Table 1 Summary of studies on combustion, thermal behaviour, and emission characteristics of biofuels.

Study Objectives	Major Contributions	References
Evaluate the performance and emission characteristics of miniature turbojet engines with JET A-1 fuel blended with Camelina oil-derived biofuel produced through HEFA technology.	Lower fuel consumption and reduced CO, CO_2, and NOx emissions were observed for JET A-1/HEFA blends compared to pure JET A-1, indicating improved fuel efficiency and emission performance.	[28]
Study the effects of Jatropha and Camelina-derived biofuels on gas turbine emissions and performance with varying biofuel blend ratios (80, 50, and 30 vol.%).	Increasing Camelina content led to significant CO, UHC, and soot reductions, although NOx emissions increased slightly due to higher combustion temperatures. Mixed emission trends were noted for Jatropha-based fuels.	[29]
Assess the performance and emissions of Jet A-1 blended with up to 20 vol.% coconut oil-derived kerosene on a 1S/60 Rover gas turbine engine across different power levels.	Engine performance metrics were similar for both fuels, with slight increases in CO and HC emissions for coconut blends and negligible differences in NOx emissions.	[30]
Examine the thermal behaviour of honge oil methyl ester (HOME) and its B-20 blend using calorimetric experiments at a 10°C/min heating rate in air and oxygen.	The B-20 blend showed similar combustion performance to diesel with high thermal stability and extended combustion duration. It exhibited lower activation energy at the start of combustion, with varying ignition and burnout indices across fuels.	[31]
Study the thermal characteristics of HOME, B-20 blend, and diesel using DSC and TG analyses at a 4.72 K/s heating rate.	HOME exhibited a wider combustion temperature range due to stable intermediates. The B-20 blend showed low offset temperature and lower emissions of harmful gases, offering the potential for engine optimization with blends.	[32]
Compare the thermal properties of Jatropha and honge biodiesels and their mixture with diesel using TG-DSC at a 10°C/min heating rate.	Mixed biodiesel showed high volatility with combustion properties like diesel, supporting its use as an efficient alternative fuel. Its lower combustion intensity suggests better combustion characteristics than pure biodiesels.	[33]
Investigate the effect of safflower methyl ester (SME) and Jet A1 fuel mixtures on a small-scale jet engine's thrust, fuel consumption, and emissions during various power cycles.	Thrust decreased by 27.5% with bio-jet fuel. HC emissions were reduced by up to 51%, but CO emissions increased by 30% during take-off. CO_2 emissions rose quickly, and fuel consumption exceeded 50% at take-off.	[34]
Examined the combustion characteristics and exhaust emissions of SAF derived from coconut oil blended with JET A-1 fuel in a J-850	Combustion efficiency remained above 90% for SAF blends up to 50%, with stable combustion. Specific fuel consumption increased by 9% for a 50% SAF blend, while	[35]

jet engine, with blends from 0% to 50% SAF.	energy consumption decreased, indicating lower overall energy needs. CO and CO_2 emissions increased with higher SAF, while HC emissions decreased.	36
Assess the effect of biodiesel from waste cooking oil on diesel engine output and environmental pollution when blended with diesel and 1-pentanol.	The 70/20/10 % diesel/biodiesel/1-Pentanol blend showed superior combustion, reduced CO and UHC, and thermal efficiency close to diesel. Adding 1-pentanol improved in-cylinder pressure and combustion due to better fuel atomization and oxygen content.	

Table 2 Selected physicochemical properties of standard JET A-1 and different HEFA-SAF [42–46].

