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Supplementary Tables

Application of teaching-learning-based optimization algorithm in designing 100 kW power plant using pyrolysis of oil palm empty fruit bunches

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Table S1 Process operating conditions

Equipment	Temperature (°C)	Pressure (bar abs)
Blower	40	1.2
HX-Air	-	1.2
Dryer	100	1.1
Mixer	100	1.1
Milling	100	1.1
Screen	100	1.1
Reactor	450–550	1.1
Gas Sep1	550	1.1
HX-Quench	100	1.1
Quench 2	45	1
Pump-Liq	50	1.2
Gas Com1	50	1.2
Gas Com2	50	1.5
Comb	730	1.5
Gas Sep2	730	1.5
HX-Comb3	-	1.5
Turbine	200	1.5
Pumpbo	50	87
H2-Comp	50	87
HX1-Cold	-	87
HDT	390	87
HX1-Hot	-	20
HX2-Hot	-	20
Flash-HDT	50	20
Decantor	50	20
PSACOL	50	20
HX2-Cold	-	20
Gasolcol	70	1.5

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Table S1 Continued

Equipment	Temperature (°C)	Pressure (bar abs)
Deieselcol	250	1.2
Bot pump	250	20
H2-Comp2	250	90
HX3-Cold	680	90
HCK	680	90
HX3-Hot	-	20
Cool-HCK	50	20
HCK-Gas	50	20

Reaction information

Primary cellulose decomposition

- CELLULOS --> CELL-ACT k=8e13,E=52900kcal/kmol
- CELL-ACT --> .95 GLYCOALD + .25 GLYOXAL + .2 ACETALDY + .25 HDRMTFUR + .16 CO2 + .23 CO + .9 WATER+ .1 CH4 + .61 C + .2 ACETONE k=1e9, E=30000kcal/kmol
- CELL-ACT --> LEVOGLUC k=4,n=1,E=10000kcal/kmol
- CELLULOS --> 5 WATER + 6 C k=8e7, E=36800kcal/kmol
- HEMICELL --> .4 HEMCELL1 + .6 HEMCELL2 k=1e10, E=31000kcal/kmol
- HEMCELL1 --> 1.25 H2 + .5 CO2 + CO + .5 FORMALDY + .25 METHANOL + .125 ETHANOL + 1.125 WATER + 2.3 C + .075 ETHENE + .05 CH4. k=3e9, E=2700kcal/kmol
- HEMCELL1 --> XYLOSE k=3,n=1,E=11000kcal/kmol
- HEMCELL2 --> .75 CO2 + .3 CH4 + .5 CO + .2 H2 + .3 FORMALDY + .25 METHANOL + .125 ETHANOL + 1.525 WATER + 1.35 C + .05 ETHENE + .2 ETYLDIOL + .4 ACETALDY k=1e10, E=3300kcal/kmol
- HEMCELL2 --> ACETICAC + 1.2 WATER + .22 1PC10CHR + .2 FORMALDY + .15 FORMICAC + .15 PROPNCAC k=8e9, E=33000kcal/kmol

Cellulose secondary reactions

- LEVOGLUC --> HDRMTFUR + 2 WATER k=1.25e12, E=60000kcal/kmol
- HDRMTFUR --> FURFURAL + FORMALDY k=5e12, E=59000kcal/kmol
- PROPANOL --> ETHANE + FORMALDY k=1e13, E=59000kcal/kmol
- GLYCOALD --> 2 FORMALDY k=5e12, E=60000kcal/kmol
- GLYCOALD --> 1PCH2OH + 1PCHO k=3e16, E=82000kcal/kmol
- PROPANOL --> PROPENE + WATER k=1e12, E=59000kcal/kmol
- ACETICAC --> 2 FORMALDE k=5e12, E=60000kcal/kmol
- ETYLDIOL --> FORMALDY + METHANOL k=1e13, E=59000kcal/kmol
- ETYLDIOL --> WATER + ACETALDY k=5e12, E=59000kcal/kmol 1ROH + FORMALDY --> 1RH + H2 + CO2 k=1e13, E=10000kcal/kmol

