10% with respect to the matrix. The FTIR measurements demonstrated a considerable interaction between POA and barium sulfate, as well as good UV-visible behavior of absorption. By altering the percentage load of the $BaSO_4$ filler, the conducting characteristics may be controlled. Furthermore, distinct bacterial strains, *Pseudomonas aeruginosa* and *Staphylococcus aureus*, were employed to assess the antibacterial activity of the POA/$BaSO_4$ nanocomposites. For *Staphylococcus aureus* and *Pseudomonas aeruginosa*, the highest inhibition zones of 0.8 and 0.9 mm were achieved using 7% and 10%, respectively.

In this Special Issue, a few articles have been published reporting the synthesis, full characterization, and in vitro and in silico biological assessment of novel compounds. A very interesting article was presented by Apostol and her colleagues [3]. They describe the synthesis and design of new compounds with an *L*-valine fragment and a 4-[(4-bromophenyl)sulfonyl]phenyl skeleton, which belong to *N*-acyl-*α*-amino acids, 4*H*-1,3-oxazol-5-ones, 2-acylamino ketones, and 1,3-oxazoles chemotypes. Antibacterial activity against bacterial and fungal strains, antioxidant activity utilizing DPPH, ABTS, and ferric-reducing power assays, and toxicity against the freshwater cladoceran Daphnia magna Strauss were all assessed. In addition, in silico investigations of the possible antibacterial action and toxicity were carried out by the authors. The findings regarding the antibacterial activity, antioxidant effect, and toxicity experiments, as well as in silico analysis, demonstrated the potential of *N*-{4-[(4-bromophenyl)sulfonyl]benzoyl}-*L*-valine and 2-{4-[(4-bromophenyl)sulfonyl]phenyl}-4-isopropyl-4*H*-1,3-oxazol-5-one for the development of new antimicrobial drugs to combat Gram-positive bacteria, particularly *Enterococcus faecium* biofilm-associated illnesses. Manolov and co-workers [4] reported the synthesis of a series

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of novel compounds between ketoprofen and nitrogen-containing heterocyclic compounds (piperidine, pyrrolidine, 1,2,3,4-tetrahydroquinoline, and 1,2,3,4-tetrahydroisoquinoline). The compounds were investigated for their anti-inflammatory and antioxidant properties in vitro. The hybrids' lipophilicity was assessed, both theoretically (*cLogP*) and empirically (R_M). The compounds' affinity for human serum albumin was estimated in silico using two software tools, and the stability of the predicted complexes was determined using molecular dynamics analysis. All new hybrids outperformed the reference compound, quercetin, in terms of HPSA activity. The in vitro results were validated by molecular docking. The maximum affinity for albumin is shown by hybrid molecule **3c** and compound **3d**. They are more potent anti-inflammatory agents than their forerunner, ketoprofen, as well as the regularly used ibuprofen. The same scientific group, from Plovdiv, Bulgaria [5], reported the synthesis of new hybrid molecules between divinylene oxide and the same nitrogen-containing heterocyclic compounds mentioned above. The anti-inflammatory, anti-arthritic, antioxidant, reducing, and chelating activities of the synthesized compounds were evaluated. When compared to the utilized ketoprofen (720.57 $\pm$ 19.78) standard, the less lipophilic molecules, H2 (60.1 $\pm$ 8.16) and H4 (62.23 $\pm$ 0.83), had an ATA that was approximately 12 times greater. The inhibition of albumin denaturation resulted in the newly produced hybrids being considered as promising anti-inflammatory medicines, as the expressed values were greater than the ketoprofen standard (126.58 $\pm$ 5.00), with the exception of H3 (150.99 $\pm$ 1.16). All reported compounds had high activity in terms of in vitro biological activities, making them excellent candidates for possible future medications. Elkaeed and colleagues investigated the anticancer and VEGFR-2 inhibitory properties of a novel 1H-indole derivative in vitro and in silico [6]. A novel 1H-indole derivative was designed to correspond to the reported properties of anti-VEGFR-2-approved drugs. The new compound's inhibitory potential was revealed by a molecular docking experiment that identified the pertinent binding sites. After that, six studies of MD simulation were carried out by the authors for 100 ns to verify the precise binding and optimal energy. Furthermore, MM-GBSA demonstrated flawless binding with a total exact energy of -40.38 Kcal/Mol. Using binding energy decomposition, the MM-GBSA tests identified the important amino acids in the protein–ligand interaction, revealing the diversity of interactions of compound **7** inside the VEGFR-2 enzyme. Because chemical **7** is novel, the authors' DFT experiments were used to optimize its molecular structure. In silico ADMET experiments revealed that compound **7** had a high drug-likeness value. It is interesting to note that compound **7** has a higher experimental in vitro prohibitory capacity than sorafenib, with an IC_{50} value of 25 nM. It is noteworthy that compound **10** showed potent inhibitory actions against two cancer cell lines (MCF-7 and HCT 116) with IC_{50} values of 12.93 and 11.52 µM, revealing good selectivity indices of 6.7 and 7.5, respectively.

