Updates on Catalysis and Analytical equipment and research

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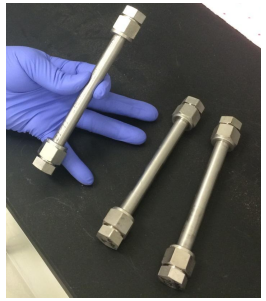
Industrial Listening Day

March 7th, 2023

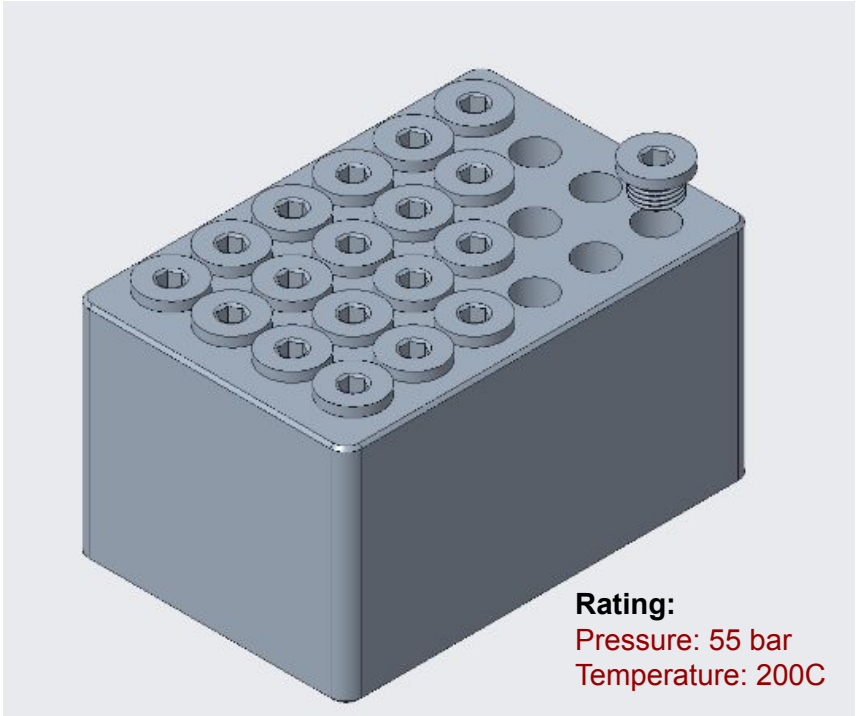
Existing capabilities: thermochemical process



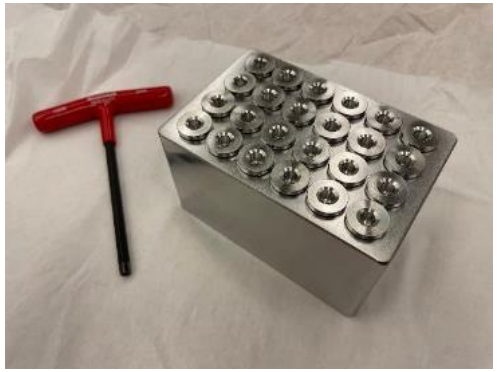


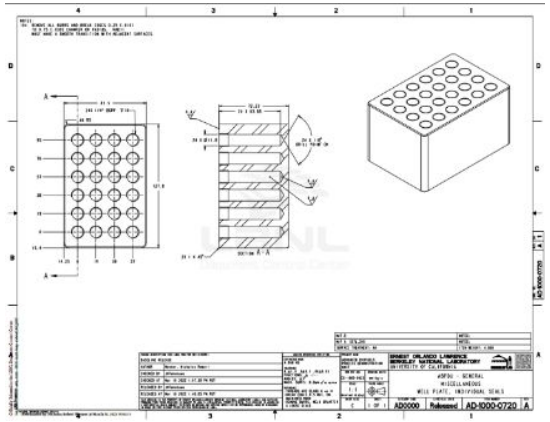

Volume:	15 mL	50 mL	2 L	10 L	50 L	210L
Reactors:	10	6	4 (1 atm)	3	1 (1 atm)	1

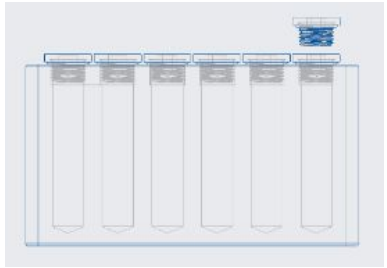
New capabilities: High throughput pressure reactor

