

Annex 9A

Understanding the Basics and Supply Potential for Biofuels

September 2021

Presented by



Based in Switzerland, Square Co publishes professional analyses designed to help players active on alternative fuels markets (biodiesel and advanced fuels) to gain a deeper understanding of regulatory frameworks, market trends and industry developments.

Square Co also publishes on a weekly basis a set of independent price assessments for each quality of biodiesel that are very well respected on the global market. As pure analysts we don't take any position on the markets, a specificity that allows us to enjoy a reputation of high reliability and full independence.

Square Co customers include oil companies, biofuel producers, trading companies and governmental bodies located all around the world.

Conclusion

Table 16: Potential of solid feedstocks

	EFB	Wheat Straw	Barley straw	Corn Stover	Bagasse
Feasibility	Low	Medium	Medium	Medium	High
Feedstock collection complexity	Easy	Very complex	Very complex	Very complex	Easy
Production	No plant running as of today, neither project announced	Some projects under construction - engineer phase or running	Some projects under construction - engineer phase or running	Some projects under construction - engineer phase or running	Units already running in Brazil
Capex Million EUR	+/- 250	+/- 250	+/- 250	+/- 250	+/- 250
Biofuel technology installation	yes	yes	yes	yes	yes
Annual Capa. prod equivalent	50kt	50kt	50kt	50kt	50kt
Comments	High capex investment and vertically integrated projects	High capex investment and complexity for securing the feedstocks	High capex investment and complexity for securing the feedstocks	High capex investment and complexity for securing the feedstocks	High capex investment and vertically integrated projects



Table 17: Potential of liquid feedstocks

	CTO	Tall Oil Pitch	Brown Liquor	EFB Oil	POME Oil	SBE oil	Grape Marc	Wine Lees
Feasibility	High	High	High	High	High	Medium	Medium	Medium
Feedstock collection complexity	Easy	Easy	Easy	Medium	Medium	Medium	Complex	Complex
Production	WVO plants running in Scandinavia is the proof the technology is working	The feedstock seems able to be processed into Biofuels	Different projects are running in Europe. The technology looks ready	No real investment need on Farm WVO side. Investment to be done on EFB recovery, product is not a fuel	No real investment need on Biofuel WVO side. Refining or cleaning the product	Complexity for collecting the SBE oil and treated it as a "good enough" palm oil for biodiesel/WVO	Possible but complex. After distillation, another step to a rectification column is required	Complex due to low availability



Table 18: Summary of the potential supply for each feedstock and associated fuel (KT)

	Feedstock	Supply (base 2020)	Indicative Biofuel Prod. Yield	Equivalent biofuel	Category of biofuel (most likely)
LIQUID	CTO	1 901	80%	1 521	WVO
	Tall Oil Pitch	475	80%	-	WVO (if all CTO used directly)
	Brown Liquor	615	70%	431	Ethanol
	EFB oil	150	80%	120	FAME
	POME oil	1 518	80%	1 214	FAME
	SBE oil	140	70%	98	FAME
	Grape Marc	8 513	40%	4 011	Ethanol
	Wine lees	587	10%	118	Ethanol
	Total liquid	13 827		8 548	
SOLID	Wheat Straw	350 342	14%	49 048	Ethanol
	Barley straw	66 505	14%	9 311	Ethanol
	Corn Stover	320 000	14%	44 800	Ethanol
	Bagasse	304 758	10%	30 476	Ethanol
	EFB	47 100	10%	6 123	Ethanol
	Total solid	1 088 695		147 694	

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1. Introduction

1.1 Context and objectives of the study

The list of eligible wastes to biofuels incentives at an EU level was first published in the Annex 9 of the ILUC Directive (1513/2015) in September 2015, before being re-printed without any change into the RED2 Directive (2001/2018) in December 2018.

Although the biofuel industry has been dealing with parts A and B of this list for the past six years, the real knowledge of many feedstocks remains limited, not to say missing.