Test (units)	ASTM Method	J100	HS100	HS100 (camelina)	J50HS50	Limits (ASTM D 1655)
Density @ 15°C ($kg.m^{-3}$)	D4052	840	760-800	759.5	786	775-840
Energy Density (MJ/kg)	D3338	42.8	43.5-44.12	43.3	-	42.8
Kinematic @ −20°C Viscosity ($mm^2.s^{-1}$)	D445	8	1.2-1.8	3.83	4.2	8
Heating value ($MJ.kg^{-1}$)	D240/D4809	42.8	43.5	-	-	42.8
Acid value ($mgKOH.g^{-1}$)	D974/D664	0.004	0.02	-	-	0.015
Freezing point (ºC)	D2386	−47	−49	−57.2	-	−47
Flash Point (ºC)	D93/D56	38	40-45	43.2	52	38
Smoke point (°C)	D1322	25	25-30	>50	10.1	25 (min)
Sulphur content (wt.%)	D4294	0.04	0.001	-	-	0.3 (max)

Table 3 Heat flow and Enthalpy at peak temperature for Tested Jet Fuels

Fuel Samples	Reaction region temperature (°C)	Peak temperature (°C)	Heat flow (mW/mg)	Enthalpy (J/g)
J100	40-248	234	−0.4372	−90.53
HS100	50-263	248	−0.3262	−69.68
J50HS50	49-324	239	−0.4296	−118.14
J10HS90	46-321	286.08	−0.4923	−135.38
J30HS70	42-332	290.12	−0.5755	−167.90

Table 4 Combustion Properties of Tested Jet Fuels

Fuel sample	T_{ignite} (°C)	T_{peak} (°C)	$T_{burn\text{-}out}$ (°C)	Peak Mass Loss Rate (DTG_{mass}, %/min)	Mean Mass Loss Rate (DTG_{mean}, %/min)	I_D (mass/min°C^2) ×10^{-4}	CPI (mass^2/min^2°C^3) ×10^{-6}
J100	183±5	234 ± 6	250 ± 7	1.6 ± 0.08	0.8 ± 0.04	3.50 ±0.18	2.10 ± 0.11
HS100	191± 5	248 ± 6	272 ± 8	1.4 ± 0.07	0.7 ±0.035	2.70 ±0.14	1.37 ±0.07
J50HS50	187± 5	239 ± 6	290 ± 8	1.45 ± 0.07	0.725 ±0.036	2.72 ±0.14	1.52 ±0.08
J10HS90	197± 5	286.08 ± 7	302 ± 8	1.3 ±0.065	0.65 ±0.033	2.17 ± 0.11	1.10 ± 0.06
J30HS70	202± 5	290.12 ± 7	311 ± 8	1.2 ± 0.06	0.6 ±0.03	1.91 ± 0.10	0.90 ±0.05

Fig. 1 (a) Photographic view of the SDT Q600 TA.

