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GREEN CHEMISTRY POSTGRADUATE SUMMER SCHOOL ONLINE  
6-10 July 2020  
Venice, Italy  
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**The Green Sciences for Sustainable Development Foundation asked students to provide some reasons why they wanted to participate in the Green Chemistry Postgraduate Summer School. Below are some significant selected replies**

“The whole experience emphasized (in me) the urge to further study and contribute to this research area. In 2017 I won a PhD grant in the Doctoral Program in Sustainable Chemistry and, since then, I have continued to work in the development and improvement of the performance of anthocyanin analogues in bio-inspired dye-sensitized solar cells. I have grown (scientifically), learning and being inspired by the work of great scientists as Michael Grätzel, and so many others that so greatly contribute to this field. I hope to someday be part of this great group of people who contributed with a valid solution to a huge problem that will impact us all, even those who try to pretend there is no problem. I am applying for this Summer School in order to pursue my ambition of improving myself and further develop my skills and scientific knowledge in this area learning from the best in the field, hoping to positively contribute to a global solution using chemistry.”

“Presently, I am trying to find new ways in which amino acids can be modified. Amino acids are bio-renewable C-chiral, nitrogen-containing feedstocks, with a plethora of different applications. Besides from being the primary units which constitute proteins, they serve various purposes within organic chemistry and the industry due to their inherent chirality. Unfortunately, currently existing methodologies to modify amino acids involve the use of petroleum-derived reagents, rendering these processes unsustainable in the long run. My project envisions the use of naturally abundant, bio-renewable feedstocks, to modify the amino acid structures in an atom-economic process, in order to address the urgent ecological needs of our planet. (...) I believe that this sort of environment will provide the opportunity to hold honest on how to target common objectives and how to circumvent challenges that we face day to day in the laboratory. IUPAC is known for bringing outstanding research together, and it is with no doubt that this initiative to bring young



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investigators in the field of green chemistry will result in novel collaborations, ideas, and solutions to the pressing needs of our society. Participating in the 2020 IUPAC Summer School would significantly impact my works as a researcher, as I am confident that revolutionary initiatives will arise from it.”

“Being a researcher, I have started enjoying my work on the field of green chemistry. My work is based on valorising waste biomass materials. My passion to explore something new has motivated me to learn, adapt the principles and ethics to conduct my research while being helpful in alleviating the economy of nation. My participation in this summer school will definitely have an effect on me at both personal and professional level. Personally I would be more strong, confident and social. Professionally this summer school will be a world class platform for me to know the work currently being under progress by the scientific community, have conversations with them and in future will be helpful in getting a chance to work with the scientists internationally. The skills acquired will definitely help me in having a progress in my work. In years to come may be I will be able to learn, cope and implement my skills in development of something good related to the field of green chemistry which would be beneficial for my country.”

“I am working in medicinal chemistry field. My research work is focus on searching for new potential drugs, also called adjuvants, able to block mechanism(s) of: bacterial resistance, e.g. efflux pumps or modified Penicillin Binding Protein (PBP2a), and/or mechanism of resistance in cancer therapy e.g. glycoprotein P. I have been designing and synthesizing imidazolone derivatives. Currently, basing on the structure-activity relationship studies, I perform synthesis of new groups of 5-arylideneimidazolones with amine moiety. Then, I will perform solubility test. Moreover, final products will be send to: (1) microbiological assays to obtain results about ability to restore antibiotic activity, (2) cancer cell assay to assess potential activity as adjuvants in chemotherapy. (...) The most interesting for me will be lectures about organic chemistry topics. I am interested to find out new possibilities and solutions to carried out syntheses. During that Summer School, I could learn new things, which I could use in my current research work as well as for planning future projects. Furthermore, this Summer School will give me an opportunity to ask questions to scientist from all around the world, which are specialists in green chemistry. Especially, I am interested in the topic of flow chemistry and I saw in the programme that there is planned lecture of Professor Oliver Kappe.”



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“My curiosity was especially sparked by the mention of green chemistry for cultural heritage. Participating in the green chemistry summer school will guide me towards innovative investigations as other green chemistry leaders will challenge, reinforce and complement my proposed hypotheses and methods. Most importantly, industry and business considerations could become further integrated within my research questions when enabled by interactions with leading chemical industry and academic actors present at the conference. I am convinced that my participation at the Venice green chemistry summer school as a young scientist would lead me to more transformative research, a higher likelihood of its realization in society and consequently the potential mitigation of climate issues arising from anthropogenic impacts.”

