



Oil shale ash as a source of Ca for CaCO_3 production

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Problem overview



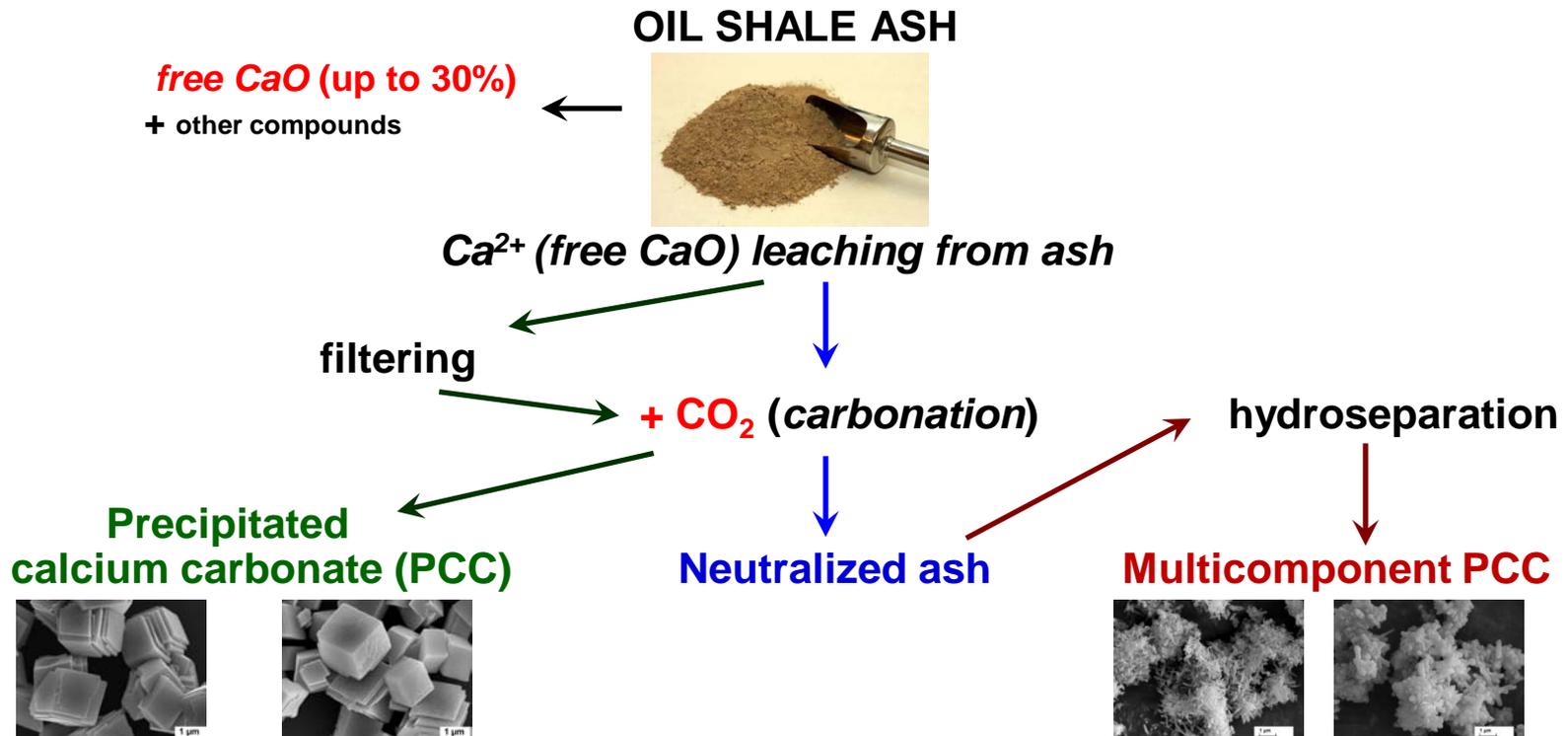
- In Estonia, over 90% of the basic power supply is provided by the use of oil shale as a fuel for power plants
- Oil shale-based power production is responsible for about 72% of total Estonian energy-related CO₂ emissions
- The processing of oil shale for heat and power production has also created over 200 million tons of alkaline waste ash



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- Oil shale ash could be considered as a low-cost source of water-soluble calcium due to high content of lime (up to 30% of free CaO)
- Binding CO_2 by Ca-rich oil shale ash leachates in the form of stable carbonates permits CO_2 emissions reduction as well as utilization of ash for precipitated calcium carbonate (PCC) production
- The feasibility of CO_2 safe disposal in the form of PCC by gas-liquid reaction is of considerable importance due to applicability of calcium carbonate in a wide range of products including paper, paints, plastics etc



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Objectives

- The main goal of the research is to develop a mathematical description of oil shale ash based multi-step PCC formation process in order to predict the optimum conditions
- By taking into account kinetics, hydrodynamics and specifics of the process, models will be proposed for each stage of the process, including Ca leaching from ash, CO₂ dissolution from gaseous phase into alkaline liquid phase and CaCO₃ precipitation
- These modeling algorithms can be potentially implemented also to design similar processes on the basis of other lime-containing wastes.

Process stages:

1. CaO hydrolysis (Ca leaching from ash)



2. CO₂ absorption into alkaline solution

3. CaCO₃ precipitation via carbonation route



List of publications

- **O. Velts, M. Hautaniemi, J. Kallas, R. Kuusik, Modeling calcium dissolution from oil shale ash: PART 1. Ca dissolution during ash washing in a batch reactor, *Fuel Processing Technology* 91(5) (2010), pp. 486-490.**
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- **Uibu, M., Velts, O., Trikkel, A., Kallas, J., Kuusik, R. (2008). Developments in CO₂ mineral carbonation by oil shale ash. In: Proceedings: 2nd International Conference on Accelerated Carbonation for Environmental and Materials Engineering, Rome, Italy, Oct. 1-3, 2008. (Ed.) Baciocchi, R.; Costa, G.; Poletini, A.; Pomi, R.. Rome, Italy: University of Rome "La Sapienza", 2008, 421 - 430.**