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EDITORIAL

Effective waste management with emphasis on circular economy

Konstantinos Moustakas[1] · **Maria Loizidou**[1]

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Circular economy is a priority goal today, especially at European level. Waste management is just one of the relevant fields for enhancing circular economy. It is true that a large number of waste researchers develop globally waste-related research initiatives and the present waste management situation can improve substantially so as to make a step towards better life quality, as well as the protection of the environment. This ESPR Special Issue includes 24 scientific articles focusing on effective waste management and circular economy. These papers have been selected on the basis of novelty and quality standards by the Scientific Committee of the THESSALONIKI 2021 8th International Conference on Sustainable Solid Waste Management (http://www.thessaloniki2021.uest.gr). The Conference took place virtually from 23rd to 26th June 2021. It was the first time that a conference event of this series did not take place with physical presence due to the COVID-19 restrictions.

After the successful organization of seven international conference events of this series, three in Athens, the first two in 2012 and 2014 and one more in 2017; one in Tinos Island, Greece, in 2015; one in Limassol, Cyprus, in 2016; one in Naxos Island, Greece, in 2018; and one in Heraklion, Crete Island, Greece, in June 2019, the ambition of the THESSALONIKI 2021 8th International Conference was to present recent developments and advanced knowledge in the area of solid waste management and circular economy by sharing and introducing further case studies, technological achievements, and aspects and experiences at different levels. This Special Issue constitutes the 4th Special Issue of ESPR published from this conference series of sustainable solid waste management. The 1st ESPR special issue was published including 25 papers presented in the ATHENS 2017 Conference, the 2nd ESPR special issue was published with 28 waste related papers from the NAXOS 2018 Conference, and the 3rd ESPR special issue included 47 papers from the HERAKLION 2019 Conference. We are glad that the 4th Special Issue is now published including 24 papers.

Without doubt, we are pleased that the series of our conferences on sustainable solid waste management goes on attracting the interest of the international scientific and academic society, private, and public sector. This is evident by the substantial increase in certain numerical indicators, such as the numbers of the conference attendees, the number of origin countries of the participants flying to Crete, and the numerical data of contributions submitted and the number of full papers included in the electronic proceedings of the THESSALONIKI 2021 conference.

Significant work is undertaken in order to keep high quality standards in the scientific work presented during the conference sessions and improve the visibility of the work presented at the conference. This is demonstrated by the significant increase of the number of collaborating journals (10 for the case of our last conference event) and the relevant high impact factors, as well as the number of research papers published at the end in the collaborating journals. Actually, about 200 papers presented during the THESSALONIKI 2021 Conference have already been published in the collaborating journals or have been accepted for publication. It is also our willingness to offer high-quality services and make the participants get familiar with the traditions, hospitality, culture, landscape, cuisine, and hospitality of Greece.

The virtual THESSALONIKI 2021 agenda was indeed rich, including splendid social events and addressing a wide variety of waste related topics presented in about 500 oral presentations within 26 oral presentation sessions and the extensive poster session with more than 200 poster presentations (http://thessaloniki2021.uest.gr/posters.html). This special issue (THESSALONIKI 2021) was prepared based on 24 articles of this conference and, of course, has international character involving authors coming from a large number of different countries. We were delighted to see that the conference was probably the most well attended virtual conference globally in 2021 in the waste field.

✉ Konstantinos Moustakas
konmoust@central.ntua.gr

[1] School of Chemical Engineering, National Technical University of Athens, Unit of Environmental Science and Technology, 9 Heroon Polytechniou Street, Zografou Campus, 157 80 Athens, Greece

The 24 articles of this ESPR Special Issue involve different issues of sustainable waste management including biological and waste-to-energy technologies, biotechnology, and bioeconomy. The papers are presented based on the acceptance date of each paper.

Within the 1st paper of the Special Issue by Ramalho et al., sanitary landfill leachate was treated by a combination of environmentally friendly technologies — immediate one-step lime precipitation (IOSLP), carbonation through atmospheric CO_2 (CB), and phytoremediation with Vetiver. IOSLP allowed considerable reductions ($\geq 66\%$) in COD, organic nitrogen, sulfate and color, and almost complete metal removal. The additional CB process led to the complete removal of ammonia nitrogen and hardness, with a decrease in pH and conductivity and an increase in the biodegradability of the effluent. Additional reductions in COD, color, and sulfate concentration were also achieved, contributing to lower greenhouse gases and CO_2 mitigation. Phytoremediation, as polishing final treatment, allows the treated effluent to be discharged in water bodies.