Lignin decomposition and secondary reactions

Initial decomposition reactions

- 1LIGH --> PROPENE + 1ROH + 1RLIGM2A k=1e13, E=163245 kJ/kmol
- LIGNIN-H --> 1PRLIGH + 1RH k=1e13, E=163245 kJ/kmol
- 1LIGM2 --> 1RPHOXM2 + 1RADIOM2 k=1e13, E=163245 kJ/kmol
- LIGN-OH --> 1PRLGM2A + 1RH k=1e13, E=163245 kJ/kmol
- LIGN-OH + 1RH --> 1RPHOXM2 + 1RADIOM2 k=1e13, E=163245 kJ/kmol
- 1LIG --> 1RPHENOX + 1RADIO k=1e13, E=184184 kJ/kmol
- LIGNIN-C --> 1PRLIG-A + 1RH k=1e13, E=184184 kJ/kmol
- LIGNIN-C --> 1RPHENOX + 1PRADIO k=1e13, E=188370 kJ/kmol
- 1PADIOM2 --> 1RADIOM2 k=1e13, E=171626 kJ/kmol
- 1PADIO --> 1PRADIO + 1RH k=1e13, E=179998 kJ/kmol
- 1PKETM2 --> 1PRKETM2 + 1RH k=1e13, E=167440 kJ/kmol
- 1PLIGC --> LIGNIN-C + KETEN-01 k=1e8, E= 121394 kJ/kmol
- LIGNIN-O --> LIGN-OH + CO2 k=1e9, E= 108836 kJ/kmol

Secondary decomposition reactions

- 1RPHOXM2 --> CO + .5 1C10H2M4 + 0.5 H2 k=4e10, E=209300 kJ/kmol
- 1RPHENOX --> .5 1C10H2 + CO + 1.5 H2 k=4e10, E=209300 kJ/kmol
- 1PRKETM2 + 1RH --> 1KETDM2 + 1ROH k=1e13, E=121394 kJ/kmol
- 1PRLIGH --> 1PRLGM2A + ACETONE k=1e13, E=133952 kJ/kmol
- 1RADIOM2 --> 1RGUAI + PROPNCAC k=1e13, E=133952 kJ/kmol
- 1RLIGM2A --> 1KETM2 + 1RPHOXM2 k=5e12, E=133952 kJ/kmol
- 1PRLGM2A --> 1PKETM2 + 1RPHOXM2 k=5e12, E=133952 kJ/kmol
- 1RLIGM2A --> 1RGUAI + 1PFET3M k=1e13, E=163254 kJ/kmol
- 1PRFETM2 --> 1RPHOXM2 + PROPDIAL k=1e13, E=133952 kJ/kmol
- 1RADIO --> 1RPHENOL + PROPNCAC k=1e13, E=153254 kJ/kmol
- 1RLIG-A --> 1KET + 1RPHENOX k=1e13, E=138138 kJ/kmol
- 1RLIG-A --> 1RPHENOL + 1PFET3 k=1e13, E=163254 kJ/kmol
- 1PRFET3 --> 1RPHENOX + PROPDIAL k=1e13, E=138138 kJ/kmol
- 1RADIOM2 --> 1ROH + SINPYALC k=3e11, E=104650 kJ/kmol
- 1RKETM2 --> 1ROH + 1KETDM2 k=3e11, E=104650 kJ/kmol
- 1RADIO --> 1ROH + CMRYLALC k=3e11, E=104650 kJ/kmol
- 1RKET --> 1ROH + 1KETD k=3e11, E=113022 kJ/kmol
- 1RC3H7O2 --> 1RMETNOL + ACETALDY =1e13, E=129766 kJ/kmol
- 0.5 1C10H2M4 --> 1RMETNOL + 1RPHENOX k=1e13, E=196742 kJ/kmol
- 1C10H2M2 --> 1RMETNOL + 0.5 1C10H2 + 1RPHENOX k=1e13, E=196742 kJ/kmol

