SABR Coalition
SUSTAINABLE ADVANCED BIOFUEL REFINERS
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SABR
FUELING A SUSTAINABLE FUTURE

Comments of Sustainable Advanced Biofuel Refiners (SABR) Coalition on
Renewable Fuel Standard (RFS) Program:
Standards for 2026 and 2027, Partial Waiver of 2025 Cellulosic Biofuel Volume Requirement,
and Other Changes, Proposed Rule, 90 Fed. Reg. 25,784 (June 17, 2025)

Docket ID No. EPA-HQ-OAR-2024-0505

August 8, 2025

The Sustainable Advanced Biofuel Refiners (SABR) Coalition is a coalition of biodiesel stakeholders that have invested in building out America's first advanced biofuel. It includes stakeholders from every link in the value chain from feedstock growers to biodiesel producers, distributors, retailers, and consumers, as well as infrastructure and products and services suppliers. These stakeholders, mostly small businesses, have invested heavily in the Renewable Fuel Standard (RFS) program. Because of the significant interests of its members with respect to the U.S. Environmental Protection Agency's (EPA's) implementation of the program, particularly with respect to biomass-based diesel and non-cellulosic advanced biofuels, we appreciate the opportunity to submit these comments on EPA's proposed rule—"Renewable Fuel Standard (RFS) Program: Standards for 2026 and 2027, Partial Waiver of 2025 Cellulosic Biofuel Volume Requirement, and Other Changes," Proposed Rule, 90 Fed. Reg. 25,784 (June 17, 2025).

In response to Congress's expansion of the RFS program in 2007, the biodiesel industry built a significant production and distribution system using a diverse array of feedstocks, providing highly-skilled and well-paying jobs and cost-effective, renewable fuel from small businesses located in rural and disadvantaged communities throughout the United States. Under the RFS program, biodiesel use grew from 300 million gallons in 2010 to 2.3 billion gallons in 2016, with the U.S. biodiesel industry making substantial investments throughout the supply chain and spurring innovation along the way.

Throughout the years, the U.S. biodiesel industry has been able to withstand numerous market distortions and threats to its existence. As a result of disparate federal and state policy and EPA's implementation of the biomass-based diesel program under the RFS, the U.S. biodiesel industry continues to face an uphill battle, despite the fact that Congress specifically sought to support biodiesel when it expanded the RFS in 2007. As a result of EPA's low volume requirements for 2023-2025 and other advantages EPA's implementation of the RFS program has given to renewable diesel (and renewable jet fuel), the biodiesel industry has existing unused refining capacity that it can deploy immediately, providing more jobs and supporting the local and rural economies in which these facilities operate. We have seen biodiesel production under the RFS program shrink, rather than grow as Congress intended, and are concerned that biodiesel will soon be almost completely, if not completely, displaced by renewable diesel and renewable jet fuel unless EPA acts.

SABR Coalition is pleased to see that EPA has proposed increases in the volume requirements for biomass-based diesel for compliance years 2026 and 2027. We are concerned, however, with the use of "RINs" versus biomass-based diesel gallons to set the volume requirements. The statute requires that a minimum "volume" be "ensured," but EPA only provides an illustration of what gallons of actual fuel could be required to meet the biomass-based diesel volume requirement. While we appreciate EPA's goal of bringing clarity to the market as to what is required under the RFS, this does not bring clarity to producers due to the different equivalence values assigned to different fuels and the unknown impact of the import RIN reduction provisions. Further, while we support efforts to focus the program on U.S. feedstocks, we understand other stakeholders have raised concerns with the proposed import RIN reduction and, as noted below, we have concerns with its application to feedstock from Canada and Mexico that may be used by U.S. biodiesel producers. If EPA changes its import RIN reduction proposal, then it must adjust the volume requirements to reflect that change and ensure, at least, the same biomass-based diesel *volumes* (i.e., 5.61 billion gallons for 2026 and 5.86 billion gallons for 2027) are required in the final rule.