In the production of fuel from waste wood biomass, wood processing by-products (man-made materials) for example plywood or particleboard are often used. The combustion of such products at a relatively low temperature achieved in local furnaces results in harmful compounds. The 2nd paper of the special issue by Růžičková et al. demonstrates the possibility of identifying the "purity/composition" of wood briquettes in terms of the used admixtures in the feedstock based on the chemical composition of deposits captured on the boiler walls. In deposits, compounds formed by the degradation of phenolic resins (phenol–formaldehyde), aminoplast resins (urea–formaldehyde, resorcinol–formaldehyde, and melamine), polyurethanes, polyvinyl acetate, and wood glue have been identified by the py-GC/MS method. Also, additives for improving of man-made materials (phthalates, flame retardands, antioxidants) are an important component of deposits used to determine the quality of the feedstock (or composition of feedstock) for the production of briquettes. The results obtained show that the deposit from the boiler is a suitable material for determining the quality of the burnt fuel.

The formation of odorous compounds during composting is a major problem in the management of biowaste. The 3rd paper of the Special Issue by Raclavská et al. deals with the possibility of elimination of odorous compounds (and especially terpenes) during composting with the addition of biocarbon in a real composting plant. Furthermore, the distribution of terpenes between the gaseous, solid, and liquid phases (aqueous leaching) is monitored. 116 terpenes were identified in the air during the preparation of the fermenter charge. Limonene was present at the highest concentration. Terpenes are present in the primary biological component of composts. During composting, in the air (11 days after founding), the concentration of monoterpenoids increases up to three-fold (monoterpenoids). After about 47 days, the concentration decreases to its original value. In some cases, the resulting concentration of VOCs was reduced after 47 days of composting below the value obtained immediately after preparing feed for composting. In individual groups of VOCs, compounds do not respond equally to the addition of biochar. For example, compounds in the terpene group showed no concentration difference in half of the compounds after the addition of biochar, but the highest decrease occurred with compounds present in the highest concentrations in VOCs: cis-thujopsene, D-limonene, and camphene. The addition of 5% biochar to the raw material base in compost production has a positive effect on the composting process, accelerating the decomposition of major bio-components of compost and prolonging the thermophilic phase.

Currently, solid waste management strategies in Havana, Cuba, are outdated. This paper (4th paper of the Special Issue by Alfonso-Cardero et al.) aimed to select the most suitable alternative for integrating material recovery facilities (MRF) with waste-to-energy technologies in the city of Havana. Seven scenarios were considered: combustion, gasification, and hydrothermal carbonization (HTC) with and without carbon capture, and anaerobic digestion (AD). The selection was based on environmental, techno-economic, and social parameters using an analytic hierarchy process (AHP) as a multi-criteria decision-making tool (MCDM). The MCDM-AHP accounted for qualitative criteria (based on experts' judgments) and quantitative (based on Aspen Plus simulation models). From the MRF, 63% of the input recyclable materials were recovered, representing an energy saving of 256 kW-h/t_{MSW}. The AHP results showed that environmental criteria had the highest priority, resulting in ~ 63% and ~ 73% higher than social and techno-economic criteria, respectively. Likewise, from the techno-economic, environmental, and social sub-criteria analysis, investment risk, pollution, and work safety had the major concern compared with the other sub-criteria levels. Overall, MRF + AD was the most suitable scenario (21% preference) for treating Havana's municipal solid waste, followed by combustion and gasification with carbon capture, respectively. This study confirms that AD is a preference option for emerging economies like Cuba, mainly due to low environmental pollution, high social acceptance and financial stability in the long term.

Further to that, the 5th paper of the Special Issue by Ferronato et al. compared the environmental impacts generated by the municipal solid waste and construction and demolition waste (CDW) management system of La Paz (Bolivia). In particular, an environmental life cycle assessment was conducted. The goal was to evaluate the most relevant environmental impact indicators per waste flow and

the contribution of recycling to mitigate the environmental footprint. The outcomes of the research underlined that, at a municipal level, CDW mismanagement contributes more than 60% to the freshwater aquatic ecotoxicity compared to the municipal solid waste management system. It represents the most relevant impact generated by this waste stream. Recycling produced higher avoided impacts than the ones generated by the system for three of six environmental impacts. The analysis suggested that municipal solid waste and CDW recovery is an important option for mitigating environmental degradation, while CDW management should be prioritized to reduce contamination of water bodies in developing countries.

Next, the remediation of contaminated soils is considered a necessary process to reduce environmental risks and to ensure the production of safe and quality food. The present study by Golia et al. (6th paper of this specific special issue) aims to assess the effect of four inorganic soil amendments, such as lime ($CaCO_3$), red mud consisting of 75% hematite (Fe_2O_3), gypsum ($CaSO_4{\cdot}2H_2O$), and Al-oxide (Al_2O_3), of a heavy metal-contaminated soil. For this purpose, a pot experiment was conducted by physically mixing individual six subsamples of a contaminated soil sample with the four inorganic materials studied, and the cultivation of two leafy plants, spinach, and lettuce. Contamination factor, geo-accumulation index, and bioavailability index were measured in soil samples, while transfer coefficient, bioaccumulation factor, and translocation factor were calculated in order to find out which material has the greater remediation potential. These materials appear to increase soil alkalinity and promote the complexation of soluble heavy metals, enhancing the immobilization of heavy metals in soil and reducing their amount in leafy vegetables. Al_2O_3 nanoparticles proved to be suitable sorbents as they can adequately reduce Cu and Zn accumulation from leafy plants cultivated in heavy metal-polluted soils.