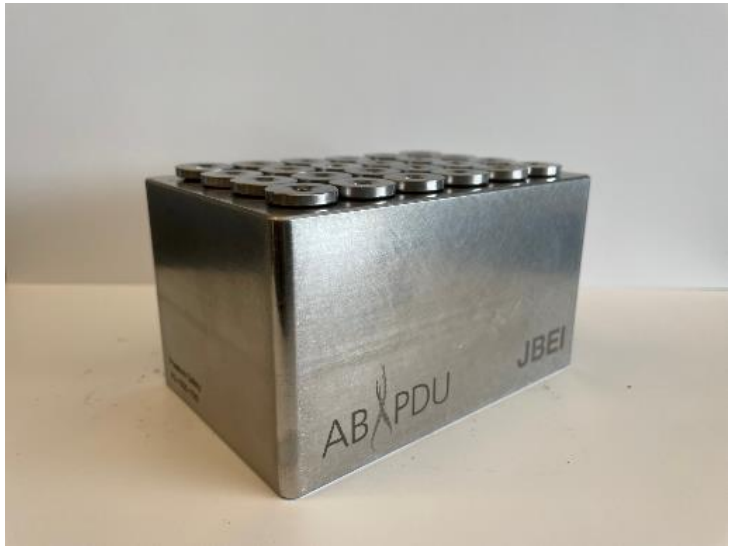


Rating:
Pressure: 55 bar
Temperature: 200C





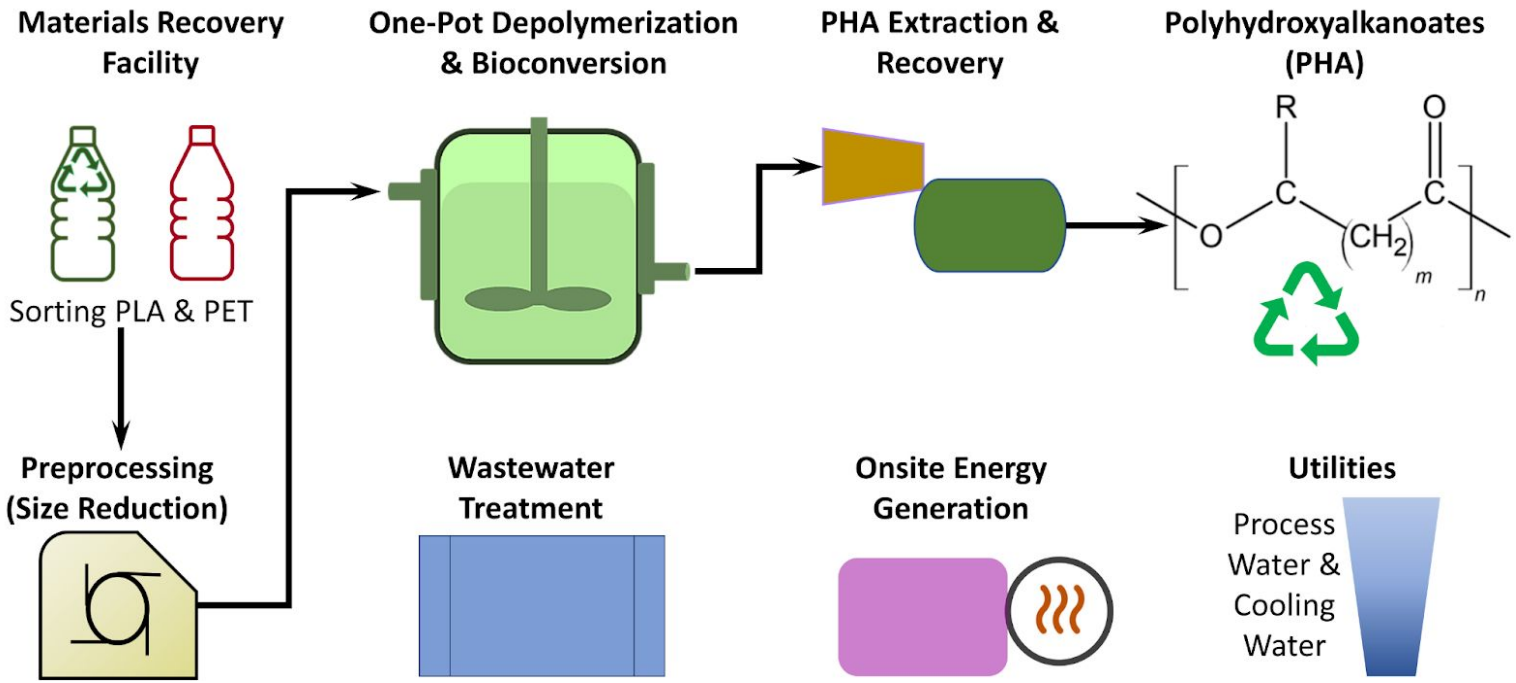


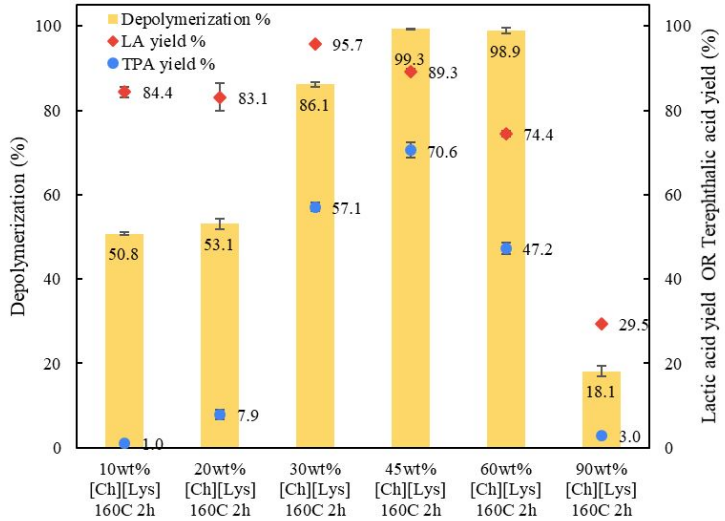


LBNL-Engineering Small Project Support

- Enhance the capabilities of scaling down and high throughput screening

One-pot conversion of polyester plastic mixtures using aqueous ionic liquid (IL)





