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9.

Apêndice

9.1.

Apêndice 1

Tabela A1 Dados da produção de AH pelo método PQ na solução de $HN0_3$.

Peso do carvão1 (g)	Peso do carvão2 (g)	Sólido / solução (g/mL)	Conc. (%)	Tempo (Hr)	Peso AH1 (g)	Peso AH2 (g)	Peso meio AH (g)	Ef. AH (%)	Peso AF (g)	Ef. AF (%)	S*
2,056	2,033	1/10	10	2	0,261	0,295	0,28	13,7	0,06	2,8	0,9
2,042	2,012	1/10	10	5	0,31	0,29	0,30	14,8	0,07	3,7	0,4
2,090	2,073	1/10	10	10	0,30	0,32	0,31	14,9	0,08	3,8	0,4
2,530	2,009	1/10	20	2	0,28	0,31	0,30	14,7	0,09	4,5	2,0
2,071	2,022	1/10	20	5	0,36	0,32	0,34	16,7	0,09	4,6	0,8
2,031	2,037	1/10	20	10	0,31	0,38	0,35	16,9	0,10	4,7	1,9
2,022	2,013	1/10	40	2	0,43	0,38	0,41	20,2	0,08	4,0	1,1
2,054	2,021	1/10	40	5	0,43	0,49	0,46	22,7	0,09	4,4	1,5
2,038	2,038	1/10	40	10	0,43	0,51	0,47	23,1	0,09	4,4	1,7
2,016	2,010	1/20	10	2	0,31	0,26	0,28	14,1	0,04	2,1	1,1
2,039	2,024	1/20	10	5	0,33	0,31	0,32	15,7	0,07	3,3	0,5
2,036	2,019	1/20	10	10	0,34	0,31	0,33	16,1	0,07	3,5	0,8
2,027	2,009	1/20	20	2	0,39	0,36	0,38	18,7	0,05	2,6	0,7
2,033	2,016	1/20	20	5	0,37	0,44	0,39	19,5	0,07	3,2	2,0
2,041	2,026	1/20	20	10	0,41	0,38	0,40	19,6	0,08	4,1	0,6
2,018	2,061	1/20	40	2	0,41	0,42	0,42	20,1	0,08	4,0	0,1
2,042	2,035	1/20	40	5	0,49	0,44	0,47	23,0	0,09	4,2	1,2
2,022	2,017	1/20	40	10	0,45	0,52	0,49	24,0	0,09	4,5	1,7
2,023	2,021	1/40	10	2	0,16	0,24	0,20	9,7	0,06	2,7	2,0
2,027	2,071	1/40	10	5	0,22	0,30	0,26	12,5	0,07	3,5	1,6
2,007	2,012	1/40	10	10	0,29	0,24	0,27	13,3	0,08	3,8	1,3
2,053	2,041	1/40	20	2	0,31	0,28	0,30	14,6	0,09	4,3	0,7
2,038	2,039	1/40	20	5	0,40	0,35	0,38	18,4	0,09	4,4	1,3
2,014	2,004	1/40	20	10	0,41	0,37	0,39	19,4	0,09	4,5	0,8
2,032	2,013	1/40	40	2	0,44	0,48	0,46	22,7	0,05	2,6	1,0
2,025	2,047	1/40	40	5	0,45	0,47	0,46	22,6	0,07	3,4	0,3
2,026	2,063	1/40	40	10	0,47	0,49	0,48	23,2	0,08	4,0	0,3

*Desvio padrão

9.2.

Apêndice 2

Tabela A2 Dados da produção de AH pelo método ELE na solução de H_2SO_4.