Following, the 7th paper of the Special Issue entitled "Design, Adoption and Implementation of Electronic Waste Policies in India" addresses the research question: why India adopts E-waste policy approaches that seem inadequate and ineffective in its local contexts. It attempts to identify alternative approaches after analyzing the current policy interventions through the lens of concepts such as policy transfer, policy convergence, and policy effectiveness. While E-waste is experiencing an unparalleled growth in the recent years across the globe, governance of it has been quite complicated, posing major challenges to the policymakers. Thus, through expert interviews and policy document analysis, this paper attempts to assess the design, adoption, and implementation of E-waste policies in India — a major electronics manufacturing hub with a massive consumer electronics market. The author argues that in a country as diverse as India, it is essential to acknowledge the demographic and socio-economic-political-environmental variances in order to devise effective E-waste policy solutions. One-size-fits-all policy approaches are questionable, and thus, sustainable E-waste management in the country demands alternative policy responses. Further concerns associated with the integration of informal sector with the formal sector should be a core focus area in the coming years.

Next, the 8th paper of the special issue by Cima and Varello deals with potential disruptive effects of copper-based antifouling paints on the biodiversity of coastal macrofouling communities. The expanded use of copper(I)-based antifouling paints (AF) has increased copper leaching into coastal environments, requiring attention and legislative restrictions for potential long-term effects on benthic populations. The ecological succession of macrofouling communities was analyzed on wooden and stainless-steel panels coated with four copper(I)-based AF immersed for 10 months in the Lagoon of Venice. With the exception of the paint containing only copper(I) compounds and based on hard-matrix technology, all paints were based on self-polishing matrices and various booster biocides. The macrofouling communities appeared dissimilar to those on the reference uncoated panels as regard the species richness, the coverage areas, and the biocoenosis structure. Generally, green algae, bryozoans, and barnacles were the most tolerant taxa and a negative species selection occurred for sponges, serpulids, and ascidians. Paint containing organotin (TBT) compound and paint containing antimicrobial/fungicide (chlorothalonil) and herbicide (Irgarol 1051) compounds as booster biocides showed the highest performance and the latter also prevented mollusks on wood panels. Paint containing only copper(I) compound and paint with the fungicide dichlofluanid as a booster rapidly decreased their efficiency, the first probably due to the insoluble matrix with the highest biocidal leaching rate, and the second due to the presence of a booster with low toxicity. The first one also inhibited red algae and mollusks and the second one did not reveal significant differences in types of species settlements with reference panels.

Next, Nemmour et al. presented new results on the gasification of spent pot lining (SPL) waste material produced in the primary aluminum smelting industry. The main objective of this 9th paper of the special issue was to evaluate how well processed SPL materials perform during the gasification process and to create an optimization strategy that will maximize the syngas fuel's quality. The novelty of this study was the creation of statistical models based on response surface methodology (RSM) to forecast syngas composition and gasification performance indicators throughout the SPL waste materials thermal conversion process. The processing of SPL solid materials into syngas fuel is modelled and simulated analytically. Syngas fuel composition (hydrogen H_2, and carbon monoxide (CO), cold gasification efficiency (CGE), and carbon conversion (CC)) was determined. The output variables (H_2, CO, CGE, and CC) are examined to

evaluate the effects of input variables (temperature, equivalency ratio, and steam-to-fuel ratio). The best operating conditions for the optimization of the gasification SPL materials are determined. In addition to this, new correlations for the variance of the four output variables in connection to the three input factors are presented.

In addition, as the world's largest developing economy, China has been rapidly increasing urban construction over the past four decades. As a result, a significant amount of construction and demolition (C&D) waste is being generated not only from new construction but also from building refurbishment activities. This paper (10th paper of the special issue by Ma et al.) evaluates carbon emissions of C&D waste generated by building refurbishment projects using a life cycle assessment approach through a case study in China. This study analyses three scenarios using different waste management strategies in a building refurbishment project in Suzhou, China. The results of this study reveal that the composition of the waste generated from building refurbishment projects is different from construction and demolition projects. In the life cycle of C&D waste management of building refurbishment projects, the refurbishment material stage generates the highest carbon emissions compared to the dismantlement, refurbishment construction, and refurbishment material end of life stages. Business-as-usual C&D waste management practice in China produces higher carbon emissions than open-ended 3R strategy, but the difference is not significant in the whole life cycle of the building refurbishment project, whereas carbon emissions for circular economy C&D waste management strategy are significantly reduced. This study fills a research gap by evaluating carbon emissions of different waste management strategies for building refurbishment projects, which are expected to be an increasing portion of overall construction activity in China for the foreseeable future. This study provide evidence that the circular economy C&D waste management can provide new perspectives and strategies to address today's challenges in C&D waste management in building sector.