- This study demonstrates the feasibility of applying ILs in depolymerization of PET and PLA mixtures using water as the bulk solvent
- The use of an aqueous solution of biocompatible IL allows the direct utilization of depolymerized stream in biological conversion

JBEI Joint BioEnergy Institute

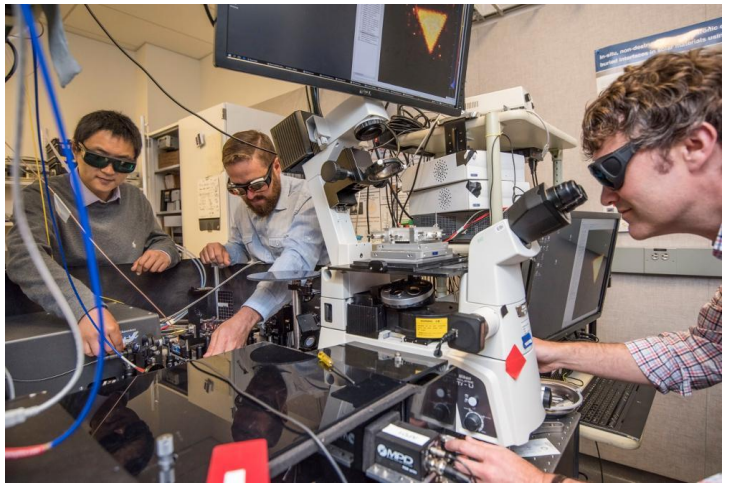
Existing Analytical Capabilities

Precision quantification and qualification of the physio-chemical characteristics of feedstocks, intermediates, and products.