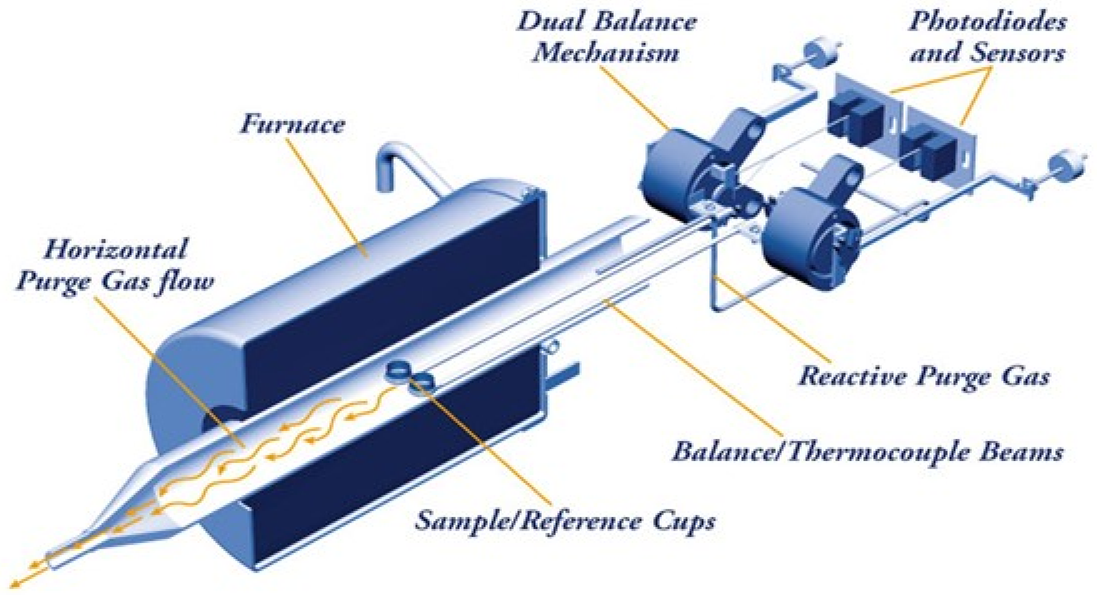

Fig. 1 (b) Schematic view of the TGA device used.

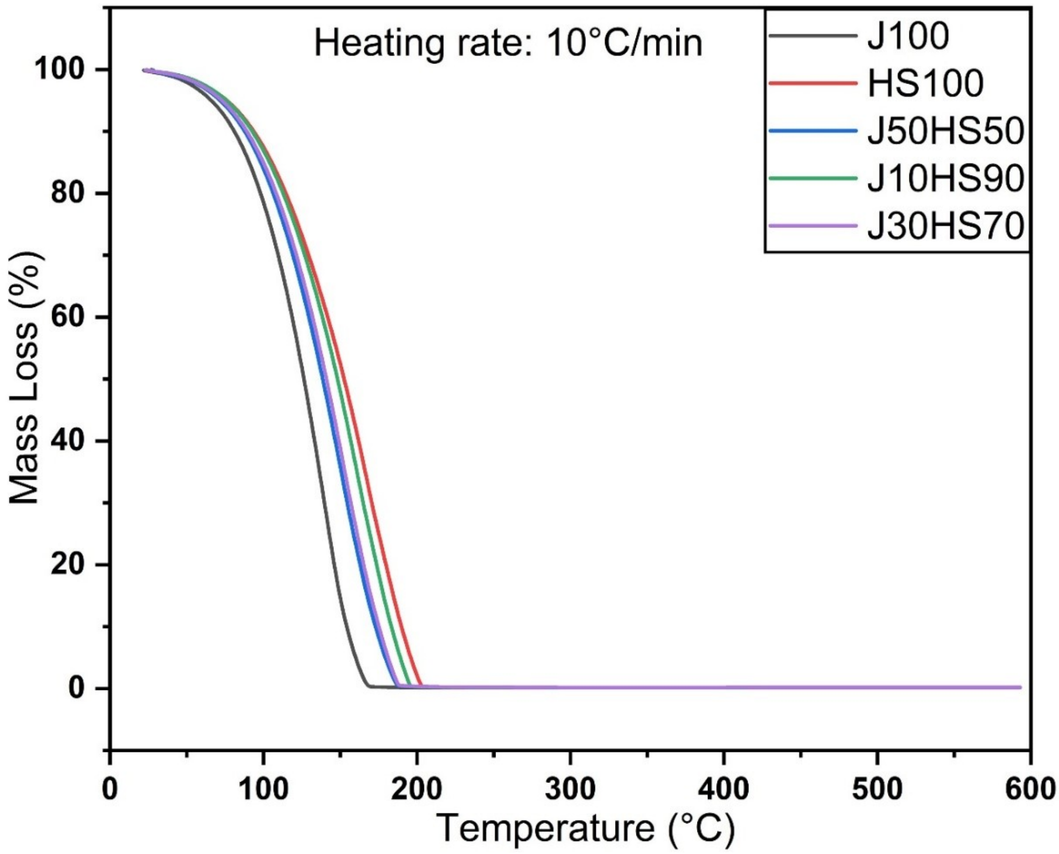

Fig. 2 TGA profiles of tested fuel samples.