What is more, the 11th paper of this ESPR Special Issue by Aslam et al. examines Lahore's air quality index (AQI) and its implication on socioeconomic development during the COVID-19 outbreak. This study has covered multiple pollutants, including carbon monoxide (CO), sulfur dioxide (SO_2), ozone (O_3), and nitrogen dioxide (NO_2), and measured their concentrations to develop AQI. The maximum AQI values during pre-winter, winter, and post-winter days were 185, 234, and 359, respectively. The increased commercial activities raised AQI values during the post-winter days. As a result, more patients were admitted to the hospitals. Anthropogenic activities are the key sources of air pollution in Lahore. Coherence and comprehensive policies should be implemented to minimize or control air pollutants, so informal production and consumption practices should be controlled.

Next, the 12th paper by Moral et al. presents a novel bioscrubber configuration for the treatment of high ammonia loads at short contact times. The biological reactor was designed to work as a moving-bed biofilm rector (MBBR) increasing biomass retention time. This configuration is still unexplored for the treatment of waste gases. Long-term operation of a lab-scale bioscrubber under different inlet concentrations of ammonia (60–570 ppm_v) and a gas contact time of 4 s was performed to study the system operational limits during 250 days. The effect of the dissolved oxygen concentration on the nitrification rate was also evaluated. Under these conditions, a critical elimination capacity (EC) of 250 $NH_3 \cdot m^{-3} \cdot h^{-1}$ and a maximum EC of 300 g $NH_3 \cdot m^{-3} \cdot h^{-1}$ were obtained. The maximum nitrification rate obtained was 0.5 kg $N \cdot m^{-3} \cdot day^{-1}$. However, this nitrification rate only was possible to be achieved under partial nitrification. For complete nitrification, the critical nitrification rate was 0.3 kg $N \cdot m^{-3} \cdot day^{-1}$. These results confirm that bioscrubber coupled to a MBBR is a good alternative to treat high ammonia loads with remarkable advantages, such as the retention of properly biomass concentration without auxiliary equipment.

Following, N-glycosylation alters the properties of different enzymes in different ways. Rhizopus homothallicus was first described as an environmental isolate from desert soil in Guatemala. A new gene encoding glucanase RhGlu16B was identified in *R. homothallicus*. It had high specific activity (9673 U/mg) when barley glucan was used as a substrate. RhGlu16B has only one N-glycosylation site in its Ala55-Gly64 loop. It was found that N-glycosylation increased its thermostability and catalytic efficiency by 5.1 °C and 59%, respectively. Adding N-glycosylation to the same region of GH16 family glucanases *Talaromyces leycettanus* TlGlu16A also increased its thermostability and catalytic efficiency by 6.4 °C and 38%, respectively. In a verification experiment using GH16 family glucanases BisGlu16B in which N-glycosylation was removed, N-glycosylation also appeared to promote thermostability and catalytic efficiency. N-glycosylation reduced the overall root mean square deviation of the enzyme structure, creating rigidity and increasing overall thermostability. The 13th paper of the special issue provided a reference for the molecular modification of GH16 family glucanases and guided the utilization of β-glucan in hemicellulose.

According to the 14th paper of this special issue, portland cement production is responsible for 5 to 8% of the total anthropogenic carbon dioxide (CO_2) emission worldwide. The largest portion of the cement production emissions result from the decarbonization of the raw material, in particular the calcium carbonates. At the same time, concrete waste management options are usually limited to backfill or

landfill, since its use as recycled aggregates is hindered by the performance degradation of the resulting concrete. The performance degradation is due to the presence of hydrated cement paste in the recycled aggregates. A novel method for separating the hydrated cement paste from the natural aggregates unlocks the possibility for obtaining high-quality aggregates and decarbonized raw material for cement production from concrete waste. The present research explores the potential of the method to produce recycled cement at an industrial scale, revealing that the alternative has benefits from a CO_2 emissions perspective, but the need for washing and drying the material before the magnetic separation requires the consumption of large amounts of energy.

