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Like 200 hundred years ago, we need green chemistry and materials to push back the frontiers of science

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In 2022, we celebrate Louis Pasteur, the man and the scientist. At the end of the 19th century, his scientific work, but also his convictions in matters of science, on the way to conduct research as well as on its aims for society, posed the foundations of what was to become a great scientific school of the 20th century.

Thus, on December 27th, 1822, Louis Pasteur was born, an international figure in scientific and medical research and founder in 1887 of the Institut Pasteur. Louis Pasteur was a forerunner of a certain way of “doing research”, concerned about its humanistic and universal aims, and the need to form and transmit this approach and these values to future generations.

In 1843, Louis Pasteur entered the Ecole Normale and studied chemistry and physics, as well as crystallography. He became associate Professor of chemistry, in the laboratory of Professor Antoine-Jérôme Balard, and in 1847 defended his doctoral thesis in chemistry at the Faculty of Sciences of Paris. His work on molecular chirality earned him the Rumford Medal in 1856. Moreover, Louis Pasteur built bridges between communities and between scientific disciplines. Indeed, Pasteur is one of the precursors in France of the establishment of collaborations between academia and chemical industry. Indeed, he started such a collaboration on biobased chemistry (beets).

Above all, Louis Pasteur established links with biology and medicine. Thus, Louis Pasteur demonstrated that "micro-organisms" are everywhere, in water, in the air, on objects, on the skin... and that some of them are responsible for diseases. Therefore, he indicated the means to avoid them and to fight them. He defined the basics of personal and social hygiene. He recommended the use of asepsis. Finally, he developed his method of reducing the virulence of microbes for various animal diseases. In 1880, he decided to apply it to the study of a human disease, rabies. On the morning of July 6th, 1885, a nine-year-old boy, Joseph Meister, who had been bitten fourteen times by a rabid dog, gave Louis Pasteur the opportunity to overcome his final hesitations and to test his treatment in humans. This first vaccination is a success: Joseph Meister will never develop rabies and will become the first human being vaccinated. By applying his method to the study of infectious diseases (microbial agents), their prevention (asepsis) and their prophylaxis by immunization (vaccination), Louis Pasteur had just founded immunology.

Our time needs more than ever the insight and contribution of scientists to innovate and propose solutions allowing the most sustainable growth possible, for all humans on the planet. Chemistry, the industry furthest upstream from other industries, thus contributes to water purification, increased agricultural yields, access to energy and quality housing or medicines and vaccines to fight against emerging diseases to improve the quality of life of man in his environment. Green chemistry, through the cross-disciplinary links it promotes, makes it possible to build bridges and contribute to sustainable progress in a circular economy.

With these aspects in mind, this issue of Green Materials focuses on the use of Green Chemistry for a sustainable development, particularly with the use of renewable resources, the substitution of harmful chemicals, and an environmentally driven approach.

The first paper is a review article¹ dedicated to the use of vegetable oils for the synthesis of a wide variety of bio-based chemicals and polymer materials to replace petroleum-based ones and minimize environmental impact.

The second paper focuses on eco-friendly substitutes for epoxy thermoset² that can be used for constructions in the areas where fouling is a problem. To this end epoxy/chitosan/silver nanocomposites were prepared, and their various mechanical properties were investigated, and a soil burial biodegradability test was also carried out.

In the third paper, wooden thermoelectric legs are proposed as thermoelectric elements³, and a simple device construction method has been successfully demonstrated. The developed fabrication process is straightforward and is easily scalable. A thermoelectric device with 20 p–n legs was developed, which produced a maximum power output of 18 nW for a hot-side temperature of 70°C.

In the fourth paper, an alternative or renewable green fuel (RGF) was obtained from waste low- and high-density polyethylene or polyolefins and computer body plastics through a pyrolysis process using cadmium carbonate (CdCO₃) from 23 to 400°C⁴. Five types of hydrocarbons were observed: saturated, olefin, phenanthrene, cyclic/aromatic and branched hydrocarbons.

The final paper focuses on the use of persimmon peel to develop a green drilling fluid additive⁵. Hence, the modification and application of persimmon peel in a water-based drilling fluid was studied in this work. A natural product derivative, aluminium chloride–persimmon peel (ACPP), was prepared from aluminium chloride and persimmon peel and was assessed as a shale inhibitor.

Taken together, the articles in this issue reveal not only the growing attention paid to the use of renewable resources and the substitution of harmful substances, following the trends in society, but also all the interest and promises of this chemistry for the improvement of current materials and the design of new green materials.

Finally, in order to continue to build bridges and networks, we invite you to contribute to next edition of *Frontiers in Green Materials*, on January 9th; 2023, at ICE Headquarters, Westminster, London, UK. This one-day event will provide a forum to discuss and inspire inter-disciplinary, innovative research based on reducing the use of hazardous substances in the design, manufacture and application of chemical and material products. Chemists, engineers and materials scientists from both research and industry are welcome to join.

For more information about the event, as well as details on how to register, please see the below website:

www.ice.org.uk/events/latest-events/frontiers-in-green-materials/

I hope to see you there!

¹ DOI : 10.1680/jgrma.20.00085

² DOI : 10.1680/jgrma.21.00020

³ DOI : 10.1680/jgrma.20.00074

⁴ DOI : 10.1680/jgrma.21.00024

⁵ DOI : 10.1680/jgrma.21.00016