Analytical Capabilities at the ABPDU

	Equipment
Chemical Compositional Analysis	HPLC with UV/Vis, RI, CAD
	HPAEC with PAD, UV/Vis
	GC-FID
	Programmable muffle furnace
	Spectrometer, FT-IR
Rheology	Rotational Rheometer
Energy Density	Bomb Calorimeter
Protein Characterization	Gel-Electrophoresis
Enzyme Activity	Micro-plate reader
Thermo properties	DSC, TGA
Sample Prep	Vacuum centrifugation, Solid phase extraction, Soxhlet extraction

Leveraging other facilities at the LBNL



Molecular Foundry

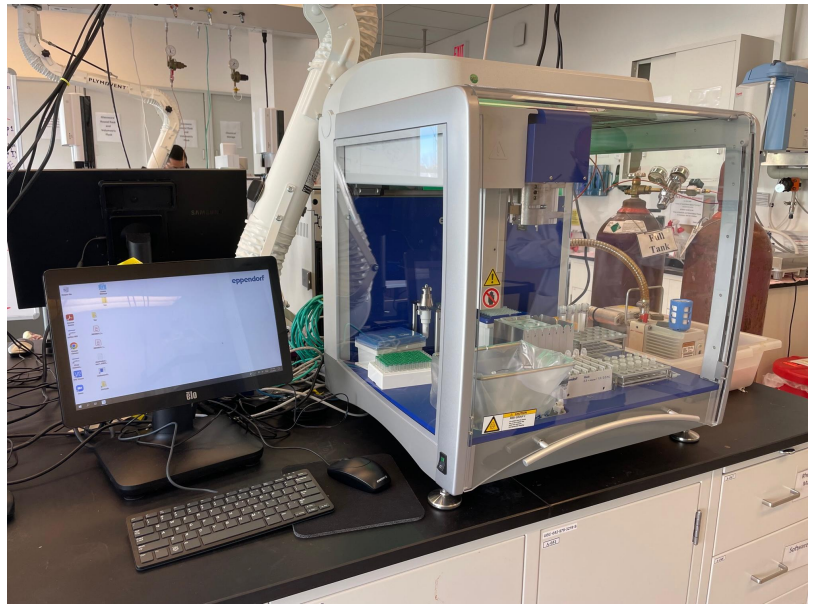
https://foundry.lbl.gov/expertise-instrumentation/

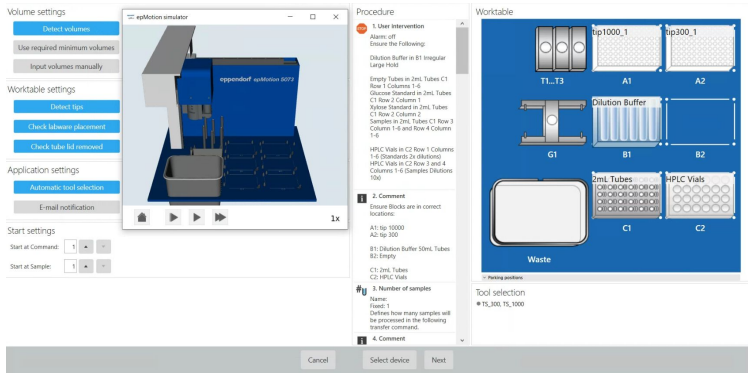
Advanced Light Source

https://als.lbl.gov/beamlines/

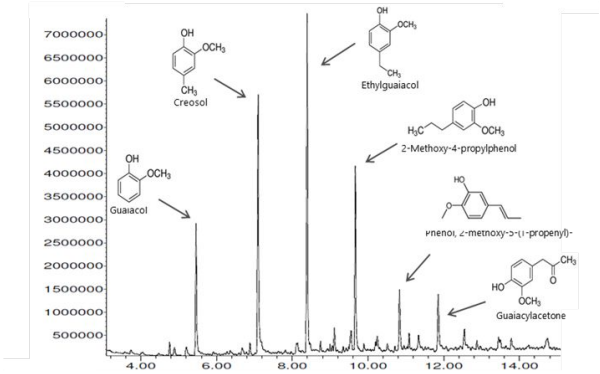
New capabilities: Liquid handler and GC-MS

