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POSTER PRESENTATIONS – ABSTRACTS

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International environmental legal framework for addressing transboundary environmental effects of hydroelectric power plants

Urška Stopar

Energy production and use with the associated emissions of greenhouse gases, particularly CO2 and its impacts on the environment, has created much attention on national and international levels. Therefore, hydroelectric power plants are an alternative in the energy sector.

It is precisely, because of the importance of international rivers, that the rules of international law must be observed. The Principle of sovereignty and responsibility of the state over its territory for international rivers is thus not strictly and absolutely meaningful, since the effects which the state causes on its territory may also be reflected in the territory of other countries. This principle implies that, while states have permanent sovereignty over their natural resources, they must ensure that they do not cause cross-border damage. This can happen quickly when one country decides to set up a hydroelectric power plant on international river, as it permanently encroaches on the ecosystem and affects the overall flow of the river and the amount of water.

In the case of international rivers, states may opt for contractual arrangements for the river, but some general rules are covered by the conventions[1]. In the absence of consensus or clear rules, international rivers also cause disputes when rivers are affected in one country, and that action affects other countries.[2]

States are also bound by international law to respect the principle of sustainable development. Based on this principle, countries are obliged to harmonize their economic development with environmental protection. Hydroelectric power plants are part of economic development, but countries must take measures to ensure environmental protection in case of installation of hydroelectric power plants.

[1] Such as: Convention on the protection and use of transboundary watercourses and international lakes done at Helsinki, 17 March 1992; it covers the use and definition of international watercourses.

[2] An example of such a dispute is between Turkey and Iraq, because of changes in the Tigris River due to hydroelectric power in Turkey, it is feared that these changes would significantly affect the river flow in Iraq.

Big problems can arise when one country arbitrarily interferes with the construction of a hydroelectric power plant due to non-compliance with the rules of international law. In this respect, it is important how and on what legal basis countries affected by such interference can initiate appropriate procedures to achieve their objectives.

Biography:

Urška Stopar, mag. prav. is a Student of Interdisciplinary doctoral programme in environmental protection at the University of Ljubljana, and a Junior associate at a law firm.

Material recovery as an important part of circular economy: Biochar from waste wooden biomass

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Biochar can be produced using a variety of waste biomass to achieve goals of zero waste management and circular economy. It is obtained by heating biomass in the absence of oxygen, i.e. pyrolysis. It is a combined process of energy extraction of biomass with simultaneous production of useful material. Biochar is a stable material, therefore its carbon structure may be considered as a permanently locked carbon dioxide. By producing biochar, no greenhouse gases are added to the atmosphere. Moreover, they are actually being removed from the atmosphere. Therefore, pyrolysis and biochar production are considered as climate change mitigation strategy, carbon negative technology or carbon sequestering technology or anthropogenic carbon sink. Biochar can also be used as an effective soil additive to increase fertility and to improve the physical properties of soil to be more capable of dealing with drought and of needing less cultivation and chemical fertilization. It can also be used for remediation of deteriorated soil.

Slovenia is one of the most forest-covered countries in the world. Nearly 60 % of its area is covered with beech (32%), spruce (31%) and oak tree wood (7%). On average, around 3 million m3 of trees per year were cut down due to regular and sanitary woodcutting in the last decades. Due to glaze ice in 2014, more than half of Slovenian forests were damaged. Moreover, the consequent bark beetles infestation resulted in additional 4 million m3 of trees to be felled annually for sanitary reasons. Consequently, Slovenia has gathered huge quantities of second-grade and waste low-priced wood (25 € – 50 € per m3), and thus it has an opportunity to make the production of wood-based biochar viable.

The presented approach is a simple and viable solution to process waste wooden biomass. We take advantage of the energy and material potential of the “so-called” waste material. The transformation (pyrolysis) into useful material (biochar) prolonging the life cycle, which is following the principles of circular economy and zero waste management.

