

Table 1. Estimated Thiele Modulus of fresh catalyst over the first 1000 h of data for Kuwait Export Crude Atmospheric Residue (KEC-AR).

Thiele - Fresh	HDS	HDV	HDNi
CAT-BA	5.77	1.45	14.58
CAT-BB	16.67	8.61	5.47
CAT-BC	1.27	1.15	1.48
CAT-BD	1.39	1.12	0.90
CAT-BE	1.67	1.04	2.19

HDS = hydrosulfurization, HDV = hydrodemetallation of vanadium, HDNi = hydrodemetallation of nickel.

Table 2. Estimated Thiele Modulus of spent catalyst over the first 1000 h of data for KEC-AR.

Thiele - Spent	HDS	HDV	HDNi
CAT-BA	15.33	15.47	15.34
CAT-BB	15.21	15.23	15.55
CAT-BC	15.43	15.49	15.47
CAT-BD	15.47	15.49	15.50
CAT-BE	15.46	15.50	15.44

Table 3. Estimated efficiency of catalyst over the first 1000 h of data for KEC-AR.

Efficiency	HDS	HDV	HDNi
CAT-BA	1.23	1.22	2.21
CAT-BB	2.55	2.42	2.22
CAT-BC	1.15	1.40	1.78
CAT-BD	1.81	1.56	1.29
CAT-BE	1.91	1.11	1.70

Table 4. Estimated Thiele Modulus of fresh catalyst over the first 1000 h of data for Kuwait Heavy Crude AR (KHC-AR).

Thiele - Fresh	HDS	HDV	HDNi
CAT-BA	3.40	1.47	7.27
CAT-BB	8.86	8.00	3.08
CAT-BC	1.26	1.16	1.59
CAT-BD	1.30	1.66	1.06
CAT-BE	1.71	4.20	2.29

Table 5. Estimated Thiele Modulus of spent catalyst over the first 1000 h of data for KHC-AR.

Thiele - Spent	HDS	HDV	HDNi
CAT-BA	15.30	15.47	15.30
CAT-BB	15.19	15.15	15.54

CAT-BC	15.44	15.49	15.50
CAT-BD	15.50	15.50	15.50
CAT-BE	15.47	15.48	15.46

Table 6. Estimated efficiency of catalyst over the first 1000 h of data for KHC-AR.

Efficiency	HDS	HDV	HDNi
CAT-BA	1.57	1.40	2.83
CAT-BB	2.69	2.79	2.49
CAT-BC	1.40	1.60	2.64
CAT-BD	2.15	1.72	2.03
CAT-BE	2.23	1.23	2.30

Table 7. Estimated Thiele Modulus of fresh catalyst over the first 1000 h of data for Kuwait Eocene Crude AR (EOC-AR).

Thiele - Fresh	HDS	HDV	HDNi
CAT-BA	4.26	1.46	9.40
CAT-BB	10.05	8.46	3.45
CAT-BC	1.26	1.15	1.53
CAT-BD	1.37	1.98	1.04
CAT-BE	1.53	1.47	2.03

Table 8. Estimated Thiele Modulus of spent catalyst over the first 1000 h of data for EOC-AR.

Thiele - Spent	HDS	HDV	HDNi
CAT-BA	15.28	15.48	15.33
CAT-BB	15.20	15.16	15.54
CAT-BC	15.44	15.50	15.49
CAT-BD	15.47	15.48	15.50
CAT-BE	15.47	15.49	15.47

Table 9. Estimated efficiency of catalyst over the first 1000 h of data for EOC-AR.

Efficiency	HDS	HDV	HDNi
CAT-BA	1.62	1.37	2.75
CAT-BB	2.61	2.69	2.40
CAT-BC	1.34	1.55	2.38
CAT-BD	2.06	1.68	1.80
CAT-BE	2.15	1.20	2.11