If supply chains and economics of UCO and Tallow C1 are well understood by market players, the picture of most of the 9A feedstocks remains blur. Their classification as “advanced” feedstocks by itself suggests intricacy as only wastes/residues/by-products challenging to transform with existing technologies have been selected.

Square Co teamed up with outsourced experts to examine all the 9A feedstocks potentially suitable for biofuels production (excluding biogas) and determine their level of complexity, maturity and availability. Understanding how and by which industry these wastes were generated constituted the backbone of our work.

This study aims at proposing a clearer vision of the origin of the most promising 9A feedstocks, explaining their basics and estimating their potential supply in the coming decade.

The result of our preliminary work led to the selection of 13 feedstocks that hold a potential with technologies already mastered by biofuels companies. All the others are either too confidential, not mature enough or too complex to cover.

This extended research brings an insight into the most promising 9A feedstocks, with a clear explanation of the wastes/residues/by-products streams, challenges associated with their production and a transparent calculation of their potential supply.

Few weeks before the expected publication of an update of the Annex 9, we propose to all biofuel stakeholders to finally gain a clearer vision of the “old” list, with the perspective to serenely apprehend the real potential of each advanced pathway. From 2022, when advanced sub-targets will be enforced in most of the EU markets, navigating the complex business environment of biofuels won't be achieved without a deeper knowledge of the 9A raw materials.

2. List of Advanced Feedstocks & Selection Covered by the Study

2.2 Classification of 9A feedstocks into 8 sub-categories

Table 2: Annex 9A displayed by origin of the feedstock

	LETTER UNDER 9A	MAIN TECHNOLOGY
1. WASTES FROM THE PULP AND FORESTRY INDUSTRY		
Tall oil (CTO)	O	HVO
Tall oil pitch	H	Fame/HVO
Brown liquor	O	Ethanol/Biogas
Sawdust	O	Ethanol
Other non-food cellulosic material	P	Ethanol
Other ligno-cellulosic material except saw logs and veneer logs	Q	Ethanol
2. WASTES FROM THE PALM INDUSTRY		
Palm Oil Mill Effluent (POME)	G	Fame/HVO
Spent Bleaching Earth Oil (SBEO)	G	Fame/HVO
Empty Fruit Bunches Oil (EFB oil)	G	Fame/HVO
Empty Fruit Bunches (EFB)	G	Ethanol
3. WASTES FROM THE SUGAR INDUSTRY		
Bagasse	J	Ethanol
4. WASTES FROM THE CEREALS INDUSTRY		
Wheat and Barley Straw	E	Ethanol
Corn Stover	E	Ethanol
Husks	M	Ethanol
Nutshells	L	Ethanol
Cobs cleaned of kernels of corn	N	Ethanol
5. WASTES FROM THE WINE INDUSTRY		
Grape Marc	K	Ethanol
Wine lees	K	Ethanol
6. ALGAE		
Cultivated on land in ponds or photobioreactors	A	Fame/HVO
7. WASTES FROM THE PROCESSING FOOD INDUSTRY		
Whey	D	Ethanol
Residues from breweries	D	Fame/HVO/Ethanol
Residues from bakeries	D	Fame/HVO/Ethanol
Coffee Pulp	D	Fame/HVO/Ethanol
Potato Juice	D	Fame/HVO/Ethanol
Other food wastes	D	Fame/HVO/Ethanol
8. OTHER UNCLASSIFIED WASTES		
Biomass fraction of municipal wastes	B	Fame/HVO/Biogas
Animal manure and sewage sludge	F	Biogas

Some companies process multiple feedstocks i.e. among those 1.200 ISCC feedstocks certifications, there is 1.014 unique certificates ID hold by 983 unique companies.

The study is delivered with an **Annex in Excel form**, displaying the details (company name, country and statute) of all ISCC valid certificates mentioned in table 20.

2. List of Advanced Feedstocks & Selection Covered by the Study



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3. Wastes from the Pulp Industry



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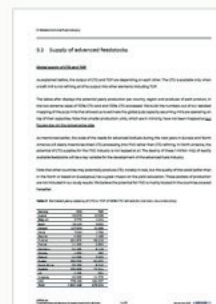
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4. Wastes from the Palm Oil Industry



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[illegible]

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QUESTION Which of the following is not a function of the *pharynx*?

