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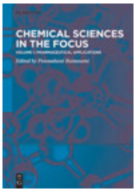

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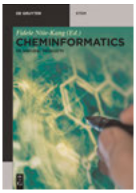

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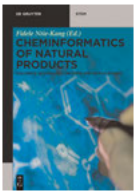

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Preface of the Book of Proceedings of the Virtual Conference on Chemistry and its Applications (VCCA-2020)

A virtual conference on chemistry and its applications (VCCA-2020) was organized online from 1^{st} to 31^{st} August 2020. The theme of the virtual conference was “Research and Innovations in Chemical Sciences: Paving the Way Forward”.

There were 190 presentations for the virtual conference with 300 participants from 50 countries. A secured platform was used for virtual interactions of the participants. After the virtual conference, there was a call for full papers to be considered for publication in the conference proceedings. Manuscripts were received and they were processed and reviewed as per the policy of De Gruyter.

This book, volume 2, is a collection of the eleven accepted manuscripts covering green and sustainable processing.

Ittibenjapong et al reported on *Catunaregam tomentosa* fruit extracts and AgNPs synthesized from these extracts. Omokpariola and Omokpariola evaluated the health and exposure risk assessment of heavy metals from the usage of rainwater from inhabitants of four oil producing area of Rivers State, Nigeria. Chinda and Chinda investigated the awareness level of social media and how it is used for learning in an era of Corona virus by Chemistry students in tertiary institutions in Rivers State Nigeria. Adeniyi and Giwa determined the concentration of cadmium, calcium, iron, lead, manganese and zinc in the groundwater sources in selected locations in Aboru, Igando, Akesanand Obadore, Lagos, Nigeria. Narod and Narrainsawmy focused on a detailed analysis of the feedback obtained from educators regarding the evaluation of the chemistry curriculum. Lowe and Canal shared their experience in including Polymer science modules to the curriculum at two neighbouring post-secondary institutes and emphasized on educating post-secondary students from different disciplines with polymer science. Constance and Amadou reported on the Influence of calcium oxide on low temperature attack two types of bauxite namely gibbsite and boehmite from Guinea. Odukoya et al studied the volatile components generated from fresh egg, adult female and male of *Pestarella tyrrhena* and these were assessed using a two-dimensional gas chromatography coupled to time-of-flight mass spectrometry to understand their contribution to odour production. Hernández-Mendoza et al compared the quadrupole inductively coupled plasma mass spectrometry (ICP-QMS) detection and the sector field ICP-MS (ICP-SFMS) for the quantification of elements such as arsenic, cadmium, copper, lead, zinc and uranium in drinking water. Lawrence et al studied the decontamination of laboratory wastewater with an activated carbon derived from maize cob, an agricultural waste, to ascertain its adsorption effectiveness for water treatment. Ejeromedoghene et al presented on the progress in the preparation

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of polymeric ionic liquids via different polymerization reactions and highlight the advances in the fabrications of polymeric ionic liquids based on smart polymeric materials.

I hope that these chapters of this volume 2 will add to literature and they will be useful references for researchers.

To conclude, VCCA-2020 was a successful event and I would like to thank all those who have contributed. I would also like to thank the Organising and International Advisory committee members, the participants and the reviewers.

Prof. Ponnadurai Ramasami

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1 Green synthesis of silver nanoparticles from *Catunaregam tomentosa* extract

Abstract: Silver nanoparticles (AgNPs) have been widely used in many fields (e.g., sensors, medical supplies, food, cosmetics, medicines, etc.) due to their unique properties such as optical property, antibacterial property, and high conductivity. AgNPs are normally synthesized by chemical, physical, or biological methods. Among these methods, biological synthesis or green synthesis of AgNPs has drawn much attention since it is an easy and environmental-friendly method. Herein, AgNPs synthesized using *Catunaregam tomentosa* extracts were studied. The extracts obtained from different *C. tomentosa* fruit were found to be blue, green, and brown. It was found from the foam test and IR spectra that all extracts (blue, green, and brown extracts) contained saponins. According to the DPPH assay, the blue and the green extracts had the antioxidant activities of 84.47 ± 12.13 and 47.66 ± 2.86 mg ascorbic acid equivalent/g of *C. tomentosa* powder, respectively. This showed that the blue and the green extracts could act as reducing agents in AgNPs synthesis. The successfully synthesized AgNPs using *C. tomentosa* extracts showed the surface plasmon resonance peak at 400 nm corresponding to literatures. The particle sizes and zeta potential values measured by dynamic light scattering also indicated the size stability of the synthesized AgNPs during seven-day period with no significant difference ($P > 0.05$).

