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Editorial

Synthesis, Characterization and Performance of Materials for a Sustainable Future

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The commonly applied resource management strategies are rarely characterized by medium–long term sustainability, but an indispensable and urgent shift is necessary according to a circular economy approach that includes actions aimed at saving and reusing resources. This need is universally recognized as particularly pressing for air, water, soil and food, all indispensable resources for life and for all human activities. By applying the concept of circular economy, it is immediately clear that a significant boost in actions devoted to reducing waste along the entire utilization chain is required to encourage reuse in production processes in order to limit final discharges as much as possible, to optimize purification treatments with the objective to material recovery and energy valorization (biorefineries), and to promote the safe and sustainable reuse of purified effluents, especially in the agronomic field.

Proposed studies for the control of harmful aquatic plants, like water Hyacinth (*Pontederia crassipes*), including possible energy production by combustion or as an alternative fuel source or reinforcing component in the production of bioplastics, represent only weak attempts to tackle their high reproductive capacity, considering its eradication is inevitably a necessity to reduce the environmental impacts it causes, clear evidence does not exist regarding possible benefits behind their utilization [1]. Indeed, only 19% of the research articles about *Pontederia crassipes* propose it as a potential source of alternative fuel. In addition, 9% of the articles are about specific research related to the use of the plant in biocomposites, bioplastic, and bioethanol. On the other hand, it is essential to analyze the costs for obtaining a homogeneous and standardized material of the compounds contained in *Pontederia crassipes*, which would help to make it a feasible option for its transformation into biodegradable products. Therefore, it is relevant to study the availability of *Pontederia crassipes* at the global, regional, and local levels, which supports the sustainable development of the regions where it is located and favors its use in order to subsequently promote the production of biodegradable products such as cardboard, pellets, packaging, and paper.

The relevance of the circular economy for climate change is still a developing area of research that needs to be explored. Khanna et al. [2] provided an overview of the relevance of the circular economy for climate change through the theory of change approach framework. They reviewed several articles dealing with the keywords "Circular economy" and "Climate Change", showing a strong relevance of the circular economy for climate change, demanding the development of a logical framework through the theory of change, which is a novel approach in social science research apart from monitoring and evaluation studies.

A related topic under the same frame concerns the use of modern construction materials, receiving significant consequences for the production of carbon dioxide emissions, which is a significant greenhouse gas. On this account, Manoharan et al. [3] reported the significant benefits of lime as an ancient construction material, as it has a significant carbonation capacity of carbon dioxide, which effective to form stable and durable structures.

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However, the characterization of ancient lime mortars is mandatory for renovation work to acquire useful knowledge about natural organic materials in the lime making the structures more potent and stable. The study provided information on the ratio of mortar mix used, the presence of organic ingredients and the need for compatible repair materials for the proper maintenance of the structures.

Still regarding the robustness of materials, the problem of weak ground conditions is currently of great interest, as with the rapid development of infrastructure, researchers are trying to cope with the improvement of problematic soil properties to build structures on it. In cold regions, the problem of weak soils is further exacerbated by freeze–thaw cycling. In this regard, calcium sulfo-aluminate (CSA) cement was proposed for soil stabilization purposes [4], especially for the design of subgrade layers.

Switching to the aquatic environment, the effects caused by exposure to pyrenes and similar polycyclic aromatic hydrocarbons (PAHs) on marine ecosystems need to be monitored, resulting in dangerous and toxic contaminants with a direct impact even on the human health. Marzuki et al. [5] compared the capacity of PAH biodegradation by two types of bacteria isolated from different sources. Quantitative analysis showed that the pyrene component's biodegradation performance of *Sphingobacterium sp. strain 21* (Sb) bacteria was relatively stronger than that of *Bacillus licheniformis strain ATCC 9789 bacteria* (BI). The biodegradation products of the two test bacteria (BI and Sb) against pyrene were simple organic compounds with alcohol and carboxylic acid groups, as obtained by the same path, namely, carbon metabolism as an energy source through oxidation reactions.

In strong connection with above topics is the matter related to soil fertility in nature and sustainable agricultural development. Humic substances (HS) are considered polymers undergoing partial decomposition or microbial alteration, resulting an important material basis for soil fertility in nature and sustainable agricultural development. There are many classical hypotheses about the formation of HS. Wang et al. [6] investigated the pathways of the Maillard reaction for the formation of humic-like substances (HLSs), reporting how a change in glucose concentration can inevitably affect the humification pathway, thereby regulating the composition and quality of HLSs.

The reliability of competitive sustainable sorption processes for the treatment of wastewater was also assessed by comparing the performance of biochar obtained from different preparation conditions and raw biomass, such as eggshells, rice husks, and spent coffee grains for the removal of phosphates, nitrates, and ammonia from water [7]. The materials were pyrolyzed at 400 and 800 °C with and without magnesium modification. The kinetic experiments demonstrated that the magnesium-modified EGS pyrolyzed at 800 °C were superior for the removal of phosphates (27.3 mg P/g), while the RH pyrolyzed at 800 °C performed better for the removal of nitrates and ammonia nitrogen, yielding a sorption efficiency of 6.8 and 33.2 mg N, respectively. The modification of biochars resulted in better sorption capacities for phosphates for the three materials tested. The materials investigated are easily available from local enterprises and local shops, and their use can contribute to the valorization of food wastes and the minimization of waste quantities disposed.

Summarizing, these few examples clearly depict an area of active research for the establishment of a new model of sustainable development aimed at the efficient use of resources and the maintenance of their circular flow in the country. Only the eco-design of products, components, systems or applications to prevent the production of waste, while maximizing recovery operations, reuse and recycling, can deliver the creation of new supply chains of secondary materials suitable for the fast replacement of virgin raw materials. The success of the ecological transition will depend on the ability of public administration, research technology and non-profit organizations to work in harmony with their intentions according to simpler, quicker and more efficient rules, thereby favoring a general increase in awareness and participation by citizens and civil society, even through an unprecedented effort of information, communication and education towards the realization of full sustainable development.

Conflicts of Interest: The authors declare no conflict of interest.

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