Peso carvão1 (g)	Peso carvão2 (g)	Peso carvão final (g)	Temperatura (°C)	Conc. (%)	Tempo (h)	Peso AH1 (g)	Peso AH2 (g)	Ef. Meia AH (%)	Peso meio AF (g)	Ef. meia AF (%)	S*
5	5,023	4,0865	25	10	5	0,30	0,36	6,02	0,01	0,30	0,57
5,012	5,042	4,0174	25	10	12	0,31	0,34	6,16	0,09	1,84	0,31
5,028	5,005	4,0714	25	10	24	0,31	0,42	6,14	0,01	0,18	1,10
5,09	5,046	4,0254	25	20	5	0,37	0,34	7,28	0,03	0,62	0,30
5,04	5,012	4,0437	25	20	12	0,38	0,45	7,67	0,00	0,00	0,63
5,031	5,098	4,0159	25	20	24	0,36	0,31	7,04	0,09	1,86	0,44
5,027	5,067	4,0162	25	40	5	0,50	0,72	9,84	0,00	0,00	2,24
5,033	5,027	4,0297	25	40	12	0,51	0,42	10,19	0,00	0,00	0,92
5,06	5,004	4,0219	25	40	24	0,51	0,43	10,14	0,00	0,00	0,82
5,034	5,033	4,0284	80	10	5	0,38	0,44	7,56	0,00	0,07	0,59
5,019	5,033	4,0796	80	10	12	0,32	0,39	6,42	0,01	0,19	0,67
5,021	5,038	4,0223	80	10	24	0,37	0,42	7,44	0,02	0,40	0,46
5,014	5,002	4,0287	80	20	5	0,46	0,51	9,29	0,00	0,00	0,44
5,037	5,046	4,0344	80	20	12	0,37	0,44	7,28	0,02	0,44	0,73
5,07	5,059	4,0685	80	20	24	0,34	0,42	6,69	0,03	0,56	0,80
5,013	5,061	4,0315	80	40	5	0,51	0,59	10,08	0,00	0,00	0,84
5,024	5,015	4,0033	80	40	12	0,54	0,61	10,74	0,00	0,00	0,70
5,03	5,074	4,0334	80	40	24	0,58	0,62	11,45	0,00	0,00	0,44
5,031	5,028	4,054	100	10	5	0,38	0,45	7,49	0,00	0,00	0,73
5,026	5,102	3,974	100	10	12	0,41	0,55	8,04	0,09	1,74	1,45
5,014	5,062	4,013	100	10	24	0,32	0,37	6,38	0,10	2,01	0,50
5,023	5,076	4,102	100	20	5	0,36	0,41	7,14	0,00	0,00	0,51
5,033	5,085	4,087	100	20	12	0,39	0,42	7,71	0,00	0,00	0,32
5,027	5,037	4,056	100	20	24	0,35	0,31	7,00	0,01	0,14	0,42
5,028	5,091	4,028	100	40	5	0,37	0,46	7,29	0,06	1,26	0,93
5,034	5,064	4,021	100	40	12	0,36	0,41	7,18	0,06	1,09	0,48
5,05	5,031	3,967	100	40	24	0,37	0,32	7,42	0,07	1,39	0,54
5,027	5,045	3,698	80	40	12	0,67	0,61	13,20	0,06	1,17	0,53

* Desvio padrão

9.3.
Apêndice 3

Tabela A3 Dados da produção de AH pelo método PRESS na solução de NaOH

Peso RJ1 (g)	Peso RJ2 (g)	Peso final RJ (g)	T (°C)	Conc. NaOH (M)	Tempo (h)	Peso AH1 (g)	Peso AH2 (g)	Peso meio AF (g)	Ef. meia AH (%)	Ef. meia AF (%)	S*
5,089	5,053	4,014	200	0,1	2	0,2932	0,3126	0,123	5,8	2,4	0,17
2,061	2,034	1,591	200	0,1	5	0,1383	0,2034	0,054	6,8	2,7	1,53
2.043	2,012	1,568	200	0,1	10	0,1317	0,1482	0,064	6,5	3,2	1,27
2,006	2,027	1,413	200	0,5	2	0,2608	0,3054	0,103	12,9	5,1	1,18
2,033	2,056	1,432	200	0,5	5	0,2653	0,2243	0,085	13,9	4,1	1,42
2,051	2,008	1,328	200	0,5	10	0,2971	0,3361	0,135	14,8	6,7	0,80
2,038	2,055	1,470	200	1	2	0,222	0,3009	0,110	10,8	5,3	1,98
2,025	2,011	1,428	200	1	5	0,1967	0,2481	0,138	9,8	6,9	1,24
2,016	2,025	1,419	200	1	10	0,2313	0,2713	0,125	11,4	6,2	1,02

* Desvio padrão

9.4.
Apêndice 4

Tabela A4 Dados da produção de AH pelo método PQ, ELE e PRESS pelas diferentes soluções (NaOH, H_2SO_4, HCl, Fe^{+2}, Fe^{+3} e HNO_3) obtidos com os parâmetros estudados, no calculo das variáveis estadísticas (a) AH e (b) AF-like.