Biography:

Matic Grojzdek obtained his master’s degree in Chemical Engineering in 2014. The thesis won Prešeren Award in December 2015. He gained industrial experiences through employment at the pharmaceutical company Krka. Since 2017 he is a PhD student and young researcher at the Faculty of Chemistry and Chemical Technology of University of Ljubljana, Slovenia. His research work is focused on biochar production and characterization. He is currently involved in national research program P2-0346 “Separation and Other Processes for a Low-Carbon, Bio and Circular Economy and Sustainable Development”.

Fate of microplastics in wastewater treatment processes

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Microplastics (MP), as anthropogenic pollutant is found everywhere in the environment. MP particles are present in many products and various industrial processes. Studies have shown, that it accumulates in the digestive track and can translocate to other tissues and cause serious effects in organisms. MP pass through the sewerage network from the domestic households and other activities and it concentrates in the wastewater treatment plant (WWTP). This way can WWTP contribute to the release of MP into the environment. Research have shown that the efficiency of MP removal depends on the type and process of WWTP. Studies that were performed showed between 60-99.9 % removal efficiency and decrease of concentration after each phase. Up to 45 % removal at pre-treatment phase, up to 78 % after primary treatment, up to 98 % after secondary and tertiary can increase the efficiency. Between 68 and 80 % of MP is retained in the sludge. Data of the identified concentrations of MP are not comparable, due to different sampling procedures and sample processes. A unified sampling method and further processes should be established to achieve comparability. Sludge is a complex mixture of organic matter, which complicates the process of MP extraction and until now used methods have certain disadvantages. Because of its properties, quantity and content, sludge is useful for multiple purposes, co-incineration, biogas production and in some countries as fertilizer.

Biography:

Nina Resnik graduated in Sanitary Engineering at Faculty of Health Sciences in 2017 and obtained master's degree in Technical Safety at Faculty of Chemistry and Chemical Technology in 2019. Since 2019 she is a PhD student and doing research focused on identification and characterisation of MP in WWTP, developing an efficient method to extract MP from samples that contain high concentrations of organic matter and doing research on impacts of absorbed MP on production of biogas.

Reduction of carbon footprint: biochar-containing construction materials

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The key element in biochar is carbon and its structure. The structure is similar to a honeycomb, as it is made of many extremely small pores. So far, the use of biochar was limited to agricultural applications as a soil amendment. When biochar is added to the soil, it can stabilize the storage of carbon in a chemically stable and inert form for an extended period. Also, this carbon contributes to mitigating greenhouse gas emissions (GHG). Today, the methods of obtaining biochar as a soil amendment or as feed supplement, its composition, and structure are strictly controlled by standards in which are defined exactly what concentrations of elements and chemical substances it may contain (Polycyclic Aromatic Hydrocarbons - PAH, heavy metals). Pyrolysis is one of the most commonly used processes for obtaining biochar. In this process, biomass is heated and exposed to relatively high temperatures (300 oC – 600 oC) in the absence of oxygen to produce three main products: char, oil, and gas. Biomass is mostly obtained from agricultural, municipal domestic, or organic wastes. If the formed char does not fulfil requirements to be classified as biochar fulfilling legislative conditions for agricultural or environmental restoration application, other possibilities of its use should be considered. This could mean that any char produced from biomass can be used in construction materials. Recently, the possibility of wastewater treatment with it has been investigated for removal of emerging contaminants. In addition, an increasing number of studies are focusing on the use of char in construction materials, especially in concrete and road construction materials. Using it as a soil conditioner it could significantly contribute to the reduction of GHG emissions. However, the use of building materials containing char could, according to the results of previous studies, potentially reduce GHG emissions by an additional 25%.

Biography:

Maša Legan graduated in Technical Safety at the Faculty of Chemistry and Chemical Technology (University of Ljubljana) in 2017 and obtained master's degree in Technical Safety at the Faculty of Chemistry and Chemical Technology in 2020. Since 2020 she is a Ph.D. student and researching composites based on cement and added materials, i.e. waste plastic and biochar in different proportions, and compatibility of the combined materials.