Title:

Neutralization of Highly Alkaline Waste Streams of Estonian Oil Shale Thermal Processing

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The sustainability of oil shale industry in Estonia will largely depend on technology development for disposal and reuse of processed shale – combusted and particularly retorted. Besides ash from oil shale combustion approximately one million tons per year of solid waste, semicoke, is formed in the retort process of shale oil production from lumpy oil shale. Even more coke-ash residue arises from the solid heat carrier process for shale oil production from fine-grained oil shale. The true environmental hazard originating from retorted oil shale in Estonia should be mainly attributed to highly alkaline leachates and sulfides. Neutralization will reduce the environmental impact of the oil shale thermal processing wastes and make their reuse possible.

We have investigated recarbonation of retorted oil shale and alkaline leachates in laboratory and field experiments. pH of the semicoke contact water decreased from 12.6 to 9 in 8 weeks in a 5 cm semicoke layer in laboratory experiments with controlled water content. In field experiments, pH decreased to 10 in a 10 cm semicoke layer in 6 months. Recarbonation of alkaline leachates of semicoke, originated from standard batch leaching tests (L/S 2:1) took up to 5 days. The leachate was slightly agitated on a laboratory mixer to avoid formation of carbonate layer on the surface. pH decreased to 8.3.

A laboratory study was conducted to evaluate the possibilities of using flue gases from thermal processing for enhanced recarbonation. Experiments were performed with ash, coke-ash residue, semicoke and alkaline leachates. Experiments were carried out in the atmosphere of model flue gas (10% carbon dioxide, 90% nitrogen) or 100% carbon dioxide.

Principal schemes of neutralization of retorted oil shale and leachates will be presented and the physico-chemical background of limiting processes discussed.
Neutralization of alkaline leachates is achieved utilizing very simple procedures. Sulfide content is critical because of hydrogen sulfide emissions.

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