In addition, we remain concerned with EPA's implementation of the program that forces biodiesel to compete with fuels Congress clearly did not anticipate to be included in the biomass-based diesel category, particularly renewable jet fuel that does not meet the statutory definition of "biodiesel." The RFS can help unleash American energy and support rural economies, but this forced competition between different fuels in different markets with different policy treatment is not leading to more energy independence or bringing increased competition to lower costs to consumers. On the contrary, biodiesel is the lower cost, cleaner-burning fuel compared to renewable diesel and renewable jet fuel. When it is cannibalized by these higher cost fuels because of advantaged policy treatment of those fuels, the program's goals are met at a higher cost to consumers and taxpayers. As biodiesel plants continue to slow down and even shut down, this also leads to lost jobs with potentially no real gains as many renewable diesel plants are converted refineries, as EPA has previously recognized, and harms the local communities where these plants were operating. Further, the concerns raised by EPA in the proposal largely stem from increased imported feedstocks by renewable diesel facilities, not U.S. *biodiesel* producers.

We do appreciate EPA's proposal to finally revise the unlawful equivalence value currently in place for renewable diesel. EPA committed to making these changes before the U.S. Court of Appeals for the D.C. Circuit, and we are pleased to see EPA is finally proposing to correct this clear advantage it has given to renewable diesel producers over biodiesel producers, which has resulted in a windfall to renewable diesel producers. Unfortunately, EPA's proposal to set the value at 1.6 for both renewable diesel and renewable jet fuel continues to give renewable diesel and now renewable jet fuel a significant advantage over biodiesel. We have reviewed EPA's calculations and continue to have concerns with EPA's approach, including the assumptions used. We have attached a White Paper as Appendix A to this letter that outlines our concerns with EPA's calculations of the equivalence values for renewable diesel, renewable jet fuel, and renewable naphtha.

Depending on the method chosen to calculate the energy of the fuel and the assumptions used, there is a high degree of variability in calculating the equivalence values for hydrotreated fuels such as renewable diesel, renewable jet fuel, and renewable naphtha. For renewable diesel, the variability ranges from 1.5 to 1.6. When RINs are trading at $1/RIN, this variability results in a difference of $.10 per gallon in RIN generation, which is very impactful in the cost-sensitive heavy-duty fuel market. The difference increases as RIN prices increase. At $2/D4 RINs, the difference is $.20/gal. An equivalence value of 1.6 is the very top end of the range and requires a lot to be true for the fuel to meet the energy values EPA uses in the calculations. In fact, most renewable diesel cannot even get to 1.6 other than through using the most favorable assumptions and then rounding up. It is quite unusual to set a default value for anything using the top end of a range rather than the bottom end of the range. This variability is not just from one refinery to another, even within the same refinery, various factors can cause values to drop below 1.55, where it should be rounded down to 1.5, and is similar to biodiesel that has an equivalence value of 1.5. Thus, if renewable diesel producers are going to claim a 1.6 equivalence value at the high end of the range, at a minimum, they must be required to demonstrate that their fuel meets the threshold of 123,800 BTU/gallon that EPA uses in its calculations, ***not just initially but through ongoing testing with regular intervals***. Otherwise, the "default" equivalence value for renewable diesel should be 1.5 based on EPA's rounding convention. The same variability occurs with renewable jet fuel, where the equivalence values are more likely in the range of 1.4 to 1.5. To be eligible for a 1.5 equivalence value, we believe a threshold of 119,000 BTU/gallon is required and renewable jet fuel producers should have the same ongoing compliance testing to use the upper end of the range. The test method for BTU value for these fuels is ASTM D240 and costs less than $400 per test.

EPA also has declined to address the other advantages renewable diesel has over biodiesel under its implementation of the program. We are further concerned that EPA is creating even more hurdles for biodiesel producers to overcome in this proposal that are not faced by other fuels, including renewable diesel and renewable jet fuel. This includes making it harder for biodiesel to be used in the heating oil market under the guise of merely making a "clarification" and purportedly requiring testing for every specification under ASTM D6751 for every "batch" of biodiesel. Since the start of the program, EPA has provided biodiesel producers with flexibility in how to define a "batch" for purposes of RIN generation—up to one month's worth of production—because biodiesel plants operate and market their fuels differently. Testing of each "batch" may differ depending on plant operations and will be a significantly higher burden for smaller facilities that are already struggling. In the meantime, many biodiesel facilities (if not all) undergo regular testing consistent with their sales contracts, voluntary quality assurance programs (e.g., BQ-9000), and simply to ensure the facility is operating efficiently. And not every parameter in ASTM D6751 needs to be tested constantly, as they are generally constant and testing is not needed to ensure the operations are resulting in high quality fuel. For example, cetane is one of the most stable parameters and is very rarely out of spec. Yet it is by far the most expensive test in D6751, costing approximately 4 to 5 times of what most of the other tests cost. Requirements to test for all parameters of ASTM D6751 on each "batch," therefore, can be overly burdensome, costly, and, in short, wholly unnecessary for purposes of promoting renewable fuel use under the RFS program. As we did not see regulatory language and EPA largely mentioned this in passing in the preamble, the industry is happy to work with EPA to address the concerns it may have. We note, however, that the RFS was not intended to regulate fuel quality, and EPA's proposal also makes clear that the fuels regulations in Part 1090 must be complied with. As such, it is unclear what is the purpose of EPA's reference to such testing.

