

IRAF-34-2410-2020	structure	location	location2	process	feedstock	capacity-LAB	capacity-Pilot	Capacity-Demo/Industri	lignin brand name	in operation	latest info date (yyyy)	info source 1	info source2	info source 3		
 lignoCOST	Aalto	Finland	Espoo	covent dissolution; precipitation	kraft lignin	yes		CPL	yes	2020	<a href="https://doi.org/10.1039/D0GC00096E">https://doi.org/10.1039/D0GC00096E</a>					
	Abo Akademi University	Finland	Turku	Isolation and fractionation; characterization, chemical derivatization	Softwood, Hardwood, Agricultural waste	Yes			OKS lignin		2018	<a href="https://doi.cnr.ncsu.edu/index.php/50series/article/view">https://doi.cnr.ncsu.edu/index.php/50series/article/view</a>	<a href="http://www.abo.fi/en/fibre-and-cellulose-news-andritz-starts-up-worlds-first-fossil-free-10-21-2020">http://www.abo.fi/en/fibre-and-cellulose-news-andritz-starts-up-worlds-first-fossil-free-10-21-2020</a>			
WG1	American Process Inc.	USA	Alpena, Michigan	Steam explosion, evaporation, hydrolysis, neutralization, and clarification	mixed hardwood	yes	yes		unknown	2016		<a href="https://www.energy.gov/eere/bioenergy/cellulosic-sugar-and-lignin-production-capabilities-rfi-responses">https://www.energy.gov/eere/bioenergy/cellulosic-sugar-and-lignin-production-capabilities-rfi-responses</a>				
Bernard Kurek	American Science and Technology Corporation	USA	Wausau, Wisconsin	Organosolv, hydrolysis, centrifugation, and granulated activated carbon	hardwood, softwood, and agricultural wastes	Yes	yes	POL-Lig; ca-LIG; K-LIG	yes	2020		<a href="http://www.amstc.org/genosolv">http://www.amstc.org/genosolv</a>				
	Andritz	Finland		classical acidification and filtration	black liquor of different feedstocks	yes	yes	A-lignin	yes	2020						
	Aristotele University of Thessaloniki	Greece	Thessaloniki	Lignin isolation (organosolv, hydrothermal-Liquid hot water coupled with lignin extraction, acid/enzymatic hydrolysis, alkaline hydrolysis); characterization, hydrogenolysis, pyrolysis (micro-fixed bed, micro-pilot fluidized bed), lignin								<a href="https://www.auct.gr/en/juni">https://www.auct.gr/en/juni</a>				
	ATIS innovation	USA	Milton, Georgia	organosolv	any lignocellulosic biomass	yes	yes		yes	2018		<a href="https://atisinnovations.com/technology/">https://atisinnovations.com/technology/</a>	<a href="https://patents.google.com/patent/US20190625">https://patents.google.com/patent/US20190625</a>			
	AVAPCO LLC	USA	Thomaston, Georgia	Fractionation (sulfur dioxide and ethanol), hydrolysis, conditioning, and clarification	softwood (southern pine), mixed hardwood chips, agricultural residues	yes	yes	yes	yes	2020		<a href="http://www.granbo.com.br/en/site/conteudos/avap-biorefinery-technology/">http://www.granbo.com.br/en/site/conteudos/avap-biorefinery-technology/</a>				
	Bio-Sep Ltd	United Kingdom		ultrasonic-assisted organosolv fractionation	different fibrous raw materials	yes	yes	?		yes	2020	<a href="https://bio-septl.com/">https://bio-septl.com/</a>				
	Bloom technology	Switzerland		aldehyde assisted fractionation		yes	yes	?		yes	2020	<a href="http://bloombiorenewables.com/">http://bloombiorenewables.com/</a>	DOI: 10.1126/science.aaf7810			
	Biomass-IP Tech	Norway	Sørbygård	Physical-chemical-based pretreatment, and enzymatic hydrolysis	softwood, hardwood, and annual crops	yes	yes	yes			2020	<a href="https://www.bwctp.com/en/molecules-extraction-and-unbleached-chemical-pulp-producing-pilot">https://www.bwctp.com/en/molecules-extraction-and-unbleached-chemical-pulp-producing-pilot</a>				
	Burgo Group SpA	Spain	Sopronhida		norway spruce	yes		Bretax ; Sartax	yes	2020		<a href="https://www.burgo.com/en/group/supressif/">https://www.burgo.com/en/group/supressif/</a>				