Furthermore, the discharge of treated wastewater from urban wastewater treatment plants is an important source of pesticide pollution that threatens the quality of drinking water resources, ecological systems, and aquatic life, as well as agricultural activities. Although various processes are suggested for the removal of pesticides from wastewater, failure to apply more appropriate and effective methods may lead to the emergence of much more toxic and dangerous intermediate and end products. The membrane filtration is more promising process because of its many advantages over other advanced treatment processes, such as the ability to treat many pollutants with very low molecular size and weight with high efficiency, being easily adapted to treatment plants and not producing daughter toxic metabolites. In this study by Ates et al. (15th paper of this Special Issue), the rejection performances of four different pesticides (tributyl phosphate, flutriafol, dicofol, and irgarol) by three reverse osmosis (RO) membranes (BW30-LE, SW30-XLE, and GE-AD) from conventionally treated urban wastewater were presented. Besides, the mechanisms underlying the rejection of these pesticides were evaluated. The rejection performance tests of RO membranes were evaluated under 10 and 20 bar transmembrane pressures (TMP) using pesticide-spiked wastewater samples. The highest rejection of tributyl phosphate (99.0%) and irgarol (98.3%) were obtained with the BW30-LE membrane, while the GE-AD membrane showed the best performances for flutriafol (99.9%) and dicofol (99.1%). Among the tested membranes, the higher roughness of the SW30-XLE membrane resulted in it being the most fouled membrane. The molecular weight and hydrophobicity/hydrophilicity of the pesticides, as well as the projection area, were effective in the pesticide removal mechanism with RO membranes.

Next, the objective of the 16th paper of the special issue by Solarte-Toro et al. is to compare the environmental and social performance of two small-scale avocado biorefineries implanted in a rural zone in the North of Colombia. Two small-scale biorefineries were proposed. Small-B_1 addressed to produce avocado oil and animal feed, and Small-B_2 focused on the guacamole production. The environmental analysis was done by applying the life cycle assessment methodology. Then, agronomic information and process simulation were required to complete the analysis. Moreover, the water footprint of the avocado crops was estimated. Both biorefineries were compared with the direct avocados production and commercialization. The social assessment was achieved by the estimation of quantitative indicators related to wages, jobs, and working hours. The agricultural carbon and water footprints of the creole avocado crop were 0.59 kg CO_2-eq/kg and 2.13 m^3/kg. In the same way, Small-B_1 and Small-B_2 obtained a carbon and water footprints of 8.99 kg CO_2-eq/kg and 6.63 m^3/kg and 0.72 kg CO_2-eq/kg and 1.38 m^3/kg, respectively. The hotspots of the creole avocado crop are related to the use of fertilizers and fungicides. Then, new strategies should be implemented to reduce the farmer's dependency. The social analysis exhibits a high resilience of the Small-B_1 biorefinery, since a salary increase to worker about 50% can be proposed. In addition, the installation of this biorefinery can create more than ten jobs. A disjunction was found between the economic, environmental, and social analyses. Thus, the need to establish a multidimensional strategy to design sustainable biorefineries is presented.

Moreover, electrochemical oxidation of trivalent chromium from leather tanning mud waste leachates to its hexavalent form was carried out within the 17th paper of the special issue by Banti et al. using a PbO_x/Pb anode electrode in a prototype small cylindrical batch electrochemical reactor. The PbO_x/Pb anode was prepared by electrochemical anodization at constant current (75 mA cm^{-2} for 30 min) in a sulfuric acid solution and characterized by the cyclic voltammetry technique to investigate the effect of pH on the process. It was found that at pH = 3, Cr(III) oxidation prevails over the competing water oxidation-oxygen evolution reaction, hence increasing the efficiency of the process. A detailed study of pH (0–3), current density (12–24 mA cm^{-2}), and cell type (divided-undivided) effects on bulk electrolysis of Cr(III) leachates in the batch prototype reactor resulted in process optimization. At pH = 3, 12 mA cm^{-2} and a cathode inserted in a porous diaphragm envelope, nearly 70% conversion was achieved at a nearly 60% current efficiency, among the highest in the previously reported literature. The method could offer an attractive route for tannery Cr(III) conversion to Cr(VI) for reuse as an etchant or electroplating agent.

Next, the ethanol and sugar plants will continue to generate electricity with sugarcane bagasse burning, emission control technologies, and cost-effective and efficient portable samplers are needed to monitor particulate materials and improve current gas cleaning equipment projects. The 18th manuscript of this Special Issue evaluates the efficiency of a Venturi scrubber in removing particles smaller than 2.5 μm emitted by the controlled burning of sugarcane bagasse under different operating conditions. The result shows that a compact, cheap, and practical piece of equipment for flare

gas treatment, such as the Venturi scrubber, can be very interesting for industries that emit high concentrations of pollutants.

