

Draft Technical Skills for Biofuels Technicians

Technical skills, knowledge, and abilities are those areas of expertise which biofuels technicians must have in order to perform a given key activity with excellence. A collection of skills, knowledge, abilities, and tools make up competencies. Skills refer to proficiency in an applied activity. This activity could be physical, mental, or interpersonal in nature. Knowledge is a particular set of information. Abilities are broad human characteristics that result from natural talent, education, or experience. Tools are materials, equipment, and implements that a biofuels technician must be able to use competently to meet the requirements of the job. The table identifies skills needed in biofuels, in general, and in each biofuels sector. The information in the table will help to determine a core set of skills across these sectors.

R	Required Skills	p	Preferred Skills
	Mechanical Skills		Biofuels
			Biomaterials, Biopolymers, Bio-Based Chemicals
	Operate distributed control systems (DCS)	R	R
	Troubleshoot and perform basic maintenance and repair on electromechanical devices	R	R
	Read & interpret piping & instrumentation diagrams (P&ID)	p	R
	Operate programmable logic controllers (PLC)	p	R
	Interpret electrical schematics		R
	Identify and maintain different types of pumps and drives	p	R
	Understand technical information (manuals, blueprints, diagrams)	R	R
	Handle large systems	p	p
	Operate and monitor job-specific equipment and systems	R	R
	Use the following:		
	• Basic hand tools	R	R
	• CO ₂ systems	p	p
	• H ₂ O systems (RO, waste coolers, cooling)	p	R
	• Bioreactor, chemical reactor, and fermentation systems	R	R
	• Vacuum systems		
	• Filtration, separation, and purification systems	R	R
	• Milling systems		
	• Hydro heaters and jet coolers		
	• Ovens and dryers	p	p
	• Pallet jacks and forklifts		
	• Heat exchangers	p	p
	• Sieves		p
	• Evaporators		R
	• Agitation systems		p
	• Conveyor systems		
	• Automotive vehicles (including manual drive vehicles and towing a trailer)		p
	• Pneumatic systems		p
	Measurement and Calibration Skills		Biofuels
			Biomaterials, Biopolymers, Bio-Based Chemicals
	Operate scales and balances	R	R
	Perform unit conversion	R	R
	Knowledge of how to calibrate an instrument	R	R

Algae and Microbial Systems	Bioprocessing	Agbiotech	Forestry Resources
R	R	R	
R	R	R	R
p	R	R	p
p	R	R	p
p	p	p	p
p	R	R	R
R	R	R	R
R	R	p	p
R	R	R	R
R	R	R	R
R	R	R	p
R	R	R	p
R	R	R	p
R	p	p	p
R	R	R	R
	p	p	R
	p	R	p
R	p	p	p
	p	p	p
R	R	p	p
	p	R	p
p	p	R	p
R	R	R	p
p	p	R	R
p	p	p	R
	R	R	R

Algae and Microbial Systems	Bioprocessing	Agbiotech	Forestry Resources
R	R	R	R
R	R	R	R
R	R	p	p

Chemistry and Biology Laboratory Skills	Biofuels	Biomaterials, Biopolymers, Bio-Based Chemicals	
Basic performance of the following:			
• Aseptic techniques	R	R	
• Chemically clean techniques	R	R	
• Culture methods (plating, replication, maintenance)	p	p	
• Serial dilutions	R	R	
• Media and buffer preparation	R	R	
• Chemical and basic lab inventory	R	R	
• Sampling	R	R	
• Cryopreservation	p	p	
• Cell counting	R	p	
• Assay design		p	
• qPCR		p	
• Genotyping		p	