SABR Coalition supports promoting U.S. biofuel production and feedstocks. Indeed, the biodiesel industry grew up using U.S. soybean oil, which remains its most important feedstock. Along those lines, we support and incorporate by reference the comments of the American Soybean Association with respect to the import RIN reduction proposal except as it may apply to feedstock from Canada and Mexico that is used by U.S. biodiesel producers. EPA's concerns appear to relate to increased imports from overseas of what is claimed to be used cooking oil and animal fats, which largely relate to *renewable diesel* production. We are also concerned with the potential for fraud with respect to such feedstocks and support EPA's efforts to address those concerns. Biodiesel producers, on the other hand, have long utilized feedstocks from Canada and have long-standing relationships with crushers in Mexico that use *U.S.* feedstocks, which gives them greater flexibility to utilize the most cost-effective feedstocks. Biodiesel facilities typically use feedstocks that are in relatively close proximity to the plant, and, for example, Canadian feedstock supplies may be closer to some U.S. biodiesel plants that have been built across the country. The issues EPA raises with respect to used cooking oil and animal fats from countries overseas, like China, just do not come into play with respect to these feedstocks. Allowing U.S. biodiesel producers to continue to receive full RIN credit when using feedstock sourced from Canada and Mexico, in addition to the United States, is also consistent with the Section 45Z Clean Fuel Production Tax Credit, which was recently amended to allow U.S. producers to utilize feedstock from North America and still receive the tax credit.

Finally, we are concerned that outstanding questions regarding EPA's handling of small refinery exemptions after recent court decisions vacated EPA's denial of numerous exemption requests. There are almost 200 requests for small refinery exemptions pending, and EPA only indicates that it will consider potential exemptions that may be granted for compliance years 2026 and 2027 with respect to finalizing the volume requirements and standards. Along those lines, we strongly support EPA's proposal to project potential exemptions when setting the percentage standards, which is the minimum required to "ensure" the volume requirements. However, we also urge EPA to provide transparency on how it plans to address small refinery exemptions moving forward and with respect to the pending requests for compliance years 2015-2025 and to consider the potential impacts of EPA's decisions on ensuring actual volumes produced in 2026 and 2027 are required to meet the volume requirements it sets for those years.

We have also attached as Appendix B to this letter more detailed comments that address each of the key issues discussed above, as well as additional issues raised by EPA in the proposal.

We appreciate EPA's willingness to discuss these issues[1] and look forward to working with the agency to address these very real concerns from the U.S. biodiesel industry and to continue on the path toward supporting U.S. energy producers and U.S. agriculture.

If you have any questions regarding these comments, please contact Joe Jobe, joe@rockhouse.us, on behalf of the Sustainable Advanced Biofuel Refiners Coalition.

Sincerely,

Joe Jobe, Chief Executive Officer
Sustainable Advanced Biofuel Refiners Coalition

[1] *See, e.g.,* Letter from EPA to SABR Coalition, dated Nov. 10, 2022 (EPA-HQ-OAR-2021-0427-0428).

APPENDIX A

Comments of Sustainable Advanced Biofuel Refiners Coalition on
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Docket ID No. EPA-HQ-OAR-2024-0505

August 8, 2025

Update to Renewability and EV Calculations for RD and SAF

Executive Summary:

We reviewed EPA's Wyborny memo and accompanying spreadsheet calculating the renewability and equivalence values (EVs) of renewable diesel (RD), renewable jet fuel (RJ), and other hydrotreated fuels. We collaborated with bio-based diesel industry technical experts to correct the mathematical errors in EPA's calculations and to ensure calculations reflect intentions expressed in the Wyborny memo.

