DEMO CRATIA

DEMOCRATIA – AQUA – TECHNICA

UNIVERSITAS STUDIORUM NEOPLANTENSIS MCMLX

SRH HOCHSCHULE HEIDELBERG

Funded by the DAAD from funds of the Federal Foreign Office:

DAAD Deutscher Akademischer Austauschdienst German Academic Exchange Service

Federal Foreign Office

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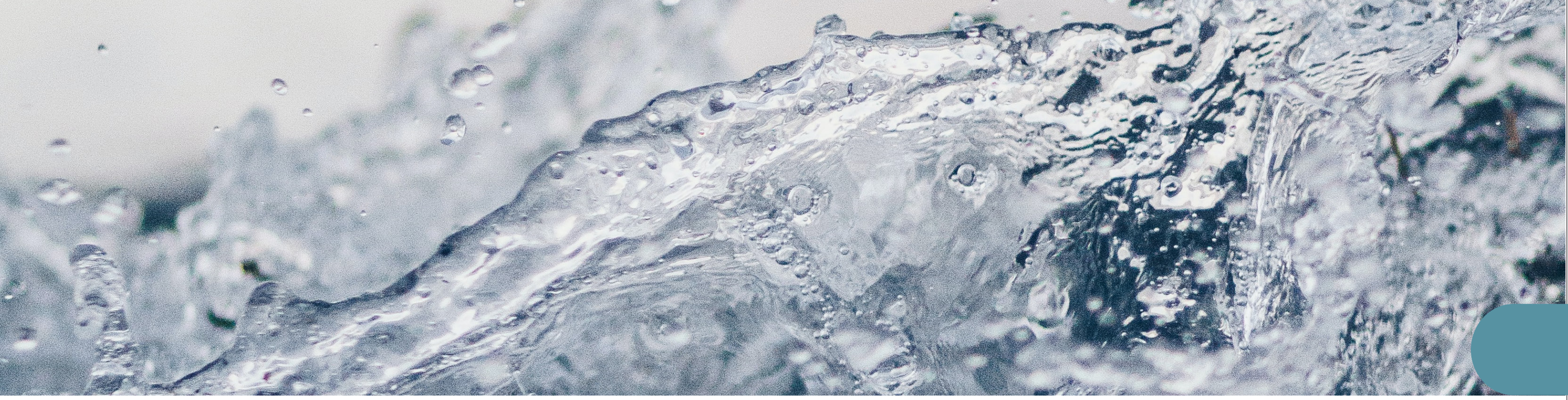
ISBN E-PUB
978-3-9822521-1-7

FUNDED BY
The DAAD from funds of the Federal Foreign Office
DAAD – German Academic Exchange Service



THE PROGRAM

DIGITAL CONFERENCE DEMOCRATIA-AQUA-TECHNICA

24.09.2020

9:00 - 9:30	Welcome from Prof. Dr. Carsten Diener (Rector SRH)
9:30 - 10:15	Welcome and Keynote speech: Prof. Dr. Ulrike Gayh (SRH)
10:15 - 11:00	Keynote speech - Research activities at the Department of Environmental Engineering and Occupational Safety and Health: Prof. Dr. Maja Turk-Sekulić, Prof. Dr. Jelena Radonić (UNS)
11:00 - 11:45	Introduction and Review Hackathon, Results Hackathon Challenge 1: Prof. Dr. Benjamin Zierock (SRH)
11:45 - 12:00	Introduction Poster Session (Overview of topics + Participants + Procedure): Prof. Dr. Ulrike Gayh / Prof. Benjamin Zierock (SRH)
12:00 - 13:30	Lunchbreak - Poster Session
13:30 - 14:15	Sustainable wastewater management and resource recovery systems through novel anaerobic and bioelectrochemical processes: Assist. Prof. Dr. Yasemin Dilsad Yilmazel (METU)
14:15 - 15:00	Wastewater Treatment from Nitrogen Compounds in the Trickling Biofilter: Olga Yantsen, Prof. Dr. Elena Gogina (NRU)
15:00 - 15:45	Introduction Digital Games-Application - Explorer App + Hackathon Challenge 4: Oliver Schlenker (SRH)
From 16:00	Final discussion + Poster session: Prof. Dr. Maja Turk-Sekulić (UNS) / Prof Dr. Ulrike Gayh (SRH) Digital city ralley Heidelberg - water and architecural highlights of the city