H- abstraction reactions

- 0.5 1C10H2 + 1RPHENOL --> PHENOL + .5 1PC10CHR k=1e8, E= 54418 kJ/kmol
- 1RGUAI + 1KETM2 --> 1MGUAIAC + 1RKETM2 k=1e12, E= 54418 kJ/kmol
- 1RGUAI + 1RH --> 1MGUAIAC k=1e12, E= 60000 kJ/kmol

Substitutive addition reactions

- 1ADIOM2 + 1RPHOXM2 --> 1C10H2M4 + .5 H2 + 2 1PH2 + 2 1PCOH + 1RC3H7O2 k=1e9, E=121394 kJ/kmol
- 1KETM2 + 1RPHOXM2 --> 1C10H2M4 + .5 H2 + 2 1PH2 + 2 1PCOH + 1RPRPACD k=1e9, E= 121394 kJ/kmol
- 1KETDM2 + 1RPHOXM2 --> 1C10H2M4 + .5 H2 + 2 1PH2 + 2 1PCOH + 1RC3H3O k=1e9, E= 121394 kJ/kmol
- SINPYALC + 1RPHOXM2 --> 1C10H2M4 + H2 + 3 1PH2 + 2 1PCOH + 1RC3H3O k=1e9, E= 121394 kJ/kmol
- 1ADIOM2 + 1RPHENOX --> .5 1C10H2M4 + .5 1C10H2 + 1.5 H2 + 2 1PH2 + 1PCOS + 1PCOH + 1RC3H7O2 k=1e9, E= 121394 kJ/kmol
- 1KETM2 + 1RPHENOX --> .5 1C10H2M4 + .5 1C10H2 + .5 H2 + 4 1PH2 + 2 1PCOS + 1RPRPACD k=1e9, E= 121394 /kmol
- 1KETDM2 + 1RPHENOX --> .5 1C10H2M4 + .5 1C10H2 + .5 H2 + 2 1PH2 + 1PCOS + 1PCOH + 1RC3H3O k=1e9, E= 121394 kJ/kmol
- SINPYALC + 1RPHOXM2 --> 1C10H2M4 + H2 + 3 1PH2 + 2 1PCOH + 1RC3H3O k=1e9, E= 121394 kJ/kmol
- 1ADIO + 1RPHENOX --> 1C10H2 + 1.5 H2 + 4 1PH2 + 2 1PCOS + 1RC3H7O2 k=1e9, E= 121394 kJ/kmol
- 1KET + 1RPHENOX --> 1C10H2 + 1.5 H2 + 4 1PH2 + 2 1PCOS + 1RPRPACD k=1e9, E= 121394 kJ/kmol
- 1KETD + 1RPHENOX --> 1C10H2 + 1.5 H2 + 4 1PH2 + 2 1PCOS + 1RC3H3O k=1e9, E= 121394 kJ/kmol
- CMRYLALC + 1RPHENOX --> 1C10H2 + 2.5 H2 + 4 1PH2 + 2 1PCOS + 1RC3H3O k=1e9, E= 121394 kJ/kmol
- 1ADIO + 1RPHOXM2 --> .5 1C10H2M4 + .5 1C10H2 + 1.5 H2 + 2PH2 + 1PCOS + 1PCOH + 1RC3H7O2 k=1e9, E= 108836 kJ/kmol
- 1KET + 1RPHOXM2 --> .5 1C10H2M4 + .5 1C10H2 + 1.5 H2 + 2PH2 + 1PCOS + 1PCOH + 1RPRPACD k=1e9, E= 108836 kJ/kmol
- 1KETD + 1RPHOXM2 --> .5 1C10H2M4 + .5 1C10H2 + 1.5 H2 + 2PH2 + 1PCOS + 1PCOH + 1RC3H3O k=1e9, E= 108836 kJ/kmol
- CMRYLALC + 1RPHOXM2 --> .5 1C10H2M4 + .5 1C10H2 + 1.5 H2 + 4 1PH2 + 1PCOS + 1PCOH + 1RC3H3O k=1e9, E= 115115 kJ/kmol
- 1RPHOXM2 + .5 1C10H2M4 --> 1C10H2M2 + 1PCHO + 1.5 H2 + 1RMETNOL + 1PCOH k=1e9, E= 115115 kJ/kmol