Following the 19th paper of the special issue deals with tannery waste as a renewable source of nitrogen for production of multicomponent fertilizers with biostimulating properties. The leather industry faces serious environmental (high chemical and water consumption) and economic (environmental fees) problems. Leather residues are a significant problem for companies, including useless leather fragments (trimmings or cuttings) and tanning waste (resistance to biodegradation). Some of the by-products such as lower specification hides (with manufacturing defects, discoloration, or abrasions) are sold on the market for finishing of furniture sides/backs, production of work gloves, or small leather goods. The rest of the useless waste is partly disposed of or landfilled, leading to groundwater contamination and soil structure changes promoting toxic metal accumulation. Chromium (III) salts are commonly used tanning agents (90% of world production) that irreversibly bind to collagen fibers, preventing aging (causing spoilage or decomposition of the leather). Excess chromium (III) compound accumulates in wastewater and as solid waste. The tanning industry should change its traditional economic model (rapid consumption of raw materials, inappropriate and inefficient management of waste) to a circular economy. This new approach will allow the conversion of tannery waste (as secondary raw materials) into new value-added materials in an environmentally-beneficial manner. Protein-rich leather waste (2.5–10.5% w/w) can be used in agricultural production as a source of nitrogen compounds by hydrolysis of tannery residues, which is now particularly important for the fertilizer sector (high natural gas prices, availability of raw materials, etc.). The studies presented in this work by Mikula et al. (19th paper of the special issue) show that solid tannery waste like shavings can be used as high-protein materials for fertilizer production following the concept of the circular economy. To select appropriate process parameters (mass ratio of shavings meal to the hydrolyzing agent (S:L), hydrolysis medium concentration, temperature) and to ensure the highest possible hydrolysis efficiency, it is useful to apply the well-known response surface methodology (RSM). The analyses revealed that chromium shavings (SCr) were most preferably treated with 10% KOH in a ratio of S:L 1:1 with the process being carried out at 160 °C (6.59% N). The optimal hydrolysis conditions for non-chromium (S) shavings were S:L ratio 1:2, 10% H_2SO_4, and temperature 160 °C (4.08% N). Chromium concentrations in hydrolysates from S and SCr shavings obtained under optimal conditions were 15.2 mg/kg and 9483 mg/kg, respectively. Hydrolysate samples were analyzed by reversed-phase high-pressure liquid chromatography (RP-HPLC) that revealed that the type of hydrolysis (acidic/alkaline) affects the amino acid profile. Approximately 4.5 times more amino acids were extracted in the KOH environment than during acidic treatment. The hydrolysates contained mainly glycine, alanine, and proline, which are primarily responsible for stimulating plant growth by supporting chlorophyll synthesis, chelating micronutrients, improving pollen fertility, or resistance to low temperatures. The conversion of tannery waste into fertilizer requires the control of contaminant levels, especially chromium, which can oxidize to the carcinogenic form Cr(VI) that is hazardous to humans and the environment.

Next, the 20th article of the special issue investigates energy and material flow for different scenarios for the production of refuse-derived fuel from bulky waste, separately collected waste and mixed municipal solid waste. In this research, we compared the proportion of energy consumption in transportation, handling, and processing the waste in the South of Poland. The findings highlight the components of the reverse supply chain consuming the highest value of energy. A model of material and energy flow was applied for transportation by light commercial vehicles and garbage trucks. Tipper semi-trailers and walking floor trailers are used for shipping refuse-derived fuel from pre-treatment facility uses. The results of this study show production of refuse-derived fuel from municipal solid waste consumes almost 10% of the energy potential of the wastes. Less energy is required for the production of refuse-derived fuel from bulky waste 2.2–4.8%, or separated collection waste 1.7–4.1%. Transportation is consuming the greatest portion of energy. For mixed municipal solid waste, it reaches 79% for separated collection waste 90% and for bulky waste up to 92% of the total energy consumed. Comparing emissions for two categories of the collection vehicles, there is no significant difference for the bulky waste collections. For mixed solid waste and separately collected waste, the emissions are higher for garbage trucks. A recommendation for practitioners is the optimization of routing to achieve a higher collection rate for minimized route length and the use of vehicles with higher loading capacity.

Introducing the next paper, biosorption is a viable and environmentally friendly process to remove pollutants and species of commercial interest. Biological materials are employed as adsorbents for the retention, removal, or recovery of potentially toxic metals from aqueous matrices. Hexavalent chromium is a potential contaminant commonly used in galvanoplasty and exhibits concerning effects on humans and the environment. The 21st paper of the Special Issue used *in natura* lettuce root (LR) and nanomodified lettuce root (LR-NP) for Cr(VI) adsorption from water medium. The nanomodification was performed by coprecipitation of magnetite nanoparticles on LR. All materials were morphologically and chemically characterized. The conditions used in removing Cr(VI) were determined by evaluating the pH at the point of zero charge (pH_{PZC} = 5.96 and 6.50 for LR and