(a)

Métodos	Ef.1 AH (%)	Ef.2 AH (%)	Ef.3 AH (%)	Ef. Meia AH (%)	Erro (E)	Re (%)	Cv (%)	U_x
HCL 40%-PQ	5,9	5,1	4,7	5,43	0,44	4,91	16,11	2,45
HNO_3 40%-PQ	19,2	21,1	20,6	20,18	1,34	8,47	7,10	4,23
NAOH 1M-PQ	5,8	5,9	4,8	5,65	0,38	1,78	5,11	0,89
H_2SO_4 40%-PQ	7,5	6,3	8,3	7,08	1,10	6,17	13,61	3,09
NAOH 0,5 M-PRESS	12,1	8,8	9,3	10,46	2,30	12,21	20,51	6,11
HCL O,5M-PRESS	4,4	4,0	5,1	4,18	0,31	1,87	7,36	0,94
HNO_3(0,01M)-PRESS	3,7	3,0	4,3	3,38	0,46	2,82	13,72	1,41
HNO_3(0,05M)-PRESS	4,5	3,9	4,2	4,19	0,45	2,74	10,72	1,37
ELE-NAOH 1M	8,8	6,5	7,4	7,66	1,61	9,78	20,98	4,89
ELE - H_2SO_4 40%	10,7	13,2	12,2	11,97	1,74	10,58	14,52	5,29
ELE-H_2SO_4 40%+FE^{+2}	12,5	14,2	13,7	13,35	1,15	6,99	8,60	3,49
ELE-H_2SO_4 40%+FE^{+3}	12,4	14,0	13,6	13,24	1,13	6,85	8,50	3,42

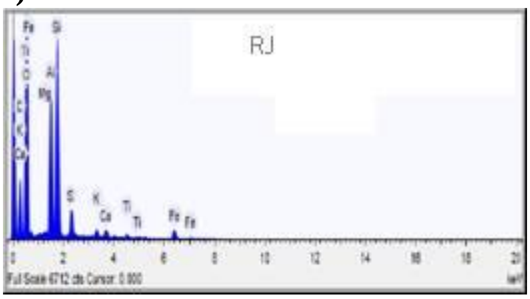
(b)

Métodos	Ef. AF1 (%)	Ef. AF2 (%)	Ef. AF3 (%)	Ef. meia AF (%)	Erro (E)	Re (%)	Cv (%)	U_x
HCL 40%-PQ	1,1	2,0	0,7	1,57	0,64	2,78	29,88	1,39
HNO_3 40%-PQ	3,6	4,1	2,8	3,83	0,37	1,68	7,14	0,84
NAOH 1M-PQ	3,0	5,1	4,8	2,06	1,33	12,18	64,99	6,09
H_2SO_4 40%-PQ	2,3	2,9	3,3	2,57	0,43	2,53	17,29	1,27
NAOH 0,5 M-PRESS	3,2	2,6	2,4	2,90	3,18	2,03	11,93	1,01
HCL 0,5M-PRESS	1,2	1,8	2,5	1,54	0,42	2,54	27,07	1,27
HNO_3(0,01M)-PRESS	1,0	0,7	2,3	0,85	0,16	0,97	18,81	0,48
HNO_3(0,05M)-PRESS	1,3	0,9	1,9	1,11	0,32	1,93	28,50	0,96
ELE-NAOH 1M	3,6	1,6	2,8	4,34	0,98	8,98	56,63	4,49
ELE - H_2SO_4 40%	0,0	1,2	0,6	0,59	0,83	5,03	141,42	2,52
ELE-H_2SO_4 40%+FE^{+2}	1,7	1,3	0,8	1,49	0,24	1,46	16,10	0,73
ELE-H_2SO_4 40%+FE^{+3}	0,5	0,0	0,4	0,28	0,38	2,30	136,83	1,15

9.5.

Apêndice 5

a)



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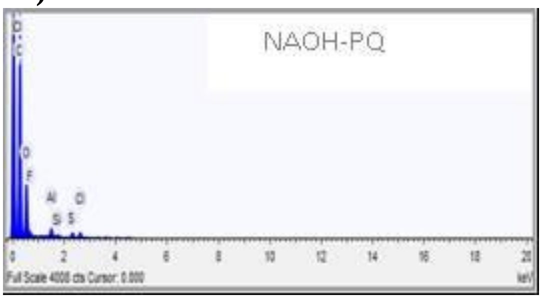

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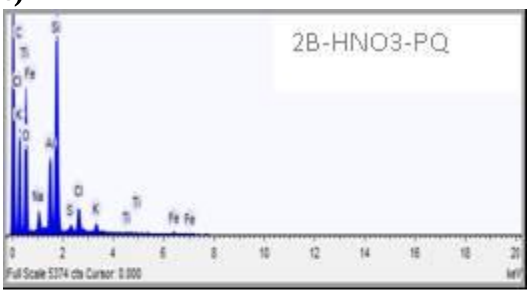