25.09.2020

9:00 - 9:15	Welcome from Prof. Dr. Maja Turk-Sekulić (UNS)
9:15 - 9:45	Health risk assessments of polycyclic aromatic hydrocarbons in ambient air in Novi Sad, Serbia: Prof. Dr. Jelena Radonić (UNS)
9:45 - 10:15	The emission of BTEX compounds during the motion of passenger cars in accordance with the NEDC: Prof. Dr. Dragan Adamović (UNS)
10:15 - 11:00	Improvement of the Drought Management: Prof. Dr. Sándor Szalai (SIU)
11:00 - 11:45	Fuelling Fire with Water: A Case Study on Conflicts around Lake Chad: Emil Unrath, Nikolaus Reeg (HIIK)
11:45 - 12:15	Water, the New Weapon: Cheikh Diallo (Species Analysis, Senegal)
12:15 - 13:30	Lunchbreak - Poster session
13:30 - 14:00	Results of the Hackathon Challenge 3 - Water Conflicts and Methods of Limitation: Ajeesh Nellikunnel Jose, John Lugongo, Prof. Dr. Ulrike Gayh (SRH)
14:00 - 14:30	The Influence of Water on a Rural Environment in its Economic and Ecological Aspects, Shown in the example of the river Alb in the Albtal (Alb-Valley): Mathias Naar (SRH)
14:30 - 15:00	Designing a democratic future: Making a Case for Transdisciplinary Research Approaches: Belen Zevallos (SRH)
15:00 - 15:30	Steps towards Green Technology: the Utilisation of Natural „Low-Cost" Coagulant in Wastewater Treatment: Sanja Radovic (UNS)
15:30 - 16:00	Treatment and Potential Uses of Contaminated Biomass after the Phytoremediation of Landfill Leachate: Katarina Antić (UNS)
16:00 - 16:30	Contaminations of the Danube Sediment: Effects of Brominated Flame Retardants effect: Maja Brboric (UNS)
16:30 - 17:00	Conclusion and Outlook of the Democratia-Aqua-Technica Initiative: Prof. Dr. Maja Turk-Sekulić (UNS) / Prof Dr. Ulrike Gayh (SRH) / Prof. Dr. Jelena Radonić (UNS)

TREATMENT AND POTENTIAL UTILIZATIONS OF CONTAMINATED BIOMASS

AFTER THE PHYTOREMEDIATION OF LANDFILL LEACHATE

INTRODUCTION

Phytoremediation is a technology that involves the use of plants to remove pollutants from the environment. Besides being an economical, energy-efficient, and environmentally friendly method, phytoremediation can be applied to large areas and is useful for treating a wide variety of contaminants (metals, radionucleotides, and organic substances) and growth media (soil, sludge, sediment, and water) (Rascio and Navari-Izzo, 2011). Phytoremediation of pollutants from the contaminated media generally happens through any one or more of the following mechanisms: phytoextraction, phytostabilisation, phytovolatilisation, phytotransformation (phytodegradation or phytostabilisation) and rhizofiltration (Parmar and Singh, 2015).

Plant species that are natural hyperaccumulators of elements can be effectively used in the phytoremediation of particular pollutants. The hyperaccumulator plant species represent plants that actively take up exceedingly large amounts of one or more pollutants from the treated medium. The pollutants are not retained in the roots, but are translocated to the shoot and accumulated in above-ground organs, especially leaves, at concentrations 100–1000-fold higher than those found in non-hyperaccumulating species (Rascio and Navari-Izzo, 2011).

LIGNOCELLULOSIC BIOMASS

Lignocellulosic biomass is mainly composed of three polymers: cellulose, hemicellulose and lignin, together with small amounts of other components, such as acetyl groups, minerals and phenolic substituents. Generally, lignocellulosic biomass consists of 35–50% cellulose, 20–35% hemicellulose, and 10–25% lignin. Proteins, oils, and ash make up the remaining fraction (Iskigor and Remzi Becer, 2015).

Since about half of the organic carbon in the biosphere is present in the form of cellulose, the conversion of cellulose into fuels and valuable chemicals has paramount importance. Disposal of contaminated lignocellulosic biomass in the soil or landfill causes serious environmental problems, but it could be utilized for the production of a number of value-added products.

PRE-TREATMENT METHODS OF CONTAMINATED BIOMASS

One of the most important goals of lignocellulosic biomass refining is to fractionate lignocellulose into its three major components: cellulose, hemicelluloses and lignin. Hence, the pre-treatment of lignocellulosic biomass prior to other treatment methods, is an essential step in order to increase cellulose and hemicellulose accessibility and biodegradability for enzymatic or chemical action (Iskigor and Remzi Becer, 2015). Pretreatment methods are divided into different categories such as mechanical, chemical, physico-chemical and biological methods or various combinations of these.

The most commonly used method of mechanical pre-treatment is torrefaction. Torrefaction is a thermochemical pre-treatment process at 200~300°C in an inert condition, which transforms biomass into a relatively superior handling, milling, co-firing and clean renewable solid biofuel (Song and Kim, 2013).

