

SLURRY HYDROCRACKER PROJECT

Appendix C - Reactor Mass Balance

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Table of Contents

C1 SUMMARY	C3
C2 REACTOR COMPONENT BALANCE	C3
C3 REFERENCES	C4

C1 SUMMARY

This Appendix shows the elemental mass balance around the hydrocracking reactor. The feed components are obtained from Athabasca bitumen composition, and the product yields as well as their sulphur and nitrogen contents are based on CANMET product data ^[1,2]. Oxygen contents in the products are arbitrary numbers based on the fact that oxygen typically takes up 0.08 - 1.8 weight % in synthetic crude oils, where it tends to be in heavier hydrocarbons ^[3].

C2 REACTOR COMPONENT BALANCE

Table C1. Feed and product elemental compositions.

	Feed (wt.%)	CANMET Product Composition (wt.%)			
Elements	Bitumen	Naphtha	LGO	VGO	Residue
C	82.70%	84.10%	83.86%	83.71%	82.45%
H	10.50%	15.12%	13.36%	12.31%	11.27%
S	5.10%	0.60%	1.80%	2.30%	3.10%
N	0.60%	0.10%	0.40%	0.60%	1.60%
O	1.10%	0.08%	0.58%	1.08%	1.58%

Table C2. CANMET product percent yields.

CANMET Yield (wt%)	
Naphtha	19.80%
LGO	33.50%
VGO	28.50%
Residue	4.50%
Gas product	13.70%

Table C3: Elemental mass flow rates of the feed and products.

	Feed (kg/h)		Products (kg/h)				
Elements	Bitumen	H2 consumed	Naphtha	LGO	VGO	residue	Gas product
Total	665516.00	27060.47	137130.14	232013.12	197384.30	31165.94	94882.98
C	550381.73	0	115326.10	194574.33	165236.41	25695.29	49549.59
H	69879.18	27060.47	20734.42	30988.82	24291.99	3513.43	17410.99
S	33941.32	0	822.78	4176.24	4539.84	966.14	23436.32
N	3993.10	0	137.13	928.05	1184.31	498.66	1244.95
O	7320.68	0	109.70	1345.68	2131.75	492.42	3241.12

Table C4. Overall mass balance around the hydrocracking reactor.

Overall Mass Balance (kg/h)	
Bitumen feed	665516
H2 consumed	27060.47
Total in	720576.47
Naphtha	142674.14
LGO	241393.12
VGO	205364.30
Vacuum residue	32425.94
Gas product	70718.98
Total out	720576.47

C3 REFERENCES

- [1] Gray, M. R. (2015). *Upgrading oilsands bitumen and heavy oil*. Retrieved from <https://ebookcentral.proquest.com>.
- [2] Speight, J.G. (2017). *Handbook of petroleum refining*, CRC Press, Taylor & Francis Group.
- [3] *Robust Summary of Information on Crude Oil*. (2011).