- 0.5 1C10H2M2 + 1RPHOXM2 --> .5 1C10H2 + .5 H2 + 1RMETNOL + .5 1C10H2M4 + 1PCOH k=1e9, E= 115115 kJ/kmol
- 0.5 1C10H2M2 + 1RPHENOX --> 1C10H2 + 1.5 H2 + 1RMETNOL + 1PCOS k=1e9, E= 117208 kJ/kmol
- 0.5 1C10H2M4 + 1RPHENOX --> .5 1C10H2 + 1.5 H2 + 1RMETNOL + 1PCOS + .5 1C10H2M2 k=1e9, E= 117208 kJ/kmol

Recomposition reactions

- 1RMETNOL + 1RPHENOX --> CO2 + .5 1C10H2 + 1.5 H2 + 1RCH3 k=1e8, E= 54418 kJ/kmol
- 1RMETNOL + 1RPHOXM2 --> 1RCH3 + CO2 + .5 1C10H2M4 + .5 H2 k=1e8, E= 54418 kJ/kmol
- 1RPHENOX --> 1PCOH + .5 1C10H2 + 3 1PH2 k=1e8, E= 48139 kJ/kmol
- 1RPHOXM2 --> 1PCOH + .5 1C10H2M4 + 1PH2 k=1e8, E= 48139 kJ/kmol
- 1RMETNOL + 1RCH3 --> ETHANOL k=1e8, E= 12558 kJ/kmol
- 1RMETNOL --> ACETALDY + WATER k=1e8, E= 12558 kJ/kmol
- 1RMETNOL + 1PRADIOM + 1PH2 --> 1PCH2OH + 1PADIOM2 k=1e8, E= 52325 kJ/kmol
- 1RMETNOL + 1PRKETM2 + 1PH2 --> 1PCH2OH + 1PKETM2 k=1e8, E= 52325 kJ/kmol
- 1RADIOM2 --> 2 1PCH2OH + 2 1PCH2 + 2 1PCHOHP + 2 1PH2 + 1C10H2M4 + 2 1PCOH k=3.16e7, E=83720 kJ/kmol
- 2 1RLIGM2A --> .2 1PC10CHR + 2 1PCH2OH + 6 1PH2 + 2 1C10H2M4 + 4 1PCOH + 2 1PCHOHP k=3.16e7, E=83720 kJ/kmol
- 2 1RLIGM2A --> 2 1PCHO + 2 WATER + 6 1PH2 + 2 1C10H2M4 + 4 1PCOH + 2 1PC2H2 k=3.16e7, E=83720 kJ/kmol
- 2 1RGUAI --> 4 1PH2 + 1C10H2M4 + 2 1PCOH k=3.16e7, E=83720 kJ/kmol
- 2 1RKETM2 --> 2 1PCH2OH + 2 1PH2 + 1C10H2M4 + 4 1PCOH + 2 1PCH2 k=3.16e7, E=83720 kJ/kmol
- 2 1PRFETM2 --> 2 1PCHO + 2 1PH2 + 1C10H2M4 + 3 1PCOH + 2 1PCH2 + 1PCHOHP k=3.16e7, E=83720 kJ/kmol
- 2 1RC3H7O2 --> 2 WATER + 2 1PC2H2 + 2 1PCHOHP + 2 1PH2 k=1e8, E= 12558 kJ/kmol
- 2 1RPRPACD --> 2 WATER + 2 1PC2H2 + 2 1PCOH + 2 1PH2 k=1e8, E= 12558 kJ/kmol
- 2 1RC3H3O --> 2 1PCOH + 2 1PC2H2 + 2 1PH2 k=1e8, E= 12558 kJ/kmol
- 1ROH + 1RCH3 --> METHANOL k=1e8, E= 12558 kJ/kmol
- 2 1RCH3 --> ETHANE k=1e8, E= 12558 kJ/kmol
- 2 1PRADIO --> 1PCOS + 1PCOH + 1C10H2 + H2 + 2 1PCH2 + 2 1PCH2OH + 2 1PCHOHP + 2 1PH2 k=6.2e7, E= 92092 kJ/kmol
- 1PRADIOM + 1RH --> 1PADIOM2 k=1e8, E= 48139 kJ/kmol
- 1RGUAI + 1RH --> 1MGUAIAC k=1e8, E= 48139 kJ/kmol
- 1PRKETM2 + 1RH --> 1RKETM2 k=1e8, E= 48139 kJ/kmol
- 2 1RADIO --> 1PCOS + 2 1PCHOHP + 2 1PCH2 + 1C10H2 + 4 1PH2 + H2 + 1PCOH + 2 1PCH2OH k=3.16e7, E=92092kJ/kmol
- 1RPHENOX + 1RLIG-A --> 3 1PCOS + 1PCHOHP + WATER + 1PC2H2 + 1.5 1C10H2 + 6 1PH2 + 1.5 H2 k=3.16e7, E=83720 kJ/kmol
- 1LIG + 1RLIG-A --> 4 1PCOS + .2 1PC10CHR + 2 1PCH2OH + 2 1PCHOHP + 2 1C10H2 + 10 1PH2 + 2.5 H2 k=3.16e7, E=83720 kJ/kmol
- 2 1PRLIG-A --> 2 1PCHOHP + 2 WATER + 2 1PC2H2 + 2 1C10H2 + 4 1PCOS + 6 1PH2 + 2 H2 k=1e8, E= 54418 kJ/kmol
- 2 1PRFET3 --> 2 1PCOH + 2 1PCH2 + 2 1PCH2OH + 2 1PCOS + 1C10H2 + H2 + 2 1PH2 k=3.16e7, E=83720 kJ/kmol
- 2 1RKET --> 3 1PCOH + 2 1PCH2 + 2 1PCH2OH + 1PCOS + 1C10H2 + H2 + 4 1PH2 k=3.16e7, E=83720 kJ/kmol
- 2 1PRLIGH --> 2 1PCHOHP + 3 WATER + 3 1PC2H2 + 5 1PCOH + 2 1C10H2M4 + H2 + 2 1RCH3 + 1PCH2 k=3.16e7, E=83720 kJ/kmol
- 1RPHENOX + 1RPHENOL --> 2 1PCOS + 1C10H2 + 1.5 H2 + 4 1PH2 k=5e7, E= 83720 kJ/kmol
- 1RPHENOX + 1RC3H3O --> 1PCOS + .5 1C10H2 + H2 + 2 1PH2 + 1PC2H2 + 1PCOH k=1e8, E= 48139 kJ/kmol
- 1RPHENOX --> 1PCOS + .5 1C10H2 + 1.5 H2 k=3e7, E= 104650 kJ/kmol
- 1RPHOXM2 --> 1PCOS + .5 1C10H2M4 + .5 H2 k=3e7, E= 104650 kJ/kmol