“At present, I am working with heterogeneous photoactivated catalysts and I am trying to focus in the synthesis of others heterocyclic compounds. From an industrial perspective, catalytic processes are better than those using stoichiometric reagents due to the simplification of product separation especially if heterogeneous catalysts are used. I think that the use of visible light-emitting diode (LED) combined with reusable heterogeneous catalysts reduces adverse environmental effects and thus accommodates some of the key strategies of Green Chemistry. I am interested in continuing my research towards increasing the versatility, the efficiency and the integrity of the catalysts as well as the uses of sustainable practices. So Green Chemistry Postgraduate Summer School would be really helpful for me to incorporate more knowledge about green principles and to design my reactions using low cost and non-toxic catalysts and reducing the use of organic solvents or other harmful reagents to deal with environmental and energy issues.”

“The main goal of my research is to eliminate the use of distillation as the major separation process. Distillation has intense energy requirements, in the biomass field this is even more pronounced due to the utilization of water, a solvent that has very poor thermal properties in comparison to conventional organic solvents. By utilizing a combination of high pressures of CO<sub>2</sub> and switchable solvents, we envision the promotion of greener separations that could considerably improve the greenness of biomass conversions. Considering the attendees and speakers of the Green Chemistry Summer School, I believe that my research could extremely benefit from the insightful ideas and expertise of the scientists participating. The opportunity to talk and learn from researchers working on fields such as biomass conversion, catalyst and solvent development will provide me with the means to tailor my research project to fit the needs of



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these fields, increasing the impact of the technology we are developing. Having the opportunity to actively engaged on discussions and participate on the Summer School will have an enormous impact not only on my research, but also on my professional and academic development. Therefore, I am confident that this event will be another turning point in my professional development, making me a greener and better prepared chemist while positively impacting my current and future endeavors.”

“I am currently working on the synthesis and characterization of hyper-crosslinked polymers. As greener synthesis are representing an advance over other methods because it is a simple, eco-friendly, and reproducible method, my research is mainly focused on green synthesis of polymers called nanosponges. These polymers are found to have a significant impact in several fields, in particular pharmacy. Therefore, this Green Chemistry Postgraduate Summer School seems to be a great opportunity for exchanging the research work with a lot of experts in green chemistry as well as gaining knowledge and new ideas for enhancing the application of this field as a consequence of various advantages. I would like to express my strong desire to participate in this summer school.”

“Motivated by a need for deriving higher-value aromatic fuel precursors and platform chemicals from biomass components such as lignin in a highly selective manner with minimal energy inputs to reduce the dependence on petroleum, my doctoral research focused on utilizing pyrolysis to depolymerize lignin and electrocatalysis to upgrade the resulting intermediates to products with improved energy content and stability. For the past two years, I have had the opportunity to work in Dr. Paul Anastas’ group as a postdoctoral fellow at the Center for Green Chemistry and Green Engineering at Yale. (...) Through participation in the IUPAC Summer School on Green Chemistry, I am excited to advance my knowledge in the field of green and renewable chemistry, network with other green chemists, and participate in fruitful conversations on best practices and innovative ways of adapting greener methods for various industrial processes. I also hope to be able to learn from leading experts about the critical challenges in this field that we as researchers need to prioritize. Participating in this program will also be beneficial towards my future career choice as an educator and a researcher as I eventually hope to pursue a career in academia.”

“The capture and conversion of CO<sub>2</sub> has been receiving close attention for environment protection. The conversion of CO<sub>2</sub> to value-added chemicals, such as aliphatic carbonates, offers an opportunity for CO<sub>2</sub> utilization. Due to the chemical inertness of CO<sub>2</sub>, catalysts have been



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prepared to reduce activation energy and process intensification was developed for shift of chemical equilibrium to enhance product yield. However, considerable energy cost is required to activate CO<sub>2</sub> and accelerate the synthesis of aliphatic carbonates. My current research focuses on the development of a two-step strategy for pathway-tunable conversion of CO<sub>2</sub> to aliphatic carbonates under ambient conditions. With CO<sub>2</sub> captured and activated in 1-alkyl-3-methylimidazolium CO<sub>2</sub>-adducts (CmC1Im- CO<sub>2</sub>), we focused on the aliphatic carbonate synthesis

from CmC1Im- CO<sub>2</sub> and alcohols in haloalkanes, where the exemplified system produces dimethyl carbonate (DMC) with high selectivity of 99.9% at CO<sub>2</sub> conversion of 40.2%. Isotopic labelling experiments validated our proposed reaction mechanism and we further interpreted the tunable reaction pathways for aliphatic carbonate synthesis by NMR characterization and theoretical calculations. The motives for attending the Summer School are to learn the latest trend and technology in green chemistry and to realize a greener and more sustainable process for C CO<sub>2</sub> conversion.”