In addition to these errors, EPA's analysis relies on flawed assumptions that do not accurately reflect the fuels currently being sold. For RD, the theoretical energy content calculated using the heat of combustion methodology is 121,780 BTU/gal, which aligns closely with the previously accepted value of 122,000 BTU/gal used by the EPA. However, in its 2024 assessment of biofuel feedstock mix, EPA assumes a higher proportion of tallow than is consumed. We recommend a more representative approach: treating used cooking oil (UCO) as a blend of soybean oil and tallow, and distillers corn oil (DCO) as corn oil. Applying this feedstock mix and using the 122,000 BTU/gal energy content results in an EV for RD of 1.53, which rounds down to 1.5.

For RJ, EPA assumes that C14 and C16 hydrocarbons are derived solely by fractionating shorter-chain fatty acids from RD. This assumption is inaccurate and does not reflect current commercial RJ production practices, which typically involve cracking longer-chain fatty acids to produce RJ-range hydrocarbons (C8 to C16). By selecting only C14 and C16 as model molecules and excluding short chain cracked hydrocarbons, which have a higher non-renewable fraction inflates the EV for RJ to 1.6. When a representative composition of C9 to C16 molecules is used, and the same heat of combustion methodology is applied, the EV for RJ is recalculated to 1.43, which rounds down to 1.4.

Depending on the method chosen and assumptions used there is a high degree of variability in calculating the equivalence values for hydrotreated fuels. For RD the variability ranges from 1.5 to 1.6. When RINs are trading at $1/RIN, this variability results in a difference of $.10 per gallon in RIN generation, which is very impactful in the cost-sensitive heavy-duty fuel market. The difference increases as RIN prices increase. At $2/D4 RIN, the difference is $.20/gal. 1.6 is the very top end of the range. In fact, most renewable diesel cannot even get to 1.6 other than through using the most favorable assumptions and then rounding up. It is quite unusual to set a default value for anything using the top end of a range rather than the bottom end of the range. This variability is not just from one refinery to another, even within the same refinery, various factors can cause values to drop below 1.55, where it should be rounded down to 1.5. Thus, if RD producers are going to claim a 1.6 EV at the high end of the range, they must demonstrate that their fuel meets the threshold of 123,800, ***not just initially but through ongoing testing with regular intervals, using either*** ASTM D240 or similar test which costs less than $400. If they do not want to do the testing, then they should use 1.5 as their EV.

Energy content is the most significant factor influencing a fuel's equivalence value. Therefore, it is critical for the EPA to establish a minimum threshold energy content for RJ, RN and propane, along with RD. We also urge the EPA to implement a compliance mechanism to periodically verify the energy content of hydrotreated fuels produced. For fuel that doesn't meet the default energy content lower EV should be assigned accordingly.

Introduction:

Equivalence value or EV are used by EPA to compare renewable energy content of all the advanced biofuels against ethanol on a volumetric basis. The latest values and calculations of EV for RD and SAF released by EPA are step in the right direction compared to the previous values for these fuels. However, there are still some assumptions and calculations used for EV determination which are not based on a rigorous scientific basis and not representative of the actual commercial production which are listed below;

1. The energy content of RD was increased from 122,000 Btu/Gal to 123,800 Btu/Gal which is at the higher end of the range of energy content of commercially produced RD.
2. The EV calculation is based on the lower heating values (LHV) of the fuel. However, for the renewability calculations, EPA used higher heating values (HHV) for determining combustion energies which leads to inconsistent comparison basis
3. The feedstock mix for determining the EV for RD assumes the composition for used cooking oil (UCO) and distillers corn oil (DCO) similar to tallow. Globally, UCO is predominantly produced from vegetable oils used as frying oils and as such replacement of UCO with vegetable oil would be better scientific representation. In the case of DCO, renewability data for Corn oil will be more representative than Tallow.
4. Sustainable aviation fuel or renewable Jet fuel is assumed to be comprised of just C14 & C16 hydrocarbons instead of using a more representative jet fuel composition consisting of hydrocarbons in the range of C9 to C16. The assumption that all the C14 and C16 hydrocarbon fractions are coming from naturally occurring shorter chain fatty acids in feed stock, is also not scientifically consistent nor representative of current commercial production of RJ. The majority of the C9 to C16 hydrocarbons fractioned in the jet range are produced by cracking longer chain fatty acids during the production process. Using C14 & C16 as model molecules and ignoring short chain cracked hydrocarbons with higher non-renewable fraction results in an inflated equivalence value for RJ.

