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WAYS OF REDUCING COMBUSTIBLES AND RESIDUAL OIL IN RETORT ASH RESIDUE

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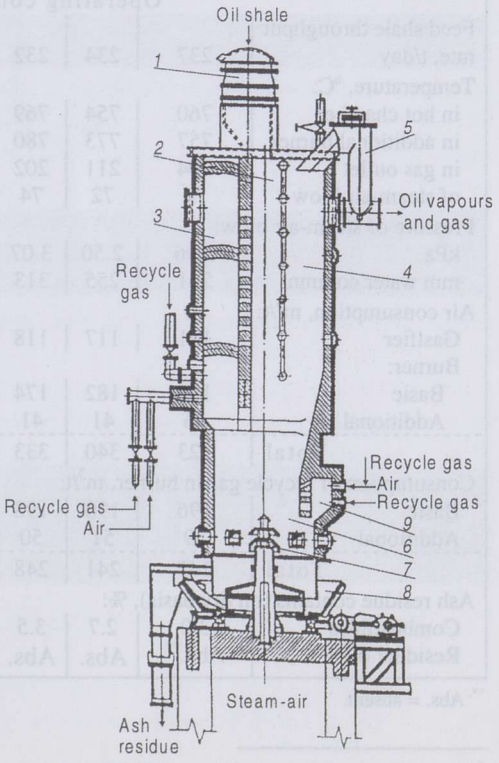
Content of combustibles in retort ash residue has been reduced to 3 % and that of residual oil to 0.2 % under retorting conditions used. In general, solid residue of well-retorted large-particle oil shale contains 5.5–7.5 % combustibles and 0.5–1.0 % residual oil (determined as Fischer assay oil).

During 2.5 months in 1976 special tests were carried out in one retort of the retort station of Slantsy Oil Shale Processing Plant (Leningrad District, Russia) with the aim to reduce the content of combustibles in solid residue. Large-particle oil shale (25–125 mm) was processed in retort No. 28 with cross-flow of heat carrier (Figure).



Retort with cross-current flow of the heat carrier gas (200–250 tonne-per-day):
1 – charging device;
2 – oil shale retorting chamber;
3 – heat carrier preparation and distribution chamber;
4 – oil vapour collecting and evacuation chamber;
5 – gas outlet;
6 – gasifier;
7 – gas blower;
8 – spent shale discharge device;
9 – additional burning device

As a rule, heating value of oil shale used in Slantsy plant is 12.14–12.56 kg 2,000–3,000 kcal/kg), on dry matter basis, or 10.93–11.30 MJ/kg (2,610–2,750 kcal/kg), on oil shale as received.

Spent shale was thoroughly warmed up owing to two-side heating, and so the steam-air mixture injected at 74 °C requires relatively small amounts of air for spent shale gasification – about 120 m^3/t* (Table). Total specific air consumption needed for the process was 338 m^3, and that of the recycle gas – 229 m^3 per tonne of feed shale. These numbers total 567 m^3 per tonne of feed shale compared to 900–1000 m^3 needed when retorts of other design are exploited. This was evidently the reason of the 60 % increase in retort throughput rate. As a rule, the retorts with cross-flow of heat carrier operated in Slantsy plant have the throughput rate about 150 tonnes of oil shale per day.

Operating Conditions of Processing Oil Shale in Retort No. 28 with Heat Carrier Cross Flow and Characteristics of Ash Residue (Tests Were Carried out in 1976 in Retort Station of Slantsy Oil Shale Processing Plant *)

Indices	February, 25–29	March		April		May		Average
		1–5	6–11	20–25	26–30	1–5	6–11	
Operating conditions								
Feed shale throughput rate, t/day	237	234	232	237	247	240	241	238
Temperature, °C:								
in hot chamber	760	754	769	764	770	786	775	767
in additional burner	757	773	780	747	757	753	734	757
in gas outlet	204	211	202	206	205	205	204	205
of steam-air blow	74	72	74	73	74	75	74	74
Pressure of steam-air blow:								
kPa	2.36	2.50	3.07	2.44	2.63	2.75	2.28	2.57
mm water column	241	255	313	249	268	281	233	263
Air consumption, m^3/t:								
Gasifier	121	117	118	119	117	120	120	118.8
Burner:								
Basic	156	182	174	165	165	167	165	167.7
Additional	46	41	41	61	58	54	56	51.0
Total	323	340	333	345	340	341	341	337.5
Consumption of recycle gas in burner, m^3/t:								
Basic	196	190	198	178	153	153	141	172.7
Additional	49	51	50	65	58	58	66	56.7
Total	245	241	248	243	211	211	207	229.4
Ash residue contains (on dry basis), %:								
Combustibles	3.0	2.7	3.5	2.8	3.4	2.7	2.9	3.0
Residual oil	Abs.**	Abs.	Abs.	0.7	0.4	Abs.	Abs.	0.2

** Abs. = absent.

* Gas and air volumes are given at 20 °C and 760 mm Hg.

Unfortunately, this retort was linked to the common condensation system and so it was not possible to measure shale oil yield.

The results of the tests carried out in retort No. 28 of Slantsy Oil Shale Processing Plant are presented in the Table. As one can see, the content of combustibles in ash residue was reduced to 3 % (as a rule, the content of combustibles in well burnt ash residue is in the range of 5.5–7.5 %). At the same time the content of residual oil was reduced to 0.2 % (as a rule, it is as high as 0.5–1.0 %).