	Ca' Foscari University of Venice	Italy	Venice	Structural characterization, Fractionation, lignin micro and nanomaterials								<a href="https://www.unive.it/pag/fileadmin/user_upload/extr/">https://www.unive.it/pag/fileadmin/user_upload/extr/</a>				
	Caima SA (alti grup)	Portugal	Constancia	sulfite process					Mg-based lignosulphonate			<a href="http://www.caima.pt/">http://www.caima.pt/</a>				
	Centre Technique du Papier (CTP)	France	Grenoble	Lignin Characterization and Initial Black liquor ; ISO & CEN expert					Lignin preparation (Kraft, Soda and hydrolytic)			<a href="http://www.bwctp.com/en/molecules-extraction-and-unbleached-chemical-pulp-producing-pilot">https://www.bwctp.com/en/molecules-extraction-and-unbleached-chemical-pulp-producing-pilot</a>				
	Centre Technique du Papier (CTP)	France	Grenoble	Lignin preparation from black liquors (Kraft, Soda and hydrolytic) at Lab-scale (100 g) until pilot scale (5 kg) under controlled conditions; Lignin characterization and application development		yes	yes	No			2020	<a href="https://www.bwctp.com/en/molecules-extraction-and-unbleached-chemical-pulp-producing-pilot">https://www.bwctp.com/en/molecules-extraction-and-unbleached-chemical-pulp-producing-pilot</a>				
	CH-Bioforce	Finland	Raisio	pressured hot water extraction and mild soda cooking (isolation)	wood chips	yes	No			yes	2020	<a href="https://ch-bioforce.com/lignin/">https://ch-bioforce.com/lignin/</a>				
	CMO-IPB	Portugal	Braganca	Lignin valorization into polyols and polyurethanes (Integrated process with vanillin/syringaldehyde - LSRE-LCM)								<a href="https://cmo.ipb.pt/web/">https://cmo.ipb.pt/web/</a>				
	CIMV	France		Acetic and formic acid based organosolv fractionation process	straws from cereal crops; sugar cane bagasse, corn stovers or fibrous plant stalks, hardwood agricultural residues such as corn stover, wheat straw, sugarcane bagasse and straw, barley straw, and rice	yes	yes	?	Biologin	yes	2019	<a href="http://www.biomass-chemistry.com/index.php/cmvt-2">http://www.biomass-chemistry.com/index.php/cmvt-2</a>				
	Clariant Corporation	Bulgaria		Chemical-free steam explosion pre-treatment, and enzymatic hydrolysis using proprietary enzymes	agricultural and forest products	yes	yes	Yes	lignin for burning	yes	2020	<a href="https://www.clariant.com/en/innovation/innovation-spotlight-videos/uniquely">https://www.clariant.com/en/innovation/innovation-spotlight-videos/uniquely</a>	<a href="https://lignox.eu/consortium/">https://lignox.eu/consortium/</a>	<a href="https://www.clariant.com/en/company/contacts-and-locations/key-sites/romania">https://www.clariant.com/en/company/contacts-and-locations/key-sites/romania</a>		
	Dawn technology	Netherlands	Delfzijl	Zamboni process; concentrated hydrochloric acid	agricultural and forest products	yes	?			yes	2020	<a href="https://www.aventum.com/technologies/dawn/">https://www.aventum.com/technologies/dawn/</a>				
	Domsjö Fabrikier AB	Sweden	Örnsköldsvik	Sulfite process	softwood	yes				yes	2020	<a href="https://www.domsjoe.adyplus.com/en/sites/lignine.aspx">https://www.domsjoe.adyplus.com/en/sites/lignine.aspx</a>	<a href="https://www.domsjoe.com/fr/noe-produits/biomateriaux/lignine-BioChoice">https://www.domsjoe.com/fr/noe-produits/biomateriaux/lignine-BioChoice</a>			
	Domtar Corporation	Canada		kraft	southern pine	yes		biochoice	yes	2020						
	EB Laboratories, LLC	USA	Lungwood, Florida	Hydrolysis with solid catalyst	29 hundred grassy and woody crops	yes	yes			yes	2020	<a href="https://www.allianceebc.com/subsidiaries/ebl/">https://www.allianceebc.com/subsidiaries/ebl/</a>				