Energy Content, Renewability and EV calculation for RD:

We believe basing the energy content of the RD based on the theoretically calculated value for different feedstock would be more representative. The energy content of the fuel is the energy released during the combustion reaction of the fuel molecules with oxygen. The combustion equation of RD molecule (which is predominantly C18) is as below:

$C_{18}H_{38} + 27.5O_2 = 18\ CO_2 + 19\ H_2O$

Heat of Combustion Rxn = Total Energies of Bond Formation in Product – Total Energies of Bond Formation in Reactant

$$= (18 \times 2 \times 799 + 19 \times 2 \times 463) - (18 * 348 + 38 * 413 + 27.5 \times 495)\ \text{kJ/mol}$$

= 11,135.5 kJ/mol

= (11, 135.5 x 1000x 3.76 x 0.78[1]) / (1.055 x 254) BTU/Gal

= 121,873 BTU/Gal (Vs 122,000 Btu/Gal previously provided by EPA)

In order to get a more representative energy content of RD based on different feedstock and the different chain lengths of each feedstock, we calculated the energy content based on heat of combustion for different chain length carbon molecules. The Table 1 shows the fraction of each of the carbon length molecules present in Soybean, canola, corn, and tallow feedstock. To calculate the feedstock mix for RD production we used the EIA information for the feedstock mix for 2024 RD production as shown in Table 3 and Table 4. The modelled feed is based on the fraction of each individual feed oil for RD production in 2024. For the modelled feed we have used corn oil as a representation for DCO and a equal split between Soybean and Tallow for UCO fraction. The modelled feed leads to energy content of RD of 121790 BTU/gal, R value of 94.32 and EV of 1.53. Using same R value but energy content of 123,800 BTU/gal as used by EPA, the EV of RD is 1.56 which gets rounded to 1.6. As can be seen, different EC values result in EV after rounding between 1.5 and 1.6. Commercially there are different RD grades produced due to variation in feed and processing conditions that has EC values ranging between 122K BTU/gal on low end to 123,800 on high end. Hence its important that the higher end of the Energy content range is not used as default for all the RD and a reliable and rigorous testing mechanism is implemented to ensure correct EV is assigned to RD based on actual energy content and not using the higher default value of 123,800 BTU/gal for all RD.

EPA has used HHV for calculating bond energy of formation and heat of combustion using bond combustion values for calculating R values. In order to stay consistent with the lower heating value used in the EV calculation we calculated the R value for RD from different feedstock using lower heating values for the combustion of the non renewable part of the fuel.

Non-Renewable Fraction in RD is 5 H atoms. The combustion equation for non-renewable part is

$2.5\ H_2 + 1.25\ O_2 = 2.5\ H_2O$

Heat of Combustion = (5x463) – (2.5x432+1.25x495) kJ/mol

= 616.3 kJ/mol

R = (1- Heat of combustion from Non-Renewable fraction/ Total heat of combustion of fuel)

= (1- 616.3/11,135) *100 %

= 94.47%

In order to get a more representative energy content of RD and non-renewable H2 content due to different feedstock and the different chain lengths of each feedstock, we calculated the R value based on non-renewable fraction for different carbon chain length. The R values in Table 1 is based on individually calculated R value for each feed stock.

[1] Neste Renewable Diesel Handbook

Total of Each Carbon Length	Soybean	Corn	Canola	Tallow		Modelled FS Mix
	%	%	%	%		%
C14	0.10	0.00	0.10	2.86		1.181
C16	14.70	16.20	7.00	29.59		19.910
C18	83.80	82.70	89.30	67.55		77.851
C20	0.80	0.90	2.90	0.00		0.735
C22	0.60	0.20	0.50	0.00		0.300
C24	0.00	0.00	0.20	0.00		0.023
Energy Content, Kj/mol						10878
Energy Content, BTU/gal	121772	121775	121516	121891		121790
R, %	93.31	93.57	93.41	95.75		94.32
EV	1.52	1.52	1.52	1.56		1.53

Table 1: Carbon chain length Fraction, Theoretical Energy Content, R, and EV values for Individual feedstock and modelled mix representative of commercial 2024 RD production based on EIA data.