Eppendorf ep*Motion*® 5073t liquid handler



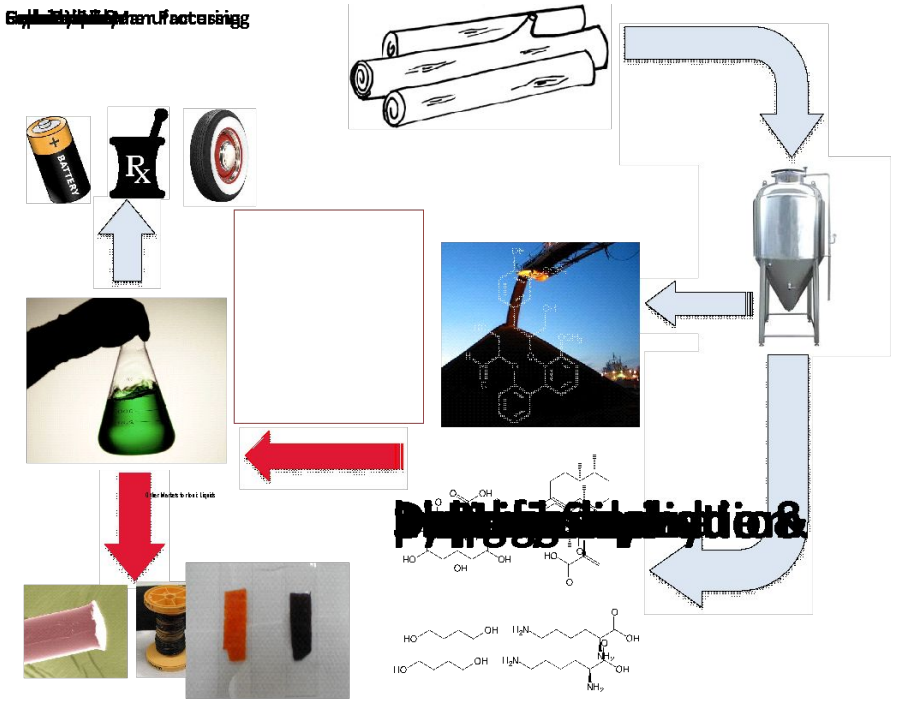


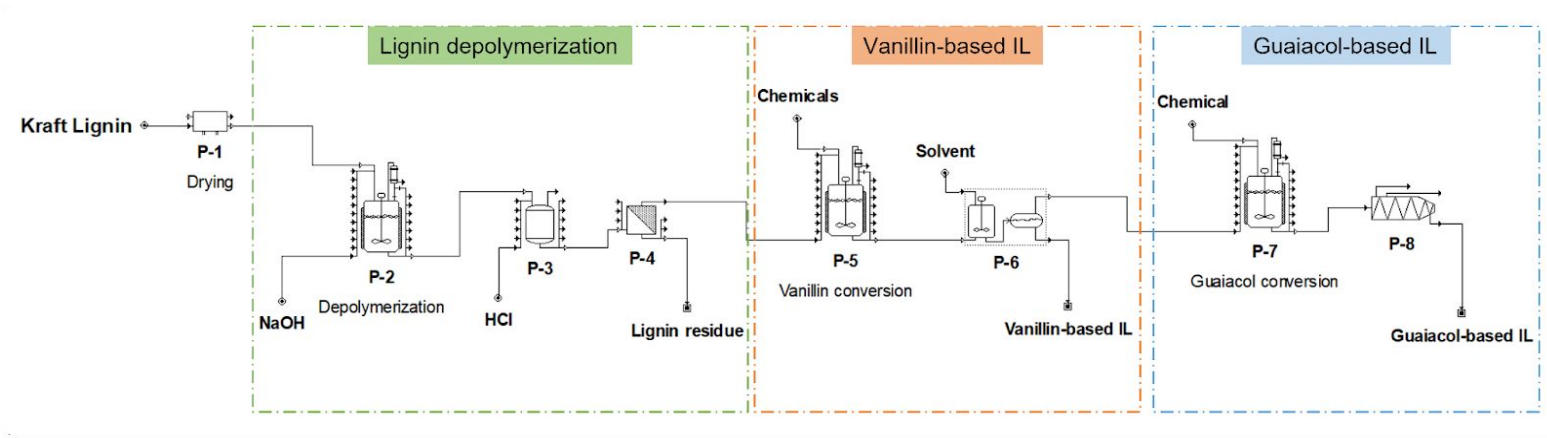
Agilent Gas Chromatography–Mass Spectrometry