LR-NP, respectively), pH, kinetics, and sorption capacity in batch procedures. The maximum sorption capacity of these materials was reached at pH 1.0 and 30 min of adsorbent-adsorbate contact time. The pseudo-second-order kinetic equation provided the best adjustments with r^2 0.9982 and 0.9812 for LR and LR-NP, respectively. Experimental sorption capacity (Q_{exp}) results were 4.51 ± 0.04 mg/g, 2.48 ± 0.57 mg/g, and 3.84 ± 0.08 mg/g for LR, NP, and LR-NP, respectively, at a 10 g/L adsorbent dose. Six isothermal models (Langmuir, Freundlich, Sips, Temkin, DR, and Hill) fit the experimental data to describe the adsorption process. Freundlich best fit the experimental data suggesting physisorption. Despite showing slightly lower Q_{exp} than LR, LR-NP provides a feasible manner to remove the Cr(VI)-containing biosorbent from the medium after sorption given its magnetic characteristic.

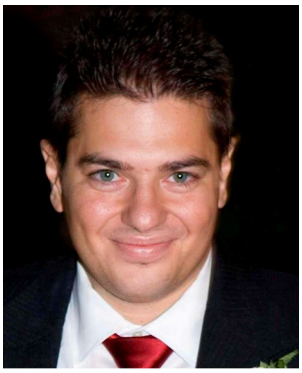
Next, cultivation of microalgae or/and cyanobacteria in nutrient-rich wastewaters offers an opportunity for enhancing sustainability of tertiary wastewater treatment processes via resources/energy recovery/production, mitigation of emitted GHGs, and provision of added value products. However, maintaining a monoculture in wastewater-media constitutes a significant challenge to be addressed. In this regard, the 22nd article of this ESPR Special Issue assesses the efficiency of the low-cost wastewater substrate disinfection techniques of filtration, use of NaClO, H_2O_2 or Fe(VI), as a preliminary treatment stage upstream a cyanobacteria cultivation photobioreactor. The growth rate of cyanobacterium *Synechococcus elongatus* PCC 7942, and nitrate and phosphate removal rates, was experimentally assessed in cultivation setups with biologically treated dairy wastewater that had been subjected to a single or a synergetic couple of disinfection techniques. The results showed that filter thickness has a greater effect on disinfection efficiency than filter pore size. Furthermore, the disinfection efficiency of Fe(VI), which was produced on-site by electrosynthesis via a Fe^0/Fe^0 cell, was greater than that of NaClO and H_2O_2. Filtration at ≤ 1.2-μm pore size coupled with chemical disinfection led to unhindered *Synechococcus elongatus* PCC 7942 growth and efficient nitrate and phosphate removal rates, at dosages, in terms of Concentration–time (*CT*) product, of $CT \geq 270$ mg min L^{-1} for NaClO and $CT \geq 157$ mg min L^{-1} for Fe(VI). The coagulation action of Fe(III) species that result from Fe(VI) reduction and the oxidation action of Fe(VI) can assist in turbidity, organic compounds, and phosphorous removal from wastewater media. Moreover, the residual iron species can assist in *Synechococcus elongatus* PCC 7942 harvesting and may enhance photosynthesis rate by increasing light transfer efficiency. Thus, a filtration configuration coupled with chemical disinfection, preferably using ferrates, downstream of sedimentation tank of a secondary biological wastewater treatment stage is proposed as a necessary, efficient, and low-cost disinfection technique for full-scale implementation of cyanobacteria cultivation as tertiary wastewater processes.

Moving to the next paper, the textile sector has to implement new sustainable practices because of rising apparel consumption per person and customer awareness of environmental concerns. The 23rd paper of the special issue by Şener Fidan et al. examines in depth the advantages of organic cotton fiber over conventional cotton fiber. Because the production of cotton, the primary raw material for textiles, is responsible for the environmental impacts of a pair of jeans, a technique known as life cycle assessment was applied to study these effects in relation to four different scenarios. The scenarios were chosen in response to the consumers' preferences about washing temperatures, drying processes, and alternatives to cotton fiber. The CML-IA technique was used to assess the environmental impacts of many categories, including global warming potential, eutrophication potential terrestrial ecotoxicity potential, acidification potential, and freshwater ecotoxicity potential. Using just 100% organic cotton fiber reduced environmental consequences by 87% in the terrestrial ecotoxicity potential and 59% in the freshwater ecotoxicity potential, according to life cycle assessment results. By using organic cotton, the environmental consequences of a pair of jeans may be mitigated. Also, all environmental impact categories were significantly influenced by consumers' behavior. The temperature at which clothing is washed has a large influence on the environment, also the decision to use a dryer instead of a clothesline during the usage phase has a similarly substantial impact on the environment. The most important categories for the use phase of pair of jeans were found in eutrophication potential, acidification potential, and global warming potential, and for the fabric manufacturing and cotton cultivation phases were found terrestrial ecotoxicity potential and freshwater ecotoxicity potential, respectively. Environmental consequences tend to be substantial on the sustainable life cycle of a pair of jeans depending on factors such as the usage of organic cotton as a raw material in manufacturing procedures and customer preferences for washing temperature and drying techniques.