The most commonly applied chemical methods can be classified in two groups: chemical hydrolysis and enzymatic hydrolysis. Among chemicals, acid and alkali are used as pre-treatment methods. Acids are predominantly applied in chemical hydrolysis. Acid hydrolysis can be divided inturn into two groups, concentrated acid hydrolysis and dilute acid hydrolysis (Dastyar et al., 2019). Dilute acid hydrolysis is commonly applied. But one drawback in this is the formation of undesirable products such as furfural, formic acid, acetic acid, uronic acid, etc.

The biological pre-treatment can be categorized into bacterial consortium, fungal treatments and enzymatic treatments. The commonly utilized microorganisms in this pre-treatment of lignocellulosic biomass are filamentous fungi. Wood-decay fungi are classified into three main groups, white-rot, brown-rot and soft-rot fungi (Isori et al., 2011). Among them, the most effective are basidiomycetes white-rot fungi, because they have the capability to degrade lignin from the holocellulose (cellulose and hemicellulose) surface and cause white-rot on wood or trees, whereas brown- and soft-rot fungi degrade only minimal lignin.

Fig. 1: Color change of biomass samples treated at different temperature: 200°C (left) and 300°C (right) (Song and Kim, 2013)

Fig. 2: Appearance of white-rot funghi of Echinodontium taxodii strains developed

Fig. 1: Color change of biomass samples treated at different temperature: 200°C (left) and 300°C (right) (Song and Kim, 2013)

TREATMENT METHODS OF CONTAMINATED BIOMASS

Treatment methods can be divided into three different categories such as production of biomass briquette, preparation of High caloric fuel (HCF) by deoxy-liquefaction and co-production of bio-ethanol, electricity and heat from biomass wastes.

Biomass briquette production procedures are widely used and variable, depending on laboratory conditions.

The direct deoxy-liquefaction technique has been proved to be an effective method to produce high quality liquid oils with lower oxygen content (only about 6%) and higher heating values (more than 40 MJ kg-1). Various types of biomass such as different terrestrial biomasses (soybean stalk, cotton stalk, corn stalk, rice straw, wheat straw, poplar leaves, and Crofton weed) and aquatic biomasses (water hyacinth, E. prolifera and Laminaria japonica) have been successfully converted into high-quality liquid oils via deoxy-liquefaction (Li et al., 2014).

The outlines of conventional ethanol production and the innovative route for co-production of bioethanol, electricity and heat from lignocellulosic biomass are shown in **Figure 5**.

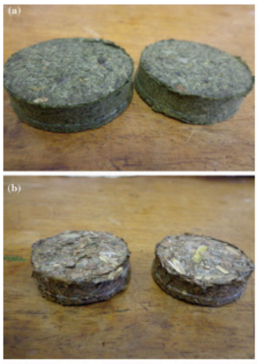


Fig. 4: Water hyacinth briquettes (a) and Maize crop briquettes (b) (Munjeri et al., 2015)

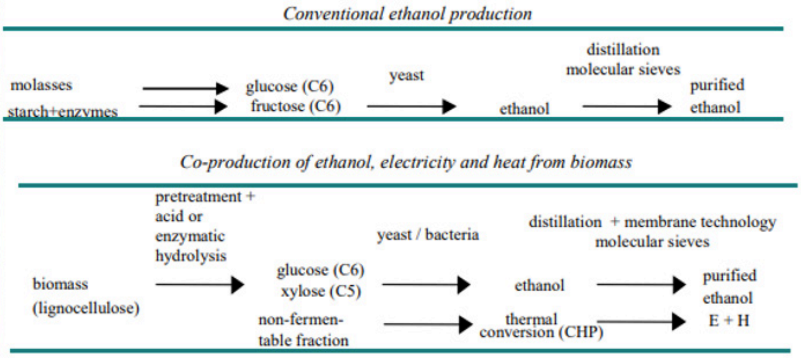


Fig. 5: Outline of conventional ethanol production (above) and the innovative route for co-production of bioethanol, electricity (E) and heat (H) from lignocellulosic biomass (below) (Reith et al., 2011)

CONCLUSION

The concept of linking phytoremediation approaches and thermochemical biofuel production is a potential and promising pathway towards sustainable phytoremediation processes via contaminant-free bioenergy production and compound recovery from used contaminated biomass. Successful commercialisation of the products created from contaminated biomass can lead to increased incomes, job creation and improved environmental management. The use of these methods may help reduce the prevalence of the water weeds in aquatic bodies and also help reduce the intensive use of wood fuel which usually leads to deforestation.

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ACKNOWLEDGEMENTS

This paper has been supported by the Ministry of Education, Science and Technological Development through the project nº 451-03-68/2020-14/200156: "Innovative scientific and artistic research from the FTS (activity) domain".

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