HISS Hanyang International Summer School	**Research Project Syllabus**

[FACULTY INFORMATION]

Name of Professor	Byong-Hun Jeon	Dept.	Earth Resources and Environmental Engineering
E-mail	bhjeon@hanyang.ac.kr	Office Phone No.	02-2220-4642
Research Area	Bioenergy, Energy material technology	Laboratory Research Center	Laboratory of Bioenergy & Environmental Remediation
Website	https://bhjeon.hanyang.ac.kr/	Lab Location	Room 1105, ITBT Bldg., Hanyang University, Seoul

[PROJECT INFORMATION]

Credit	3	Project Hours	20 per week (total 80 hours)
Project Duration	✓ **4 weeks** ☐ 6weeks *Please tick your preference.		
Intro to Lab / Research Center	➢ Research Topic Development of ion-exchange materials to remove inorganic contaminants in biooil for advanced biofuel		
	➢ Research Activities - Bio-oil production using fast pyrolysis from lignocellulosic biomass. - Synthesis of ion-exchange resin to remove inorganic contaminants. - Evaluation of removal efficiency of inorganic contaminants using ion exchange resin. - Optimization of various parameters such as operating temperature, ion selectivity, reaction rate, regeneration efficiency, exchange capacity, partial regeneration of resin, etc.. - Selection of the suitable resin for industrial-level application for effective inorganic contaminants removal.		
	➢ Achievement (Publications / Awards / Corporate Project / Government Project) - Prof. Jeon has published more than 304 SCI(E) journal articles with citation of 11766 and h-index of 59. - 1) Selected as the top researcher at Hanyang University in 2017-2020, 2) Selected 5 times by BRIC (People Who Lighted Korea), 3) Brain Pool project excellence selection in 2013, 2017, 4) Awarded by the Ministry of Environment in the environmental engineering in 2009, 5) Various media reports (YTN TV Science), 6) Performed numerous invitational presentations at the American Chemical Society National Meeting. - He is running more than 10 government and corporate funded research projects including BK21 PLUS.		
Pre-requisite & Eligibility	➢ Academic Background - Bioenergy, Environmental biogeochemistry ➢ Relevant Experience -Basic understanding in environmental engineering ➢ Language -Proficient English speaking and writing		

Objectives & Description	This research aims to develop an ion-exchange resin that can effectively remove inorganic contaminants in bio-oil. The removal efficiency of inorganic contaminants will be evaluated using Inductively Coupled Plasma. - Literature survey to understand the basic of engineering. - Experimental set up, handling different analytical instruments, and result interpretation. - Report writing using the experimental results.	
Evaluation	Attendance Final Group Project Participation Presentation	10% 25% 25% 20% 20%

[WEEKLY SCHEDULE]

Week	Weekly Topic & Activities	Student Assignment	Reference
1	1. Introduction 2. Literature survey	- Laboratory safety and ethics training. - Literature survey for research	
2	1. Production of biooil from different lignocellulosic biomass using pyrolysis 2. Design of Ion-exchange resin	- Bio-oil production through pyrolysis from coffee grounds, wood waste, rice straw, and pine sawdust. - Preparation of various sulfonic acid-functionalized styrene backboned polymeric resins for the removal of inorganic contaminants.	
3	Ion-exchange resin synthesis and manufacturing	- Evaluation of inorganic contaminant removal rate using various ion-exchange resins, polymer resins with acid functional groups (carboxylic, phosphonic, sulfonic acids), Amberlite XAD-16 with chloro-sulfonic acid functional groups, and ion- exchange fibers. - Evaluation of ion-exchange capacity and selectivity coefficient of various resins according at various pH change to provide maximum ion-exchange capacity and improve kinetics.	
4	Evaluation of removal inorganic contaminants using ion-exchange resins	- Evaluation of inorganic contaminants removal efficiency using various ion-exchange resins with acid functional groups (carboxylic, phosphonic, sulfonic acids), Amberlite XAD-16 with chloro-sulfonic acid functional groups, and ion-exchange fibers.	

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222 Wangsimni-ro, Seongdong-gu, Seoul, 04763, Korea
Tel. +82-2-2220-2458 | researchprj@hanyang.ac.kr

5	Regeneration efficiency of ion-exchange resin, resin layer combination method, parameter optimization.	- Optimization of operating conditions such as temperature, operating time, resin filling rate, biooil loading rate, pH for economical and reusable ion exchange resin. - Selection of optimal conditions for the operation of the ion-exchange resin tower (backwash, settling, injection, displacement, rinse, service).	
6	Report writing	- Organization of presentable results - Preparation of a full report in the form of manuscript with the generated results	

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