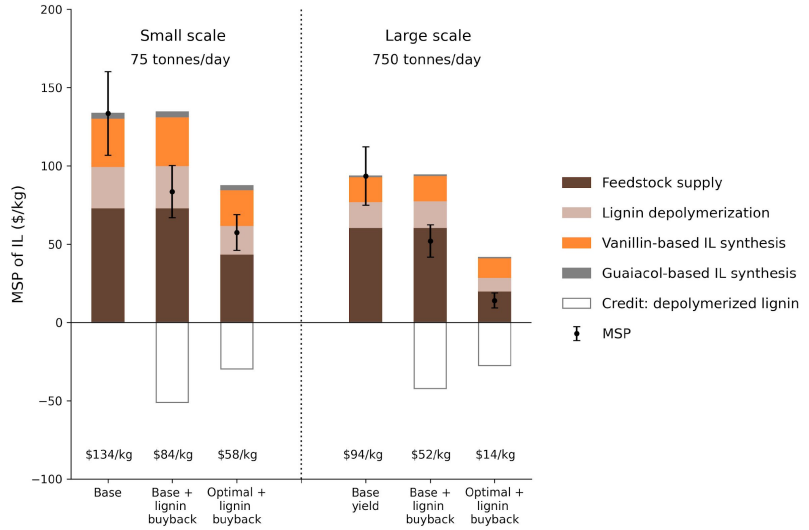


- Improve data accuracy, throughput, and sample preparation efficiency
- Capable of identifying some of the unknown chemical compounds in bioprocess

Lignin derived ionic liquids (LIL): synthesis and applications for biopolymer processing