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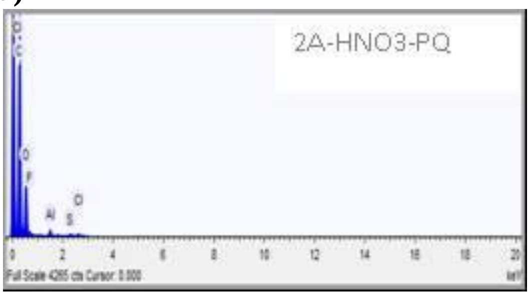

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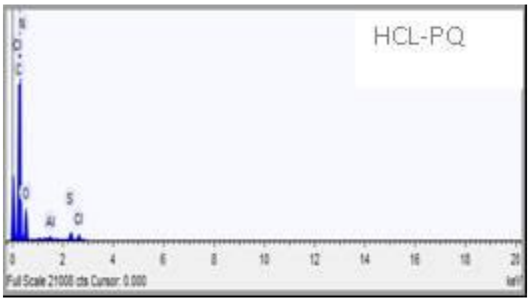

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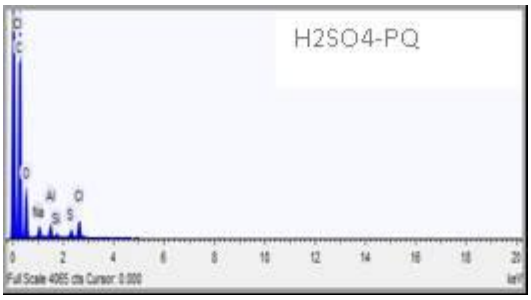

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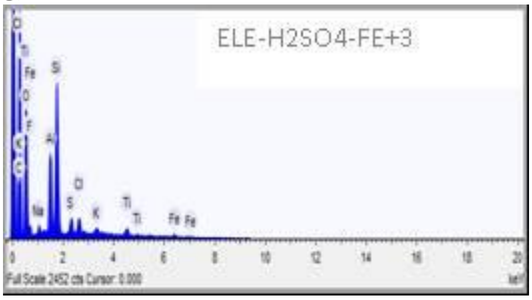

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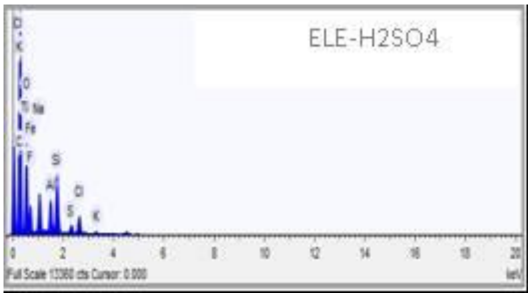

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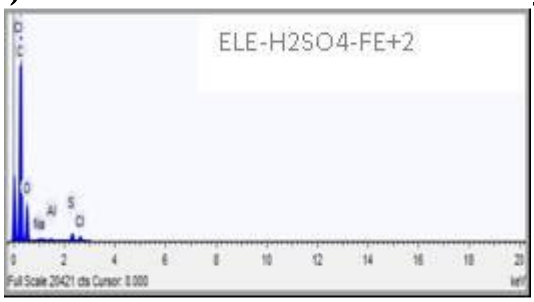

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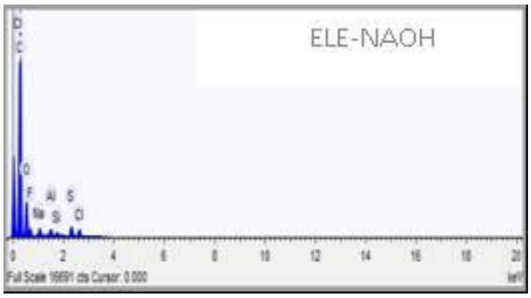

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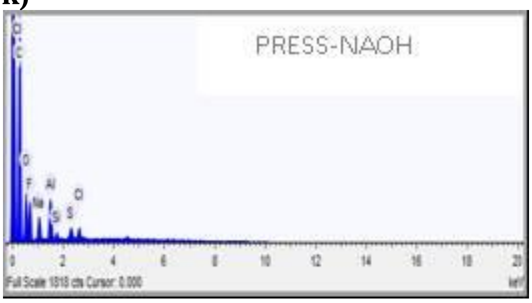

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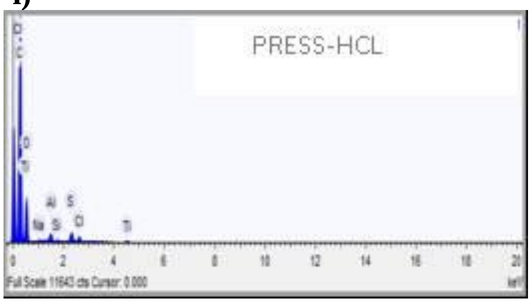

Figura A5 Espectros de SEM-EDS dos AH e RJ.