Instrumentation Skills	Biofuels	Biomaterials, Biopolymers, Bio-Based Chemicals	
Basic operation, maintenance, and troubleshooting of:			
• Autoclave	R	R	
• Conductivity meter	R	p	
• Centrifuge	R	R	
• Shaker and water bath	R	R	
• Incubator	p	R	
• Dissolved oxygen meter	R	p	
• Temperature probe	R	R	
• pH meter and pH probe	R	R	
• Turbidity probe	p	p	
• Light meter	p	R	
• Autopipettor and pipettes	R	R	
• Microscopes	p	p	
• Autotitrator	R	R	
• Ovens (drying and ashing)	R	R	
• Hydrometer	R	p	
• Viscometer	R	R	
• Sieve	R	R	
• Spectrophotometer	R	R	
• Chromatographs	R	p	
• Gas chromatography	R	p	
• Liquid chromatography/high-performance liquid chromatography (HPLC)	R	R	
• Spectrometers (near infrared [NIR], atomic absorption [AA], inductively coupled plasma [ICP], mass [MS])	p	R	
• Autohemocytometer	p	p	
• Flow cytometer	p	p	
• Flow meter	R	R	
• Flash point tester	R	p	
• Identification key	p		
• Protein analyzer	p	p	
• Bulk density analyzer	p	R	
• Total organic content (TOC) analyzer and carbon-nitrogen-sulfur analyzer	p	p	
• Vacuum apparatus	p	R	



Algae and Microbial Systems	Bioprocessing	Agbiotech	Forestry Resources
R	R	R	p
R	R	R	p
R	R	R	p
R	R	R	p
R	R	R	
R	R	R	p
R	R	R	R
R	p	R	p
R	R	R	p
R	p	R	p
p	p		p
R	p	p	p

Algae and Microbial Systems	Bioprocessing	Agbiotech	Forestry Resources
R	R	R	
R	R	R	p
R	R	R	p
R	R	R	
R	R	R	
R	R	R	p
R	R	R	p
R	R	R	p
R	p	R	p
R	R	R	p
R	R	R	p
R	p	p	p
R	p	R	p
p	p	R	p
p	p	p	p
R	p	R	p
R	R	R	R
R	R	R	p
R	p	R	R
R	R	R	p
R	p	p	p
R	p	p	p
R	R	p	p
	p	p	R
p	p	p	R
R	R	R	R
p	p	R	p
p	p	R	R
R	p	R	R



Process Engineering Skills	Biofuels	Biomaterials, Biopolymers, Bio-Based Chemicals
Develop, follow, and optimize a workflow	R	R
Read and interpret process flow diagrams (PFD)	R	R
Minimize wasted energy, resources, and time	R	R
Know how to develop and follow a standard operating procedure (SOP)	R	R
Basic quality control related to feedstock, process, and products	R	R

Laboratory and Workplace Safety Skills	Biofuels	Biomaterials, Biopolymers, Bio-based Chemicals
Know how to:		
• Perform first aid and cardiopulmonary resuscitation (CPR)	p	R
• Perform lock-out and tag-out	R	p
• Read and interpret safety and material signage and general safety nomenclature	R	R
• Implement acid and base spill procedures	R	R
• Handle hazardous waste and materials according to chemical hygiene plan	R	R
• Monitor ISO and HAACP	R	R
• Follow Occupational Safety and Health Administration regulations (OSHA)	R	R
• Comply with HAZMAT/EHS/HAZCOM	R	R
• Prevent explosions	R	R
• Read a material safety data sheet (SDS)	R	R
• Don personal protective equipment (PPE)	R	R
• Dispose of chemical, biological, and hazardous materials properly	R	R
• Use of a fume hood	R	R
• Prepare a vehicle for safe transport including rigging and handling	p	p
Work in the following areas:		
• High decibel	R	R
• Electrical	R	R
• Hot works	R	R
• Steam systems	R	p
• Pressurized gases	R	R
• Bulk machinery	R	R
• Confined spaces	R	p

Data Management Documentation and Communication Skills	Biofuels	Biomaterials, Biopolymers, Bio-Based Chemicals
Data Management	R	R
• Record and enter data (keep a written and/or electronic laboratory notebook)	R	R
• Report data (for internal laboratory use, presentations, publications)	R	R
• Perform bioinformatics, data analysis, and trends analysis	R	R
Computer Proficiency	R	R
• Use word processing and spreadsheet programs	R	R
• Operate basic data management system	R	R
• Perform Internet research	R	R
• Communicate in writing (reports and email) with proper etiquette	R	R
• Interact via online social networks	p	