Primary char devolatization reactions

- 1PCOS --> CO k=2e8, E= 199300 kJ/kmol
- 1PCOH --> CO k=2e8, E= 138138 kJ/kmol
- 1PH2 --> H2 k=2e8, E= 209300 kJ/kmol
- 1PC2H2 --> H2 + .2 1PC10CHR k=5e8, E= 205114 kJ/kmol

- 1PCH2OH --> 1ROH + 1PCH2 k=2e8, E= 0 kJ/kmol
- 1PCHOHP --> 1ROH + .5 1PC2H2 k=2e8, E= 0 kJ/kmol
- 1PCHO --> 1ROH + .1 1PC10CHR k=2e8, E= 0 kJ/kmol
- 1PCH2 --> H2 + .1 1PC10CHR k=2.5e9, E=209300 kJ/kmol
- 1PCH2OH --> .5 CH4 + .5 CO2 + .5 H2 k=3e8, E= 0 kJ/kmol
- 1PCHOHP --> .5 CH4 + .5 CO2 k=3e8, E= 0 kJ/kmol
- 1PCHO --> .25 CO2 + .25 CH4 + .5 CO k=3e8, E= 0 kJ/kmol

Reactions with estimated kinetics, with stoichiometry from literature

For the following equations, the reaction stoichiometry was taken from various sources in the literature, while the kinetic factors were derived from an independent bibliography or were adjusted manually to reproduce the published reaction behavior (such as temperature of the start of decomposition, percentage decomposed after the given time). As every reaction was based on individual sources, the corresponding references are given with each one.