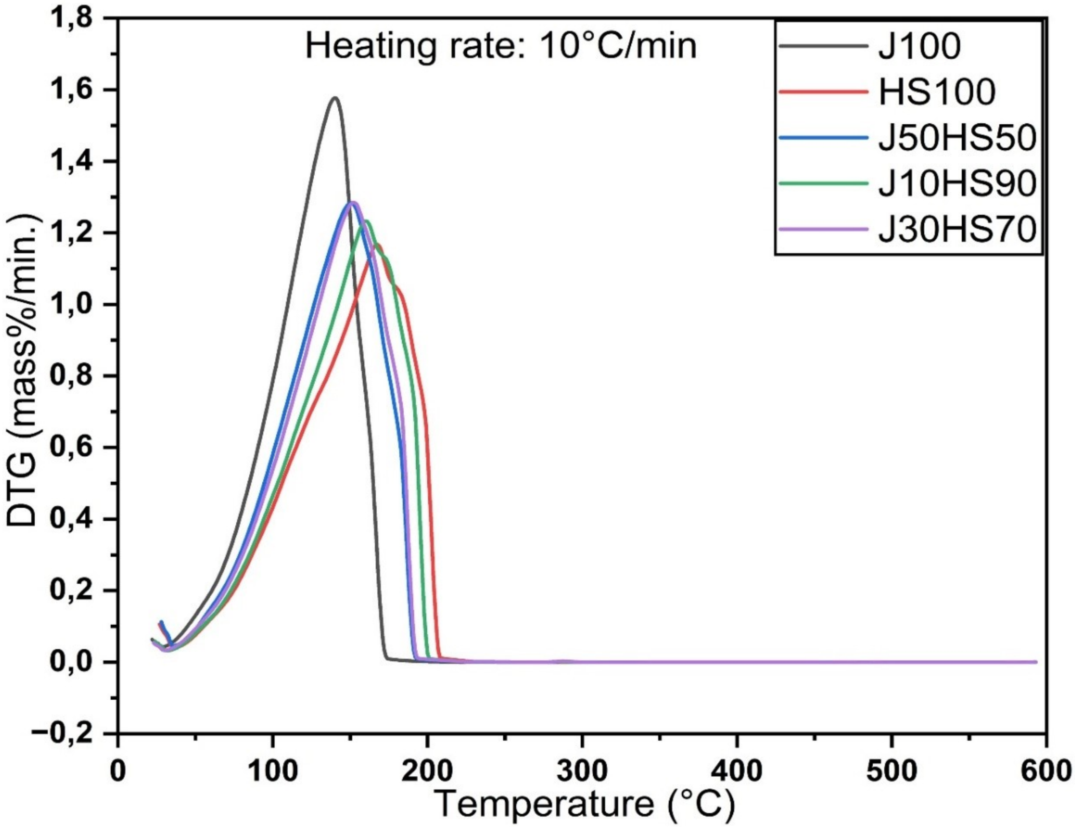

Fig. 3 DTG profiles of tested fuel samples.