Sustainable long-term solutions to managing tailings storage facilities are integral for mines to operate in a safe and environmentally responsible manner. The long-term storage of subaqueous tailings can pose significant safety, environmental and economic risks; therefore, alternative containment strategies for maintaining geochemical stability of reactive materials must be explored. In the last paper of the Special Issue by Rodin et al., the physical and geochemical stabilization of coal tailings using microbially induced calcite precipitation was evaluated at laboratory pilot scale. Three application

techniques simulated commonly used agricultural approaches and equipment that could be deployed for field-scale treatment: spraying on treatment solutions with irrigation sprinklers, mixing tailings, and treatment solutions with a rototiller and distributing treatment solutions via shallow trenches using an excavator ripper. Test cells containing $1.0 \times 1.0 \times 0.5$ m of tailings were treated with ureolytic bacteria (*Sporosarcina pasteurii*) and cementation solutions composed of urea and calcium chloride for 28 days. Penetrometer tests were performed following incubation to evaluate the extent of cementation. The spray-on application method showed the greatest strength improvement, with in an increase in surface strength of more than 50% for the 28-day testing period. The distribution of treatment solution using trenches was found to be less effective and resulted in greater variability in particle size distribution of treated tailings and would not be recommended for use in the field. The use of rototilling equipment provided a homogenous distribution of treatment solution; however, the disruption to the tailings material was less effective for facilitating effective cementation. Bacterial plate counts of soil samples indicated that *S. pasteurii* cultures remained viable in a tailings environment for 28 days at 18 °C and near-neutral pH. The treatment was also found to stabilize the pH of tailings porewater sampled over the 28-day incubation period, suggesting the potential for the treatment to provide short-term geochemical stability under unsaturated conditions.

The Guest Editors would like to express our thanks to the Editor-In-Chief of Environmental Science and Pollution Research, Dr. Philippe Garrigues, for providing us with the opportunity and trust to publish this Special Issue on Effective waste management with emphasis on circular economy, and we are also happy that another ESPR Special Issue will include high-quality papers from the recent conference of this conference series, CORFU 2022 Conference (http://corfu2022.uest.gr), that was a successful hybrid conference event that was held from 15 to 18th June 2022 with 900 participants, which was a record achieved for our conference series on sustainable solid waste management. Finally, we are happy to share that another Special Issue will include high-quality papers from the future CHANIA 2023 10th Conference on Sustainable Solid Waste Management that will take place in Chania, Crete Island, Greece, from 21st to 24th June 2023 (http://chania2023.uest.gr).



Konstantinos Moustakas is Senior Researcher, with PhD in waste management. He works as Laboratory-Teaching Staff in the Unit of Environmental Science and Technology (www.uest.gr) of the School of Chemical Engineering of the National Technical University of Athens. He has actively participated in more than 65 projects in many countries. He has long teaching experience and considerable international experience as senior researcher and project manager. He has cooperated with the European Commission directly, as he acted as TAIEX expert (institutional building) in many countries. He has long training activity in the field of environment in different countries and has been working for the Hellenic Open University as Collaborating Teaching Staff in the field of solid waste for 7 years. He has already published more than 300 articles in journals and conferences, he serves as Associate Editor in a Journal and Member of the Editorial Board of some others, he has served as Guest Editor in several Special Issues, while he has had the key role in the organization of a large number of international conferences. Indicatively, he is the Head of the Organising Committee and key member of the Scientific Committee for the successful series of conferences on Sustainable Solid Waste Management. He is also Secretary General of the Hellenic Solid Waste Management Association currently.

Maria Loizidou obtained her PhD in chemical engineering focusing on the field of environmental protection at the University of London. She followed an academic career being Professor at the School of Chemical Engineering of the National Technical University of Athens and Head of the Unit of Environmental Science and Technology (www.uest.gr) with great achievements and distinctions.

Her efforts are continuous in the field of the environmental protection and human health, enhancing education, innovation, and research technology. She has been scientific responsible for 200 environmental projects supporting competent authorities, municipalities, and others (http://www.uest.gr/index.php/projects). She has more than 600 publications in international scientific journals (http://www.uest.gr/index.php/publications) and conferences and about 10,000 citations.

Prof. Loizidou is the Head of the Scientific Committee of this series of conferences on Sustainable Waste Management. She has also organized many other conferences in the field of climate adaptation, circular economy, and industrial waste and wastewater treatment and valorization.

Prof. Loizidou is the Head of WtERT-Greece since January 2020. She has also won the first Green AWARD with the LIFE SOL-BRINE project that was voted as the best LIFE ENVIRONMENT project for the period 1992–2017 among more than 4000 LIFE projects from all over Europe.