- FURAN --> WATER + .125 CH4 + .125 ETHENE + .08333333 BENZENE + .0625 NAPHTLEN + .25 1PC10CHR ; Assumptions: CH4, ethane, benzene and naphthalene in equal mole C conversion fractions, each pathway independent, producing char. k =7.5e8, E=142000 kJ ·kmol1
- PROPDIAL --> 2 WATER + .3 1PC10CHR - k=2e6, E=175000kJ/kmol k =7.5e8, E=142000 kJ/kmol
- LEVOGLUC --> .27 1PC10CHR + 2.7 WATER + .7 ACETALDY + .7 CO + .3 ACETONE + .3 CO2 k =250000, E=95000kJ/kmol
- 1KETM2 --> 1RMGUAI + 1 RC3H3O k =1.5e4, E= 90000 kJ/kmol
- XYLOSE --> FORMICAC + WATER + 2 C + CO2 + CH4 + H2 k =1e4, E= 90000 kJ/kmol
- 1KETDM2 --> 1MGUAIAC + WATER + .3 1PC10CHR k =1,2e4, E=95000 kJ/kmol
- SINPYALC --> 1MGUAIAC + METHANOL + .2 1PC10CHR k =1e4, E=95000 kJ/kmol
- CMRYLALC --> PHENOL + METHANOL + .2 1PC10CHR k =1e4, E=95000 kJ/kmol
- FURFURAL --> .5 CH4 + .4 1PC10CHR + .5 CO2 + WATER k =9.5e4, E=105000 kJ /kmol
- ACETICAC --> CO2 + CH4 k=5.75e5, E=43500kcal/kmol
- ACETICAC --> KETEN-01 + WATER k: 5.25e12,E=70.51kcal/kmol
- PROPDIAL --> ACETALDY + CO ; Assumptions: decarboxylation by CO production. k=8e8 and E=130000kJ/kmol
- FORMALDY --> H2 + CO k=2.8e6, E =33500kcal/kmol
- METHANOL --> CO + 2 H2 k= 8000, E= 195000kJ/kmol
- FURFURAL --> FURAN + CO k=2.5e8, E=155000kJ/kmol
- XYLOSE --> FURFURAL + 3WATER; fast route assumed. k=1.3e7, E= 149000 kJ/kmol
- XYLOSE --> CO2 + ACETONE + FORMALDY + 3 WATER + .75 GLYCOALD + .175 1PC10CHR + .25 ACETALDY + .25 CO + 1PCHOHP; slow route assumed. k=2.6e5, E= 102500 kJ/kmol
- LEVOGLUC --> .8 GLYCOALD + .7 ACETOL + .45 CO2 + .3 CO + .055 1PC10CHR + .3 ETYLDIOL + .2 ACETALDY. k=5e9, E= 165000 kJ/kmol
- KETEN-01 --> CO + .085 ETHENE + .0415 1PC10CHR + .415 CH4 ; Assumptions: basis: CO 65% , ethene 5% , CH4 30% , H2 3% + carbon-like mass. k=9.5e9, 55500kcal/kmol
- PROPNCAC --> .55 CO2 + .4 ETHANE + .6 WATER + .3 PROPENE + .45 CO + .15 CH4 + .15 ETHENE; Assumptions: integrated the given reaction mechanisms into one single reaction, as intermediate product is no compound of the simulation. k=1e8, E=49000kcal/kmol
- ACETONE --> KETENE + CH4; Assumptions: at 580ºC, 15% mol conversion after 2,5min residence time. k=2e7, E= 145000 kJ/kmol
- ACETALDY --> .8 CO + .7 CH4 + .1 H2 + .1 ETHENE + .1 ETHANE + .1 CO2 k=50000, E=98000kJ/kmol
- 1PRADIO + 1RCH3 --> CMRYLALC + 1PCH2OH k=1e8, E=48139 kJ/kmol
- 1PRKETM2 + 1 PRKETM2 --> 2 1PCH2OH + 1C10H2M4 + 4 1PCOH + 2 1PCH2 k=3.16e7, E=83720 kJ/kmol