Keywords: antioxidant; *Catunaregam tomentosa*; green synthesis; plant extract; silver nanoparticles.

1.1 Introduction

Silver nanoparticles (AgNPs) have been extensively used in medical area, healthcare products, cosmetics, food industry, pharmaceutical industry, drug delivery, engineering, mechanics, optical sensors, and chemical industries [1, 2]. These are due to their unique properties including antibacterial [3, 4], antiviral [5], antifungal [6, 7], anti-inflammatory

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[1, 8], catalytic, optical, and electrical properties [1, 2]. However, these properties, especially biological or pharmacological activity, are found to depend on the characteristics of nanoparticles such as size, shape, morphology, surface chemistry, size distribution, and aggregation [2]. Therefore, synthesized nanoparticles are usually characterized by these techniques including UV–Vis spectroscopy, dynamic light scattering (DLS), scanning electron microscopy (SEM), transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FTIR), X-ray diffractometry (XRD), X-ray photoelectron spectroscopy (XPS), atomic force microscopy (AFM), and localized surface plasmon resonance (LSPR) to achieve highest potential of their properties [2]. Typically, physical and chemical methods (e.g., evaporation-condensation, spark discharging, pyrolysis, laser ablation, electrochemical reduction, thermal decomposition, sono-decomposition, chemical reduction, etc.) are employed to synthesize AgNPs [2]. Although no hazardous chemicals are used in physical methods, high energy requirement, imperfection of nanoparticle surfaces, and nonuniform properties are major drawbacks of these methods. Chemical methods provide ease of production with higher yield compared to physical methods, but hazardous and toxic by-products are generated during syntheses [1, 2]. These might cause a serious safety issue when AgNPs are used in consumer products. Therefore, environmental-friendly approaches of AgNPs syntheses or 'green syntheses' are needed. Many researchers reported the use of microorganisms, biomolecules, and plants as reducing and capping agents for AgNPs syntheses. Not only are there nontoxic residues after syntheses, but green syntheses also provide cost-effective and simple way to produce well-defined size, shape and distribution of AgNPs [1, 2]. Among these green reagents, plant extracts seem to be the promising choice for industrial-scale production of metal nanoparticles since they provide single-step and low-cost upscaling syntheses [1, 9]. To date, several plant extracts from different parts including leaf, bark, stem, root, flower, fruit, peel, and seed used for AgNPs syntheses are reported in literatures [1, 10, 11]. Biomolecules found in plant extracts such as alkaloids, phenolic compounds, terpenoids, tannins, saponins, flavones, quinones, proteins, enzymes and polysaccharides are responsible for Ag^+ reduction and are potentially capping and stabilizing agents [1, 10, 11].

Fruit extracts are one of the plant parts that have been widely studied for AgNPs syntheses as listed in Table 1.1. Not only are being local fruit chosen for AgNPs syntheses, but there are also many reasons underpinning this. For example, Cashew apple (*Anacardium occidentale* L.) was chosen due to being a low-cost by-product from cashew nut industry and potential antibacterial agents [12]. *Annona reticulata* L. fruit or custard apple [13], *Averrhoa bilimbi* L. Fruit [14], *Momordica cymbalaria* fruit [15], *Quercus infectoria* fruit or oak [16], *Sambucus nigra* fruit or European black elderberry [17], *Tanacetum vulgare* fruit or tansy [18], and *Tribulus terrestris* L. fruit [19] have long been employed in traditional medicine for various treatments and are found to exhibit antioxidant activity. *Catunaregam tomentosa* (Blume ex DC) Tirveng (Figure 1.1), a medium height tree, cream white flowers, and berry fruits with yellow hairs, is found in many countries in Southeast Asia including Burma, Vietnam, Malaysia, and also Thailand [20]. Indigenous knowledge indicated that its extract has been used as a