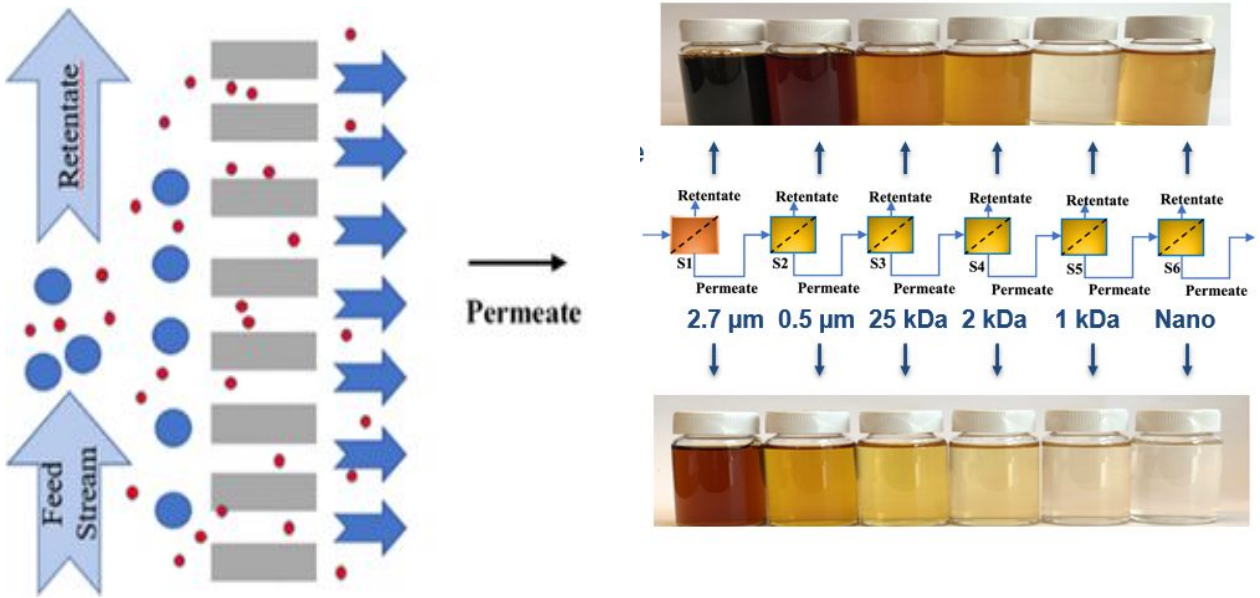


- TEA results indicate the potential of producing affordable ILs from kraft lignin and the MSP of LIL is $14/kg with optimal case
- Life-cycle assessment results show the potential to reduce GHG emissions by up to 85% relative to existing ILs ([Ch][Lys])

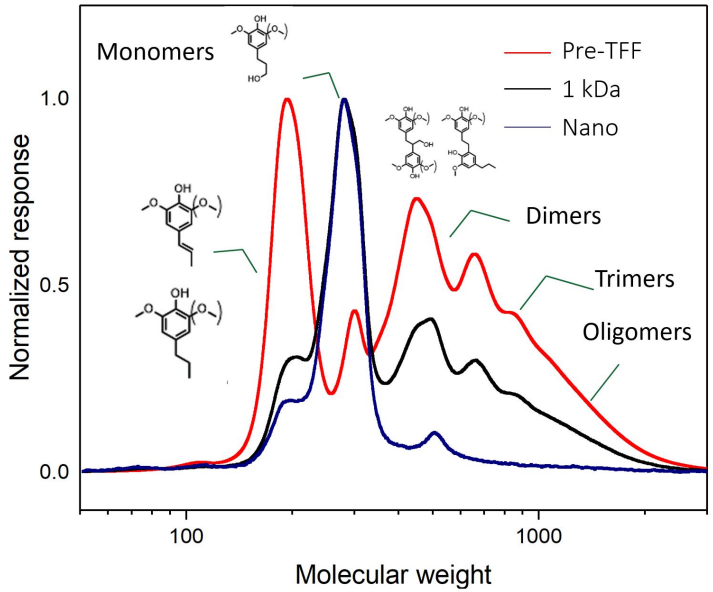
TECHNOLOGY COMMERCIALIZATION FUND
QUEENS UNIVERSITY of CHARLOTTE
ILLIUM TECHNOLOGIES
NATURAL FIBER WELDING

Lignin fractionation using Tangential Flow Filtration (TFF)