	Ethanol Technologies Limited	Australia	Dungog, New South Wales	Concentrated sulfuric acid hydrolysis	Sugar cane bagasse, softwood (radiata pine)	Yes	Yes	No		yes	2020	<a href="https://www.ethetc.com.au/">https://www.ethetc.com.au/</a>				
	Fibrilia Innovations (formerly lignol)	Canada		see lignol process								<a href="https://www.fibrilia.ca/wp-content/uploads/2019/01/3-jean-Hamel-FPInno-Lignin-2018-Dec.pdf">https://www.fibrilia.ca/wp-content/uploads/2019/01/3-jean-Hamel-FPInno-Lignin-2018-Dec.pdf</a>	<a href="https://item.fi/documents/1410877/20549047/">https://item.fi/documents/1410877/20549047/</a>	<a href="https://chempolis.com/">https://chempolis.com/</a>		
	FInnovations	Canada	Point-Claire	Proprietary TMP-Bio, including pretreatment stage combining mechanical action and mild chemical treatment	Hardwoods	Yes	Yes	yes	LignoForce Lignin; H-Lignin; K-Lignin;	unknown	2018					
	Fraunhofer	Germany		Low-temperature organosolv fractionation process based on the use of ketones (Fabrida process)	Hardwood, herbaceous, food-processing residues	yes	yes	no			2018					
	Futurool - Axens	France		steam explosion, enzyme hydrolysis	miscanthus; agricultural residues	yes	yes	yes			2020	<a href="https://www.axens.fr/product/process/">https://www.axens.fr/product/process/</a>	<a href="https://www.lirrae.fr/biomassforthefuture/Communication/Actualites/INA-SELECTS-FUTUROL/">https://www.lirrae.fr/biomassforthefuture/Communication/Actualites/INA-SELECTS-FUTUROL/</a>			
	Glycos Biotech LLC	USA	Athens, Georgia	Ammonia fiber expansion pretreatment (AFEX) and commercial enzymes	Corn stover; wheat straw, switchgrass, sugarcane bagasse, rice straw, forage sorghum	Yes	Yes	No	UHSL lignin		2016	<a href="https://www.glycos-energy.com/sites/glycos-energy/2016/07/26/our-new-enzyme-capability-and-responses">https://www.glycos-energy.com/sites/glycos-energy/2016/07/26/our-new-enzyme-capability-and-responses</a>				
	GransBio	Brazil	Sao Paulo	Hydrothermal pretreatment and enzymatic hydrolysis	Sugarcane residues	No	Yes	No			2016	<a href="https://www.energy.gov/sites/prod/files/2018/10/TS1533.pdf">https://www.energy.gov/sites/prod/files/2018/10/TS1533.pdf</a>				
	GreenValue SA	India	Switzerland	aqueous sodium hydroxide extraction	wood	yes	yes		sulphur free lignins	yes	2020	<a href="http://www.greenvalue-sa.com">www.greenvalue-sa.com</a>	<a href="http://www.bio-based.eu/BiB/">http://www.bio-based.eu/BiB/</a>			
	ICMI	USA	St. Joseph, Missouri	Patent pending dilute acid pretreatment, enzymatic hydrolysis, and filter press	sorghum, corn stover, bagasse, wood chips	Yes	Yes	Yes			2016	<a href="http://bio-de-faq.com/0001613_lignin.pdf">http://bio-de-faq.com/0001613_lignin.pdf</a>	<a href="http://www.estif.gov/biblio/200006013-lignin.html">http://www.estif.gov/biblio/200006013-lignin.html</a>	<a href="http://www.valmet.com/pulp/other-value-chain-processes">http://www.valmet.com/pulp/other-value-chain-processes</a>		
	Ingenvevry Corporation	USA	South Carolina	sulfurification of lignins	westwoood Kraftplex lignin	yes			Kraftplex	2020		<a href="http://www.ingenvevry.com/products/kraftplex/">http://www.ingenvevry.com/products/kraftplex/</a>				
	Inventiv Group	Finland		Kraft sulfification process by CO2 assisted acid precipitation + specific acid washing	softwood/hardwood black liquor stream	yes			Lignobiose	yes	2020	<a href="http://patents.google.com/patent/US9382389B2/en">http://patents.google.com/patent/US9382389B2/en</a>	<a href="http://www.valmet.com/pulp/other-value-chain-processes">http://www.valmet.com/pulp/other-value-chain-processes</a>			
	Institute of Bio- and Geosciences - Plant Sciences	Germany		Organosolv	perennial plants	yes	no	no	OrganoCat	yes	2020	doi: 10.3390/molecules25153330.				