Reactions for nitrogen containing compounds

- GLUTACID --> AMMONIA + CO2 + ACETICAC + PROPNCAC + WATER + .3 1PC10CHR + CHAR-N + 1PCHO acc. to k=1e6, E=90000 kJ/kmol
- GLUTACID --> PYRROLID + CO2 + WATER k=9e8, E=117000 kJ/kmol

- PYRROLE --> .15 NAPHTLEN + .5 HCN + .15 ETHENE + .0975 1PC10CHR + .2 PROPENE + .05 ETHANE + .025 CH4 + .4 CHAR-N + .1 AMMONIA , Assumptions: reaction mechanism by regression based on given product components, Naphthalene representing PCHs, ethane / propene representing propyne); Assumptions: propyne and HCN as main products; k=2,25e13, E=49500 kcal/kmol
- PYRROLID --> HCN + .5 ACETONE + .3 CO + .2 ETHANE + .2 ETHENE + .075 H2 + .2 WATER + .075 CH4 + .025 1PC10CHR + .025 PROPENE , with acetone introduced as intermediate product (acetone instead of propanal). k= 1e6, E= 120000 kJ/kmol
- GLUTACID --> PYRROLE + CO2 + 2 WATER k= 4,5e8, E= 117000 kJ/kmol
- PYRROLE --> HCN + .66666666 PROPENE + .1 1PC10CHR ; Assumptions: HCN and propene + C (instead of propyne) as primary decomposition products. k=9e13, E=62.500kcal/kmol

Table S2 Detail of equipment costs in each section from Aspen Process Evaluation Analysis

Section	Equipment	Equipment cost (USD)
Pretreatment	Compressor (BLOWER)	540,500
	Heat Exchanger (HX-AIR)	10,900
	Dryer (DRYER)	83,600
	Crusher (MILLING)	67,200
	Screener (SCREEN)	18,300
Pyrolysis	Pyrolysis reactor (PYR)	451,700
Separation	Cyclone (GS-SEP1)	28,300
	Heat Exchanger (QUENCH)	10,700
	Flash Vessel (QUENCH2)	19,100
	Pump (PUMPLIQ)	19,900
	Compressor (GAS-COM1)	560,100
	Heat Exchanger (HX-GAS)	12,000
Combustion	Compressor (GAS-COM2)	671,900
	Combustion chamber (COMB)	63,500
	Cyclone (GS-SEP2)	503,200
	Heat Exchanger (HX-COMB3)	21,100
	Turbine (TURBINE)	99,700
Hydrotreating	Pump (PUMPBO)	66,600
	Compressor (H2-COMP1)	1,900,100
	Heat Exchanger (HX1-COLD)	122,700
	Reactor (HDT)	127,610
Distillation	Heat Exchanger (HX1-HOT)	12,000
	Heat Exchanger (HX2-HOT)	10,900
	Flash (FLSH-HDT)	23,000
	Flash (PSACOL)	29,500
	Decanter (DECANTER)	83,600
	Heat Exchanger (HX2-COLD)	11,000
	Distillation (GASOLCOL)	226,245
	Distillation (DIESLCOL)	315,797
	Pump (BOTPUMP)	83,600
	Heat Exchanger (COOL-HCK)	19,500
	Flash (FLSH-HCK)	19,200
Hydrocracking	Compressor (H2-COMP2)	1,502,400
	Heat Exchanger (HX3-COLD)	25,800
	Reactor (HCK)	61,200
	Heat Exchanger (HX3-HOT)	11,300
Diesel generator	Diesel generator	22,000
Total equipment cost		7,855,752