Type of Feed	Used for RD	Overall Mix
	Million Lbs	***Fraction***
Canola	3059	0.114
Corn	3450	0.128
Soybean oil	6062	0.225
Tallow	6974	0.259
Uco	7389	0.274
50% uco as Soy		0.137
50% uco as Tallow		0.137

Table 2 Modelled feedstock mix based on 2024 RD production

Table 2b. U.S. Feedstocks consumed for production of biofuels[1,2]
million pounds per month

Period	Waste oils, fats, and greases: Poultry	Tallow[3]	White Grease	Yellow Grease[4]	Other	Oil from Algae
2024						
January	W	631	45	616	9	-
February	12	715	55	586	20	-
March	W	586	68	635	20	-
April	27	486	70	700	19	-
May	20	449	70	513	17	-
June	21	567	57	714	18	-
July	23	665	68	657	19	-
August	24	576	58	695	19	-
September	25	494	50	587	19	-
October	24	592	46	604	16	-
November	21	696	56	543	23	-
December	16	707	46	540	15	-
Total	258	7,165	688	7,389	215	

Table 3 Fats usage for biofuels in 2024 per EIA Report

Table 2c. U.S. Feedstocks consumed for production of biofuels[1,2]
million pounds per month

	Vegetable oils									
	Canola oil			Corn oil			Soybean Oil			
Period	Total	Biodiesel Plants	Renewable Diesel Plants	Total	Biodiesel Plants	Renewable Diesel Plants	Total	Biodiesel Plants	Renewable Diesel Plants	Other vegetable oils[5]
2024										
January	376	153	224	335	71	264	960	545	416	4
February	296	130	166	314	74	240	888	522	367	W
March	326	145	181	322	83	239	1,026	548	479	W
April	361	175	186	339	W	W	1,070	505	565	W
May	397	158	239	341	81	259	1,076	597	479	18
June	386	162	224	403	80	324	1,267	578	689	37
July	546	139	407	349	85	264	1,139	642	497	W
August	440	168	272	422	90	331	1,217	636	581	W
September	289	127	162	361	70	291	1,076	673	403	W
October	454	138	316	421	65	356	1,227	709	518	W
November	410	120	290	404	63	341	1,192	724	467	W
December	524	132	392	320	67	253	1,097	697	400	W
Total	4,805	1,747	3,059	4,330	904	3,450	13,236	7,374	5,861	239

Table 4 Vegetable usage for biofuels in 2024 per EIA Report

Renewability and EV calculation for SAF:

Instead of assuming SAF consists of only naturally occurring C14 and C16 alkanes, we used the expected Carbon chain distribution in the C9 to C16 range that is similar to traditional JET fuel[2]. As can be seen, the SAF consists of a mixture of molecules with carbon length between C9 and C16 with median carbon length of C12. The hydrocarbons in the molecular range in Jet range are produced by cracking longer chain molecules during the production process along with some natural molecules in jet range. In this work we calculated the Renewability of the SAF with the composition shown in Figure 1.

We used the LHV for energy content calculations for each carbon chain alkane and the non-renewable energy content. The Table 5 shows the renewability of different carbon length paraffins that make up SAF produced from oleic acid (used as a representative feedstock).

Molecular Formula	C9H20	C10H22	C11H24	C12H26	C13H28	C14H30	C15H32	C16H34
No of C	9	10	11	12	13	14	15	16
No of H	20	22	24	26	28	30	32	34
wt% in SPK	0.14	0.17	0.20	0.18	0.12	0.11	0.05	0.02
Renewability, R, %	90.21	91.16	91.94	92.60	93.15	93.63	94.04	94.41
Modeled EC,KJ/Kg	44281	44194	44122	44062	44011	43967	43929	43896
Overall R, %	92.47							
Overall EC, BTU/gal	116310							
Overal EV	1.43							

Table 5 Renewability values, EV for C9 to C16 paraffins and their theoretical energy content