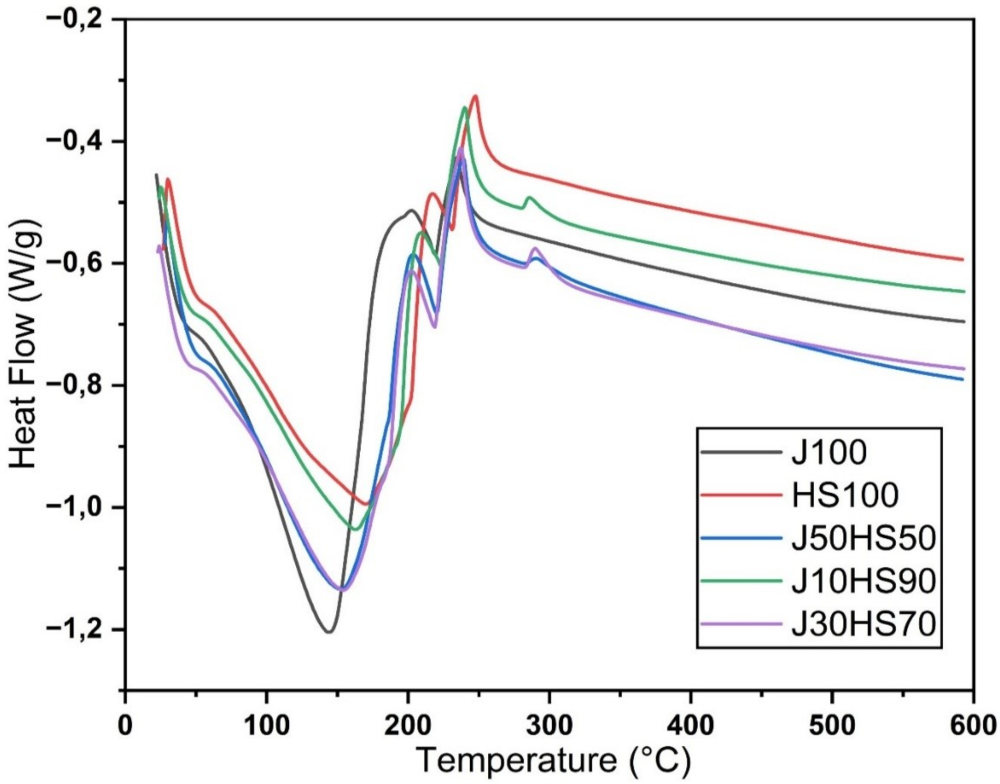

Fig. 4 DSC combustion curves of tested fuel samples.

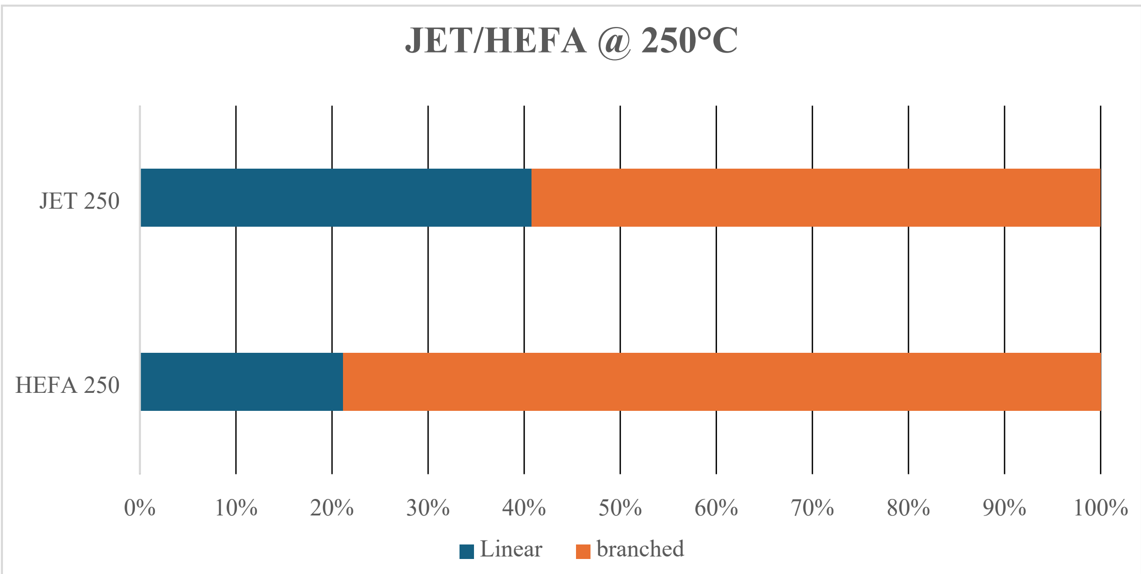

Fig. 5 Relative percentage of branched and linear hydrocarbons in pure JET A-1 (J100) and HEFA-SAF (HS100).