	Institute of Microbiology of the Czech Academy of Sciences	Czech Republic	Prague	Oxidases for valorization of lignin monomers												
	Institute of Wood Chemistry, lignin chemistry lab	Latvia	Riga	Targeted physical - chemical modification of lignin structure, properties, functionality, PUR foam production; siliceous-containing fertilizers production; biochar fertilizers production;	Commercial, technical and laboratory lignins of different origin, plant polyphenols, softwood and	Yes	Yes	No			2020		<a href="https://imbucas.cz/en/">https://imbucas.cz/en/</a>			
	Iowa State University	USA	Ames, Iowa	Autothermal bubbling fluidized bed pyrolysis; sugars concentrated using evaporation or reduced to glucose and xylose using acid hydrolysis	Woody biomass (e.g., red oak and pine) and herbaceous feedstocks (e.g., corn stover and switchgrass)	Yes	Yes	Yes			2020	<a href="https://www.biorenew.iastate.edu/research/thermic-chemical/fastpyrolysis/">https://www.biorenew.iastate.edu/research/thermic-chemical/fastpyrolysis/</a>				
	Kabin S.A.	Brazil	Telemaco Borba-PR	Kraft Lignin - LignoBoost XS		Yes	Yes	Yes			2020	<a href="http://www.kabin.com.br">http://www.kabin.com.br</a>				
	Leaf Resources Ltd.	Australia	Darra, Queensland	glycell process (low temperature and pressure) + enzyme	U.S. mixed southern hardwood, eucalyptus, bagasse, empty fruit bunch	Yes	Yes	No			2018	<a href="https://leafresources.com.au/">https://leafresources.com.au/</a>				
	Lignin Enterprises (Liquid Lignin)	USA	Charleston, SC	slip recovery process (fully liquid phase precipitation)	various black liquors	yes	yes	?	liquid-lignin	yes	2018	<a href="https://www.wur.nl/en/Research-Projects/Iceniing/2011/2013/">https://www.wur.nl/en/Research-Projects/Iceniing/2011/2013/</a>	<a href="https://www.wur.nl/en/Research-Projects/Iceniing/2011/2013/">https://www.wur.nl/en/Research-Projects/Iceniing/2011/2013/</a>	<a href="https://doi.org/10.1080/02773815.2015.1039545">doi.org/10.1080/02773815.2015.1039545</a>		
	Lignin platform	Netherlands	Wageningen	biomass fractionation product purification; scale-up	aspen, poplar, cotton wood	yes	yes					<a href="https://www.wur.nl/en/Research-Projects/Iceniing/2011/2013/">https://www.wur.nl/en/Research-Projects/Iceniing/2011/2013/</a>	<a href="https://www.wur.nl/en/Research-Projects/Iceniing/2011/2013/">https://www.wur.nl/en/Research-Projects/Iceniing/2011/2013/</a>			
	LSRE-LCM	Portugal	Porto	Lignin valorization into vanillin and syringaldehyde (Integrated process with polyols/polyurethanes - CMU/FPB)		yes						<a href="https://www.lsre-lcm.eu/pdf/sr_de_faq.pdf">https://www.lsre-lcm.eu/pdf/sr_de_faq.pdf</a>				
	Mercer (Zellstoff- und Papierfabrik Rosenthal)	Germany		Kraft lignin								<a href="https://mercer.com/products-services/">https://mercer.com/products-services/</a>				
	MetGen Oy	Finland	Kaarina	Enzymatic technologies for hydrolysis, sugar conversion (fructose, glucose) and lignin refining (MEININ™) to address whole bioprocessing value-chain; MEININ™ lignin refining process is lignin alogistic, operating in alkaline aqueous medium (pH 10-12) where enzyme will oxidize and depolymerize lignin. Subsequently cascading membrane operations is	Any type lignocellulosic biomass	yes			Metrin Micro; Metrin Ultra; Metrin Nano	yes	2020	<a href="https://www.metgen.com/lignin-products/">https://www.metgen.com/lignin-products/</a>	<a href="https://www.metgen.com/metnin-technologies/">https://www.metgen.com/metnin-technologies/</a>			