ANSWER *It is the site of the vocal folds.*

EXPLANATION The pharynx is a muscular tube that serves as a common pathway for food and air. It is located at the back of the mouth and is divided into three parts: the nasopharynx, oropharynx, and laryngopharynx. The vocal folds are located in the larynx, which is part of the respiratory system.

REFERENCE *Textbook of Anatomy and Physiology, 12th Edition, Chapter 15: The Respiratory System, Section 15.1: The Larynx and Trachea.*

QUESTIONS

1. Which of the following is not a function of the *pharynx*?
2. The *pharynx* is a muscular tube that serves as a common pathway for food and air. It is located at the back of the mouth and is divided into three parts: the nasopharynx, oropharynx, and laryngopharynx.
3. The vocal folds are located in the larynx, which is part of the respiratory system.
4. The *pharynx* is a muscular tube that serves as a common pathway for food and air. It is located at the back of the mouth and is divided into three parts: the nasopharynx, oropharynx, and laryngopharynx.

ANSWER 1. Which of the following is not a function of the *pharynx*?

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[illegible]

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[illegible]

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Kalkulation der Kosten für die Produktion eines Produktes									
Berechnung der Kosten für die Produktion eines Produktes (in €)									
Produkt	Material	Fertigung	Verwaltung	Vertrieb	Gesamt	Material	Fertigung	Verwaltung	Vertrieb
Produkt A	100	200	50	20	370	100	200	50	20
Produkt B	150	300	75	30	555	150	300	75	30
Produkt C	200	400	100	40	740	200	400	100	40
Produkt D	250	500	125	50	925	250	500	125	50
Produkt E	300	600	150	60	1110	300	600	150	60
Produkt F	350	700	175	70	1300	350	700	175	70
Produkt G	400	800	200	80	1480	400	800	200	80
Produkt H	450	900	225	90	1665	450	900	225	90
Produkt I	500	1000	250	100	1850	500	1000	250	100
Produkt J	550	1100	275	110	2035	550	1100	275	110
Produkt K	600	1200	300	120	2220	600	1200	300	120
Produkt L	650	1300	325	130	2405	650	1300	325	130
Produkt M	700	1400	350	140	2590	700	1400	350	140
Produkt N	750	1500	375	150	2775	750	1500	375	150
Produkt O	800	1600	400	160	2960	800	1600	400	160
Produkt P	850	1700	425	170	3155	850	1700	425	170
Produkt Q	900	1800	450	180	3340	900	1800	450	180
Produkt R	950	1900	475	190	3525	950	1900	475	190
Produkt S	1000	2000	500	200	3710	1000	2000	500	200
Produkt T	1050	2100	525	210	3895	1050	2100	525	210
Produkt U	1100	2200	550	220	4080	1100	2200	550	220
Produkt V	1150	2300	575	230	4265	1150	2300	575	230
Produkt W	1200	2400	600	240	4450	1200	2400	600	240
Produkt X	1250	2500	625	250	4635	1250	2500	625	250
Produkt Y	1300	2600	650	260	4820	1300	2600	650	260
Produkt Z	1350	2700	675	270	5005	1350	2700	675	270

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5. Wastes from the Sugar Industry



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6. Wastes from the Cereal Industry



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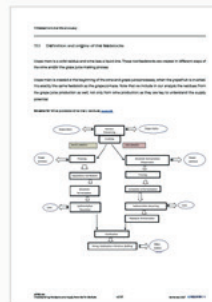


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7. Wastes from the Wine Industry



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The table shows the origin and origin of the waste. It lists various waste streams and their corresponding quantities. The table is organized into columns for different waste types and rows for different quantities.

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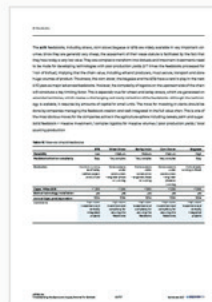


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8. Conclusion



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