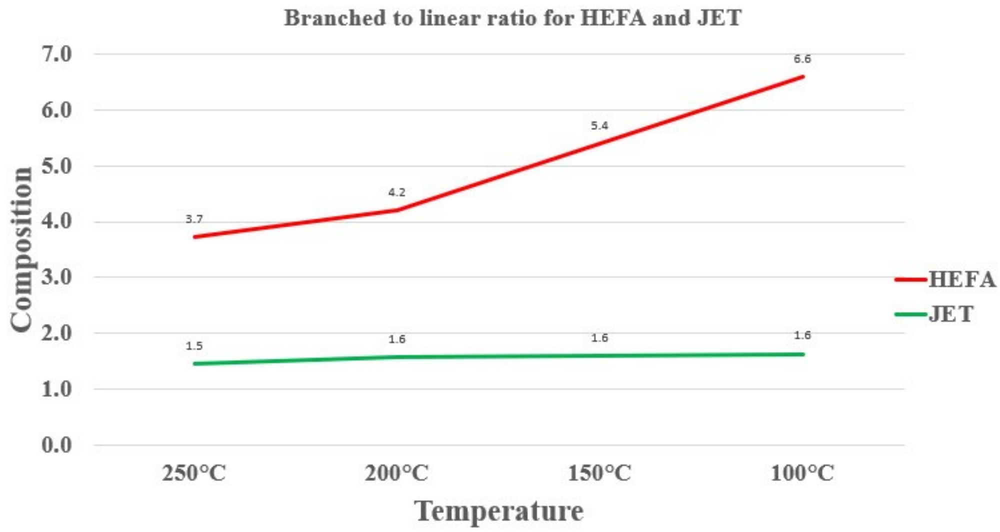

Fig. 6 Branched to linear hydrocarbons ratio for HEFA and JET as a function of injector temperature.