	Metsa Group	Finland		see also Fortum - use of lignin and derivatives							2020	<a href="https://www.expandfibre.com/">https://www.expandfibre.com/</a>				
	National Renewable Energy Laboratory	USA	Golden, Colorado	Pretreatment at elevated temperatures using acid or caustic catalyst or autophydrolysis; enzymatic hydrolysis on whole pretreated slurry or on washed pretreated solids after removing residual liquor; if acid pretreatment, then hemi-cellulosic sugars may be recovered prior to hydrolysis; enzymatic hydrolysis using readily available enzyme cocktails; deacetylation and mechanical refining are optional pretreatments	Any lignocellulosic biomass and presorted municipal solid waste lignocellulosic material	Yes	Yes	Yes								
	Nippon Paper Industries	Japan		bamboo, palm, grain refining; hydrolympho, pyrolysis and biotechnological processes; Cooperation with SEKA&B, Biorefinery lignin - pilot		yes	Yes				2020	<a href="https://www.nipponpapergroup.com/english/research/">https://www.nipponpapergroup.com/english/research/</a>	<a href="http://www.processum.se/nipponpaper/">http://www.processum.se/nipponpaper/</a>			
	Processum Biorefinery	Sweden		see booregard		Yes	Yes	Yes			2020	<a href="https://www.processum.se/nipponpaper/">https://www.processum.se/nipponpaper/</a>	<a href="http://www.processum.se/nipponpaper/">http://www.processum.se/nipponpaper/</a>			
	Rayonier Advanced Materials	USA	Fernandina beach, Florida	bamboo							2019	<a href="https://www.pulpnews.com/20190804/6647/bor/">https://www.pulpnews.com/20190804/6647/bor/</a>				
	Renfuel	Sweden		bath of bio-oil and catalytic substances	black liquor side streams	yes					2020	<a href="https://renfuel.se/">https://renfuel.se/</a>	<a href="http://renfuel.se/technology/?lang=en">http://renfuel.se/technology/?lang=en</a>			
	Renmatix, Inc.	USA	Kennesaw, Georgia	Proprietary two-step process: hot water extraction + auto hydrolysis followed by a supercritical water process	Woody biomass (hardwood and softwood), agricultural	Yes	Yes	Yes			2020	<a href="https://renmatix.com/plantwide-process/">https://renmatix.com/plantwide-process/</a>				
	Resolute forest products	Canada	Thunder bay	Thermomechanical and biological - TMB Big process		yes					2020	<a href="https://resolute-melioration.com/Plantwide-and-dryerline-in-thermomechanical-Pulp-Bio-2017.pdf">https://resolute-melioration.com/Plantwide-and-dryerline-in-thermomechanical-Pulp-Bio-2017.pdf</a>				
	Rise LignoCity	Sweden		Open innovation site for lignin - upscaling and support to reach the market. Production capacity about almost 1 tonne-SW kraft lignin/hour. Flexible process with possibilities to use different black liquors from customers or the black liquor we have		yes						<a href="http://www.rise-ligno-city.se/">http://www.rise-ligno-city.se/</a>	<a href="http://www.rise-ligno-city.se/">http://www.rise-ligno-city.se/</a>			
	SAPP North America	USA	Westbrook, Maine	Pre-hydrolysis kraft process	Hardwoods including eucalyptus, aspen, and maple	Yes	Yes	No				<a href="https://www.sappi.com/fi/lignosulphonate-application-areas">https://www.sappi.com/fi/lignosulphonate-application-areas</a>				