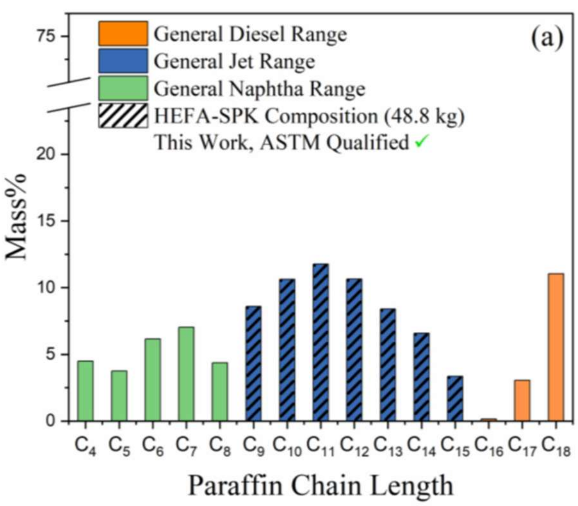

Figure 1Liquid paraffin HEFA-SPK compositions [2]

SAF modeled as C12 Alkane as a product from oleic acid by deoxygenation and cracking.

The combustion equation for SAF is as below:

$C_{12}H_{26} + 18.5O_2 = 12\ CO_2 + 13\ H_2O$

Heat of combustion for this reaction is: 7,491 Kj/mol

[2] Mannion et, al, "A physics constrained methodology for the life cycle assessment of sustainable aviation fuel production", Biomass and Bioenergy 185 (2024) 107169

Non-Renewable Fraction in SAF is 4.5 H atoms (assuming an equal mix of C12 formed with and without 3 terminal nonrenewable hydrogen). So, the combustion equation for non-renewable part is

$$2.25\ H_2 + 1.125\ O_2 = 2.25\ H_2O$$

Heat of Combustion = (4.5x463) – (2.25x432+1.125x495) kJ/mol
= 554.6 kJ/mol

R = (1- Heat of combustion from Non Renewable fraction/ Total heat of combustion of fuel)
= (1- 554.6/7,491) *100 %
= 92.6%

EQ Value = (92.6/97.2) * (115611/77000)

EQ value = 1.43 RIN value

While we used oleic acid to model the feedstock from which the C9 to C16 alkane molecules are produced via cracking and hydro-deoxygenation, there will be minor variation in the R and Equivalence value for SAF made using other feedstock. Also, like RD , there are different grades of SAF produced based on process conditions during production and feedstock used. For RD grades that indeed have high energy content of 119,000 BTU/gal a regular and robust testing mechanism should be put in place to verify the higher energy content and not assign higher energy content of 119,000 and above by default for all SAF.

Appendix1: Bond Energy Values in Kj/Mol

Bond Type	Energy
C-H	413
C-C	348
C-O	358
C=O	799
C=C	602
H-H	432
O=O	495
O-H	463

Appendix2: Simplified Molecular Structure for Bond Energy Calculations

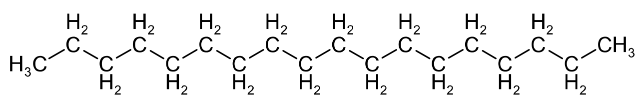

Figure 1. Molecular Structure of RD molecule (C18)

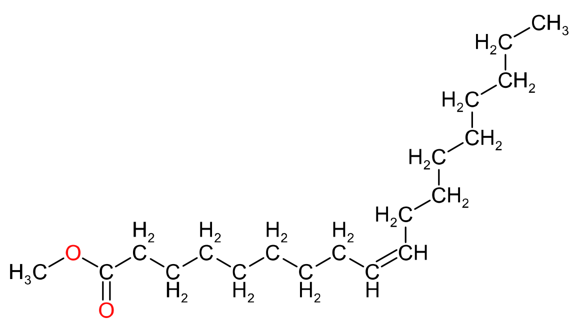

Figure 2. Molecular Structure of BD molecule (Methyl Oleate)

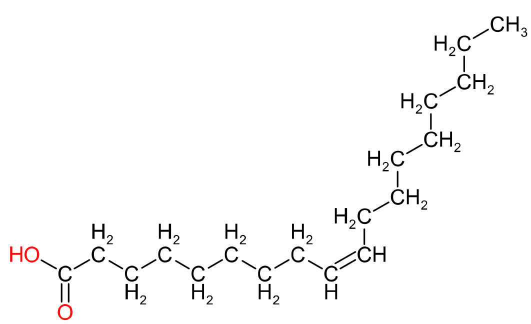

Figure 3. Molecular Structure of Oleic acid