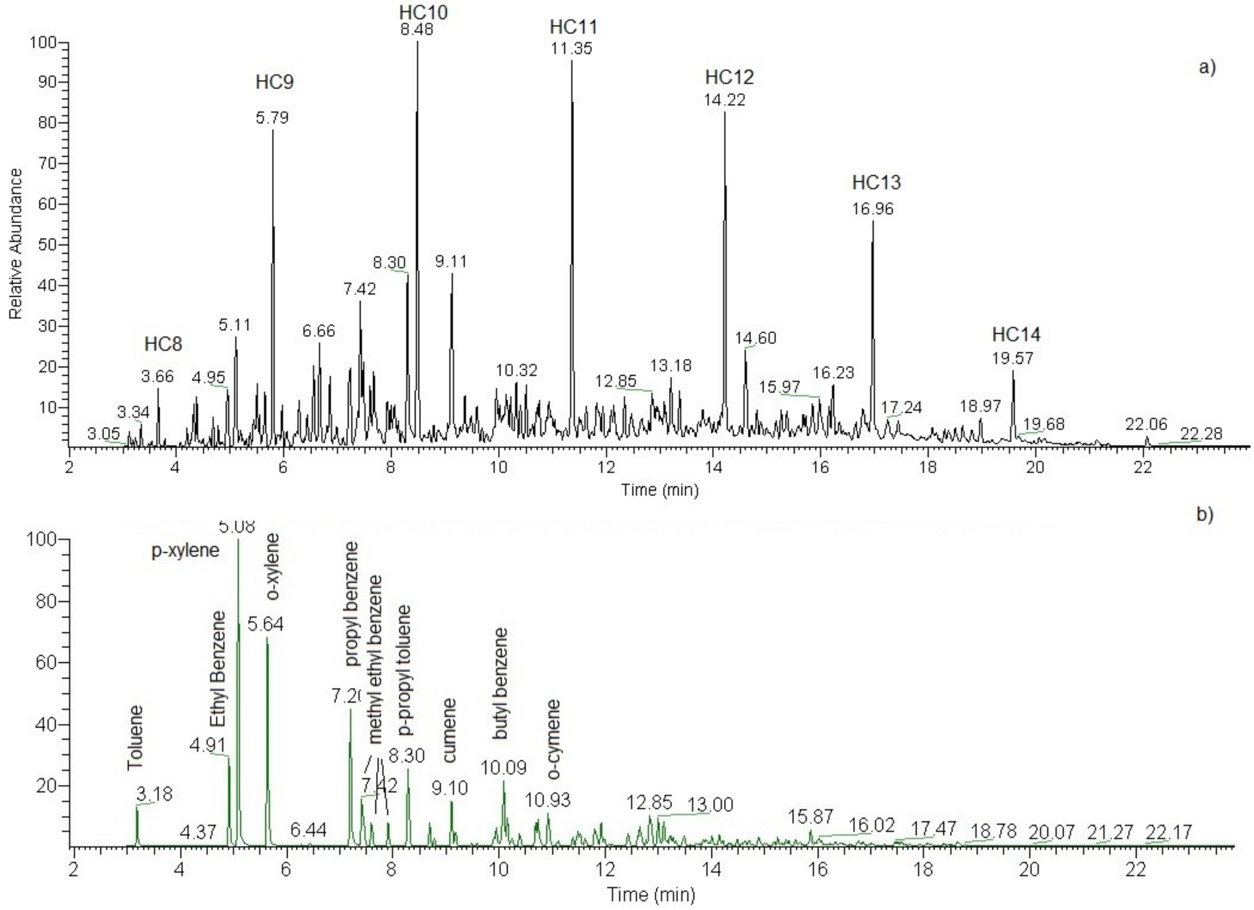

Figure 7 JET A-1 (J100) Chromatogram (a) TIC, (b) ion extract m/z 91 obtained by GC-MS analysis.

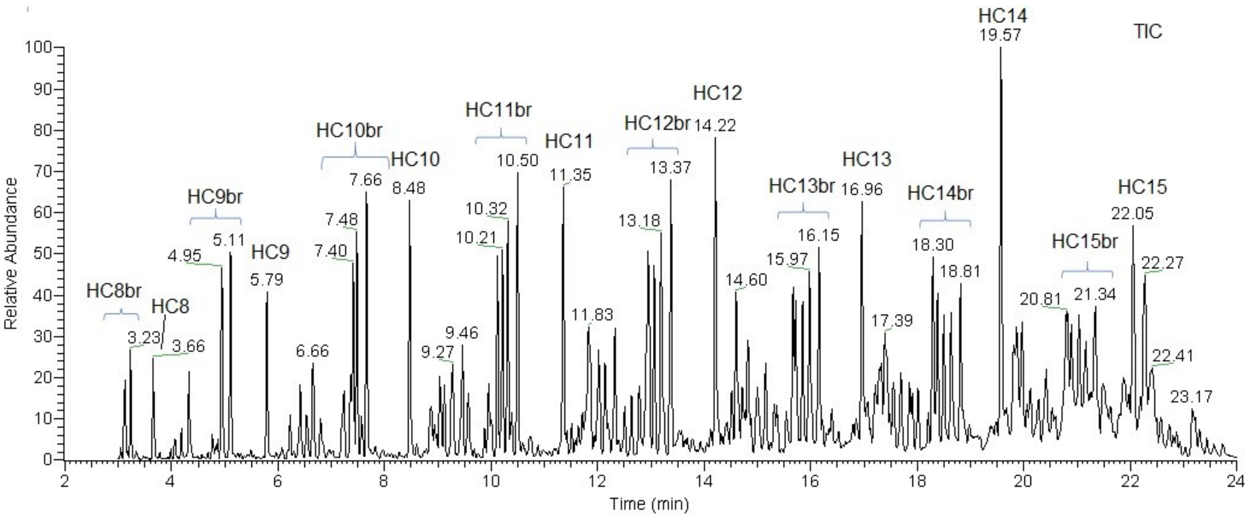

Figure 8 HEFA-SAF (HS100) Chromatogram (TIC) obtained by GC-MS analysis.