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Editor Note

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New Frontiers of Chemical Sciences: Waste and Sustainability

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Dear Colleagues,

It is a pleasure for me to have the opportunity to be an Editorial Board Member for the Global Journal of Chemical Sciences. It will surely be an excellent platform for sharing knowledge and stimulating ideas concerning all the broad research areas of Chemical Sciences, a multidisciplinary field which covers many scientific issues, from Organic & Inorganic Chemistry, to Food Chemistry, Environmental Chemistry and Petro Chemistry, all true and fundamental to the subsistence of mankind and Nature.

In this short note I would like to propose a critical reflection on the Future of the Chemical Sciences: which new challenges and frontiers will the Chemists of the 21st Century have to face?

For all the last century, Chemical Science and Industrial Chemistry have made a huge contribution to the development of new technical solutions, materials and processes that have revolutionized many aspects of life, largely improving World Economy and Society. Unfortunately, much of our technological progress was made without regard to its impact on the environment and human health. It is widely established that the actual economic development model is no longer compatible either with the availability of natural resources, or with the maintenance of a climatic balance suitable for the life of all the species.

The concepts of waste, pollution and environmental protection, therefore, are topical issues that are the subject of ever-increasing debates, becoming the "hot topics" of the 21st century Chemical Sciences.

In particular, natural resources must be managed so as not to deprive future generations of their value. The starting point is the concept of sustainability aiming at establishing novel cyclical production models in which waste becomes a resource for other processes. In this framework, Chemistry assumes a crucial role, since the development of new technological solutions, the research of new advanced materials and/or of new ways for the exploitation of already existing feedstock are necessary steps to reach the objectives of zero-waste and circular economy.

Based on my field of interest, I would like to give some practical examples.

In the last decade, several Refineries and Petro chemistry Industries all over the World have converted their lines of production in a "sustainable" vision, introducing "unconventional" feedstock for the synthesis of fuels and chemicals. In Italy, ENI recently patented a new hydrogenation process, called ENI Ecofining™, for the synthesis of fuels from different types of bio-feedstock, such as vegetable oils, animal fats and even Used Cooking Oils (UCO) and algal oils. Similarly, UPM Research Centre in Finland is pioneering a transformation of the forest industry, with the development a novel renewable bio-diesel from wood-based tall oil, that is a natural wood extract deriving from the pulp production process.

However, the use of "unconventional" raw materials generates new challenges, since traditional processes and catalysts are not always suitable for exploiting tricky feedstock such as Wastes and Bio-oils. These streams, in fact, usually have a complicated and uncertain chemical composition, which can vary even over the time, thus making it uneasy to design a stable and efficient catalytic material for their conversion.

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Even more stimulating is the virtuous conversion of CO_2 into "value-added" products. Carbon dioxide, which is the most abundant anthropogenic greenhouse gas emitted into the atmosphere, is nowadays assuming an important and strategic play-role in the energy field, as well as in the synthesis of industrial relevant products. As new raw material, CO_2 represents an abundant and economic carbon source and its direct utilization for industrial purposes finds commercial applications in the synthesis of methanol and chemicals such as olefins and aromatics. In this scenario, catalysis one again becomes essential and the development of more efficient and stable materials for an effective transformation of CO_2 appears of great interest.

The transition towards a "sustainable" future must necessarily consider the problem of the availability of clean water in sufficient quantity for the subsistence of all humanity. Indeed, almost the 90% of the worldwide freshwater availability is currently destined for industrial and agricultural consumptions, while ca. 1 billion people globally lack access to safe water supplies. Therefore, the improvement of quality of drinking water and the reduction of water contamination are very challenging issues, involving almost all the research areas of chemical sciences, including the development of new materials for membrane permeation and osmosis, the use of alternative chemicals as flocculants and clarification agents and the design of novel low-cost and stable catalysts for the exploitation of the catalytic wet air oxidation (CWAO) process, especially at industrial scale.

In conclusion, further researches combined with practical advances in all chemical sciences areas are urgently required for the rapid implementation of a more sustainable and "circular" development model that can improve environmental quality, social well-being and economic prosperity.

Our professional commitment, as Members of the Scientific Community, is to best interpret the challenge traced by the UN's Sustainable Developments Goals, opening the doors to a "greener" future and actively participating in the safeguarding of our Planet for the next generations.

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