Table 1: Amount and composition of feed streams for the FT reactor .

Gas	**Volume flow (Nm^3/h)**	**CO**	**H_2**	**N_2**	**CH_4**	**H_2O**	**CO_2**
		Mole fraction (-)					
COG	70,000	0.04	0.61	0.06	0.24	0.04	0.01
COG no H_2O	67,200	0.04	0.63	0.06	0.25	0	0.01
BFG	100,114	0.24	0.04	0.47	0	0.04	0.22
BFG no H_2O	96,109	0.24	0.04	0.49	0	0	0.23
Mix no H_2O (feedstock stream)	**163,309**	**0.16**	**0.28**	**0.32**	**0.10**	**0**	**0.14**

Table 2: Reaction constants for the reactions occurring in the FT reactor [1].

Reaction	**Effective rate constant k_0 (m^3/kg s)**	**Activation energy E_A (kJ/mol)**	**Enthalpy of reaction $\Delta_R H$ (kJ/mol)**
Fischer-Tropsch	2.6	52	-152
Methanation	9.1	70	-206
Water-gas shift	155	70	-41

Table 3: Product distribution (mass fractions) for the aromatisation unit [2–4].

Product component	**Propane**	**Butane**	**Pentane**	**Hexane**	**Heptane**	**Octane**
Hydrogen	0.0010	0.0139	0.0315	0.0292	0.0237	0.0216
Methane	0.0310	0.0973	0.0553	0.0488	0.0464	0.0426

Ethane	0.0580	0.1512	0.0553	0.0488	0.0464	0.0426
Propane	0.0549	0.3719	0.0781	0.0849	0.1092	0.1185
Butane	0.0001	0.1688	0.0781	0.0849	0.1092	0.1185
Pentane	0.0001	–	0.1937	–	–	–
Hexane	–	–	–	0.1942	–	–
Heptane	–	–	–	–	0.1953	–
Octane	–	–	–	–	–	0.1957
Benzene	0.0485	0.0485	0.0700	0.0702	0.0648	0.0635
Toluene	0.2576	0.0836	0.2022	0.2027	0.1870	0.1833
Xylene	0.2968	0.0608	0.2358	0.2363	0.2181	0.2181
Propylbenzene	0.2520	0.0278	–	–	–	–

Table 4: Inlet and outlet mass fractions of reactive components in the alkylation and oligomerisation unit [5,6].

Component	**Fraction in**	**Fraction Out**
Propene	0.039593	0.000802
Butene	0.061012	0.001237
Pentene	0.061158	0.00124
Iso-pentene	0.001882	3.92E-05
Hexene	0.012857	0.000257
Benzene	0.246659	0.004996
Toluene	0.576839	0.011685

Propylbenzene	0	0.489873
Pentylbenzene	0	0.489873

Table 5: Complete list of parameters for modeled LTFT in a fixed bed reactor. If no source is stated, the parameters are either calculated in the aforementioned formulas or obtained from the Aspen Plus simulation.

Symbol	**Parameter**	**Reactor 1**	**Reactor 2**	**Unit**
p_0	Inlet pressure	49.5	47.5	bar
$\dot{n}_0$	Inlet molar flow	7286	6538	kmol/h
z	Reactor length [1]	8	8	m
d_{int}	Internal tube diameter [1]	0.07	0.07	m
N_T	Number of tubes	1417	1923	-
$c_{CO,0}$	Inlet CO concentration	183	128	mol/m^3
$c_{H2,0}$	Inlet H_2 concentration	321	223	mol/m^3
$c_{H2O,0}$	Inlet H_2O concentration	0	55	mol/m^3
ρ_B	Catalyst bulk density [7]	790	790	kg/m^3
m_{cat}	Catalyst mass	34465	46772	kg
τ	Residence time	25	37	s
T_0	Inlet temperature	240	230	°C
T_C	Cooling medium temperature	221	227	°C
U_0	Overall heat transfer coefficient	306	229	W/m^2 K
u_s	Surface velocity (empty tubes)	0.32	0.22	m/s
α	Chain growth probability	0.934	0.934	-

d_P	Catalyst particle diameter [7]	0.003	0.003	m
d_R	Equivalent cross-section diameter	2.635	3.070	m
d_{wall}	Wall thickness [7]	0.01	0.01	m
λ_{wall}	Wall heat conductivity [7]	50	50	W/m K
λ_{rad}	Radial heat conductivity	7.7	5.2	W/m K
λ_{fluid}	Gas mixture heat conductivity	0.071	0.063	W/m K
υ	Gas mixture kinematic viscosity	$9.11x10^{-7}$	$9.66x10^{-7}$	m^2/s
c_p	Gas mixture heat capacity	33.5	34.5	J/mol K
$\alpha_{w,int}$	Internal heat transfer coefficient	764	539	W/m^2 K
$\alpha_{w,ext}$	External heat transfer coefficient [7]	1600	1600	W/m^2 K

Table 6: Purchased equipment cost of all equipment in the process in 2021 Euros for a location in France [8,9].

Equipment	**Purchased Equipment Cost (Eur)**
Compressor 1	€6,424,000
Cooler 1	€55,000
Compressor 2	€6,955,000
Heater 2	€35,000
FT-Reactor 1	€576,000
Flash Vessel 1	€162,000
Compressor 8	€1,636,000
FT-Reactor 2	€692,000

Flash Vessel 2	€242,000
Steam Turbine	€519,000
Cooler 3	€108,000
3-Phase Flash Vessel	€491,000
Membrane Module 1	€2,000,000
Flash Vessel 4	€14,000
Flash Vessel 5	€15,000
Flash Vessel 6	€14,000
Flash Vessel 7	€14,000
Flash Vessel 8	€32,000
Flash Vessel 9	€14,000
Flash Vessel 10	€13,000
Column 1	€43,000
Column 2	€42,000
Column 3	€833,000
Column 4	€143,000
Column 5	€44,000
Column 6	€88,000
Column 7	€44,000
Pump 1	€20,000
Pump 2	€21,000

Compressor 3	€336,000
Compressor 4	€374,000
Compressor 5	€395,000
Compressor 6	€314,000
Compressor 7	€304,000
Aromatisation	€18,000
Hydrocracker	€146,000
Oligomerisation	€21,000
Cooler 5	€33,000
Heater 6	€33,000
Cooler 7	€33,000
Cooler 8	€34,000
Cooler 9	€33,000
Cooler 10	€47,000
Cooler 11	€34,000
Cooler 12	€33,000
Heater 13	€33,000
Total	**€23,348,000**

Table 7: Dimensions of the major equipment of the SMG-FT process.

Equipment Dimension	**Value and Unit**
FT Reactor 1	

Tube Diameter	0.08 m
Tube Length	8 m
No. of Tubes	1417
Tubes Surface Area	2849 m^2
Pressure	49.5 bar
FT Reactor 2	
Tube Diameter	0.08 m
Tube Length	8 m
No. of Tubes	1851
Tubes Surface Area	3721 m^2
Pressure	47.5 bar
Hydrocracker	
Volume	23.4 m^3
Diameter	1.85 m
Length	8.7 m
Pressure	30 bar
Wall thickness	35 mm
Aromatisation Unit	
Volume	1.10 m^3
Diameter	0.7 m
Length	2.85 m

Pressure	4 bar
Wall thickness	1.74 mm
Alkylation Unit	
Volume	0.667 m^3
Diameter	0.6 m
Length	2.36 m
Pressure	38 bar
Wall thickness	14.5 mm

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