Scientists from the Republic of Korea [7] set out to investigate and compare the coumarin-based compounds found in *G. littoralis* extracts, as well as the antioxidant and anti-osteoporotic properties of various *G. littoralis* extracts (leaf and stem, fruit, whole plant, and root extracts) on bone metabolism. In their research, they looked into how *G. littoralis* extract affected the growth and osteoblastic differentiation of MC3T3-E1 osteoblasts. The highest concentrations of scopoletin (53.0 mg/g) and umbelliferone (1.60 mg/g) were found in stem extracts when compared to the other samples. According to the findings presented here, ethanolic extracts of *G. littoralis* are an efficient osteoporosis preventative.

In their article [8], Rahman and colleagues describe the development of charge transfer (CT) complexes between organic and/or bioactive compounds, which is a crucial component in understanding molecule–receptor interactions. They created two novel CT complexes, procainamide–chloranilic acid and procainamide–2,3-dichloro-5,6-dicyano-1,4-benzoquinone, using the electron donor procainamide, electron acceptor chloranilic acid, and 2,3-dichloro-5,6-dicyano-1,4-benzoquinone. The stability of each complex was examined for the first time by utilizing spectroscopic properties such as the formation constant, molar extinction coefficient, oscillator intensity of the ionization potential, dipole moment, and standard free energy. Density functional theory (DFT) calculations were carried out,

utilizing the ωB97XD/6-311++G(2d,p) level of theory to comprehend the complexes' non-covalent interactions. Both the DFT-computed interaction energies (ΔIEs) and the Gibbs free energies (ΔGs) matched, as observed experimentally. The DFT results strongly support the experimental findings.

Sheep placenta extract (SPE) is widely used in traditional medicine for its physiological effects, such as its wound-healing, antioxidant, and anti-inflammatory characteristics. However, the antiaging effects of SPE are uncertain. Chou and colleagues [9] studied the effect of SPE on aging using the senescence-accelerated mouse prone 8 (SAMP8) strain. After assessing age index characteristics, such as skin glossiness, spine lordosis, and kyphosis, it was discovered that SPE therapy reduced the aging index. Furthermore, they discovered that biochemical indicators such as lactic acid, glucose, ketone bodies, free fatty acids, tumor necrosis factor-alpha (TNF-α), and interleukin 6 (IL-6) did not change in the SPE-treated experimental group after 13 weeks. They discovered that lipid peroxidation (LPO) was reduced, while catalase and superoxide dismutase (SOD) activity was dramatically elevated in the brain tissues of SPE-treated male and female mice. SPE supplementation decreased the aging index and minimized the oxidative stress brought on by the aging process in mice without creating any harmful effects, suggesting the potential of SPE as a potent antiaging remedy.

Additionally, Rosales Martínez and Rodríguez-García shared their thoughts on how hydrogen/deuterium exchange in ambrox could lengthen the aroma of perfumes and extend their shelf lives [10]. Ambrox is a common ingredient in high-end perfumery since it is a natural marine compound with a wonderful ambergris-like scent. Improving the long-term aroma and shelf life of perfumes is a primary objective in the fragrance industry. To the best of the authors' knowledge, the exchange of hydrogen for deuterium to minimize the volatility of smell components has not yet been researched. In their opinion-type article, they share a new use of deuteration to synthesize deuterated ambrox in order to reduce volatility, improve long-term smell, and extend the shelf-life of perfumes.

The included articles demonstrate the importance and versatility of the search for new potential biologically active structures and their applications. All contributors show an impressive passion and professional abilities in the pursuit of new synthetic methods for producing new structural hybrid molecules, as well as those extracted from plant and animal sources. They use novel, proven, and dependable methods and technology to attain their goals. The new synthetic compounds and extracts described here have the potential to be used as new therapeutic formulations due to the variety of actions they exhibit, some of which are even more active than the standards with which they are compared.

As we reflect on the collective efforts and accomplishments showcased in this special issue, it is clear that the synthesis, application, and biological evaluation of chemical organic compounds represent a thriving and ever-evolving field of research. The potential for discovery remains boundless, and the pursuit of innovative solutions to global challenges continues to inspire scientists worldwide.

We extend our sincere gratitude to all the authors, reviewers, and contributors who have made this special issue possible. Your dedication to advancing the frontiers of knowledge is truly commendable. We hope that the research presented here serves as a source of inspiration and a catalyst for further exploration in the fascinating world of chemical organic compounds.

In the spirit of scientific inquiry and collaboration, we look forward to the continued advancement of this field and the remarkable discoveries that lie ahead. Thank you for joining us on this enlightening journey, and may our collective efforts continue to shape a brighter, more sustainable future.

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