“The plastic market is in continuous growth, as well as the demand of plasticizers and additives for plastic products. Only a small percentage of the plastics and plasticizers produced nowadays are bio-based or bio-degradable, representing therefore a big issue for pollution and human health. In my project I focus on the use of *Cynara cardunculus*, a renewable raw material, to produce plasticizers and lubricants that will be used in the development of innovative packaging materials and mulching films. (...) My participation at the Green Chemistry Postgraduate Summer School would be of utmost importance to increase my knowledge about Green Chemistry, a field in which I am new. I am interested in the exploitation of renewable resources and in new reaction pathways, two of the main topics offered by this summer school. Through lectures held by distinguished scientist and the possibility to share ideas about my project, my actual research will benefit and the basis for new ideas will be laid. Therefore, I strongly wish that my application will be accepted.”

“As a doctor student I will focus on the construction of covalent organic frameworks (COFs) and their application to sensing. COFs have been reported to show plenty of unique properties such as ordered channels, large specific surface area, highly tunable porosity, optional building blocks. Research on the applications of functionalized COFs is of great importance. This summer school is a wonderful chance, and I will feel a great honor to have the option to attend the academic



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activities. I want to listen to lectures by international academic experts and get a quick understand of the academic frontier of the fields and the industry trends. I believe it's a chance to inspire my scientific research ideas and develop my current research system. Besides, it's an opportunity to communicate with the peers, to share ideas and achievements, which is a good way to self-examination.”

“I am currently involved in the development of cyclodextrin-based nanosponge (CD NS) formulations for pharmaceutical use. I characterize them from a physicochemical point of view and test it in vitro and in vivo. CD based NSs were chosen as drug carriers due to their remarkable properties, such as ability to load various molecules, low cost, availability in nature, biodegradability and environmental friendly synthesis. I am applying to this Summer School because I would like to broaden my knowledge in Green Chemistry since CD NSs belong to this field and their syntheses are evolving in the direction of greener processes. It would be a great opportunity to exchange ideas and learn from the experience of experts in this field. I believe that this experience would be very useful for my present and future career.”

“With their high specific surface and unique physicochemical properties, nanoparticles have real assets to be an efficient solution of the problem. The idea would be to manage to synthesize efficient catalysts toward pollutants using cheap and available materials. In my case, I am studying magnesium oxide nanoparticles. However, nanomaterials do not represent the only potential solutions to the pollution problem, and pollution is not the only problem. I know that I currently do not have all the knowledge of how chemistry is used to solve environmental issues all around the world. This is why attending to the Green Chemistry Summer School of 2020 is a real opportunity for me: I will be able to deepen my knowledge on my personal field (nanomaterials for catalysis) while expanding my knowledge out of these field.”

“Due to extensive industrialization and urbanization, clean water resources are continually endangered. Two of the most toxic and environmentally detrimental pollutants are dyes and toxic metals. They can adversely affect humans and animals, and should be properly addressed. Herein we are planning to tailor a hybrid superabsorbent polymer for the adsorption and recovery of such pollutants and subsequently use this smart material as photocatalyst for the photo degradation of organic contaminants using different advanced oxidation processes.”



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“Industrial activity and technological developments have seriously modified the environment causing serious problems and damage to the earth. (...) Nowadays, I’m doing research in the frame of my doctoral studies in Chemical Engineering, working on the synthesis, development and improvement of heterogeneous catalysts based on metallic nanoparticles. Nanomaterials are obtained with environmental-friendly methods and protocols; using ecological reagents like starch and glucose. I have worked on two different lines: one of them is the Selective Catalytic Reduction (SCR) of NO<sub>x</sub> gases and the other one is the development of well-dispersed and stable silver and palladium nanoparticles following green protocols and showing superior catalytic activity. The goal of the researches is to achieve better yields and selectivity using new methods of synthesis of metal-catalysts, starting from green protocols. (...) This Postgraduate Summer School would be a great opportunity for my personal and professional growth. I am really exciting with the idea of meeting people from other countries and exchange ideas and points of view about environmental issues and how to improve them. I am completely interested on showing our work, but also learning more about Green Chemistry and Sustainable Energy, and how to apply them. It would be not only very useful for my personal development, but also for my country and society.”

“The summer school will provide me with a platform for networking with a variety of Green Chemistry experts and colleagues. Discussing my current research work and plans with the attendees will allow me to get valuable feedback and open new doors for possible collaborations or further training. Also, the information gained will go a long way in improving my quest and expertise for championing of green economy approaches in meeting the 17 UN-Goals. Given my home country of origin, Kenya, where there are limited training opportunities on Green Chemistry, this School will provide me with a rare opportunity for learning the latest developments on the concepts and management of Green Chemistry. The information gained at the School will be incorporated in my current and future research activities and be disseminated to my colleagues in my research group, as I will be able to train and guide them on the latest green concepts. This will bring a radical shift to our research approaches, leading to a significant increase in research output from the group. Moreover, once I relocate back to Kenya when done with my studies in 2020, I will organize and train students at my former university on the new concepts on Green Chemistry.”