TFF



GPC analysis of permeate



TEA of the low MW lignin recovery cost

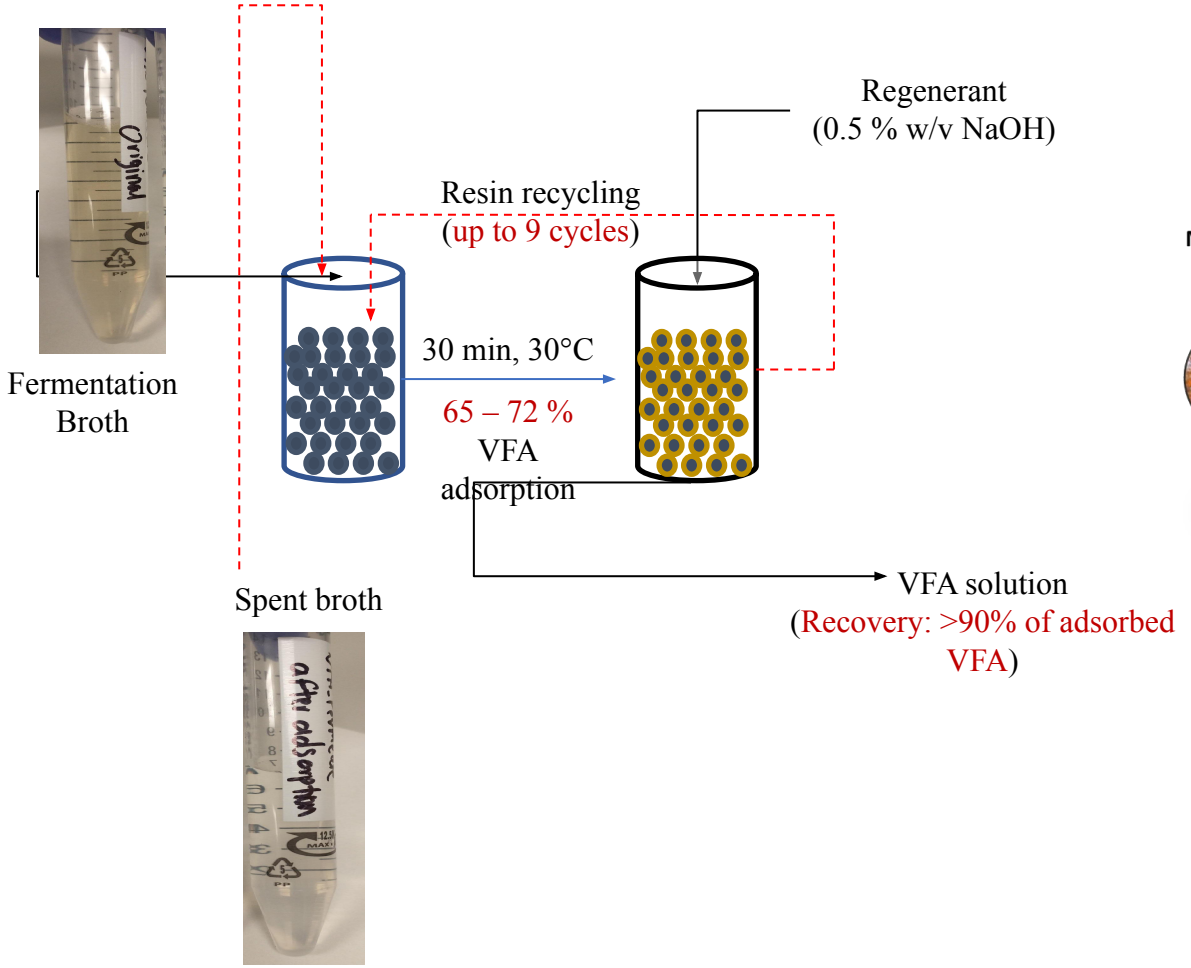
TFF system	Alfa Laval M20 (AL)			
Pretreatment catalysts	Sodium Hydroxide		Cholinium Lysinate	
Lignin (low MW + high MW) in black liquor (g/kg)	44.74		123.4	
MW cut-off	5 kDa	< 400 Da	5 kDa	< 400 Da
Permeate recovery (%)	22.5%	1.9%	36.8%	2.1%
Annual running cost ($/yr)	133,635	216,136	133,635	216,136
Annual low MW lignin production (tonne/yr)	794	67	3,580	204
Low MW lignin recovery cost ($/tonne)	168	3,225	37.3	1,058

- TFF is capable of fractionating aqueous lignin streams
- A high initial concentration of lignin in the black liquor plays a critical role in the lignin product yield and recovery cost

Yan et al. Ind. Eng. Chem. Res. 2022, 61, 12, 4407–4417

Advanced Recovery from wastewater: volatile fatty acids (VFA) and rare earth element (REE) Recovery

VFA recovery after fermentation of wastewater



REE recovery from mining-influenced water (MIW)