# Use of sewage sludge ash in concrete after phosphorous recovery

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Phosphorous is a vital element for human beings as well as for animals. The mines from which phosphorous is extracted are almost emptied. Scientists estimate that there will be a grave shortage of phosphorous within the next 40-100 years. It is therefore important to find alternative sources from which phosphorous can be extracted. A secondary source might well be sewage sludge ash, as it contains about 10-20% phosphorous.
Sewage sludge ash is transported to Norway for deposition. This is a waste of a phosphorous source and an expensive and bad environmental solution. It is a far better thing to extract phosphorous from the sewage sludge ash and use the residue in the concrete. Furthermore - *not* taking ash to Norway means less $CO_2$ emission because of shorter transport.
Scientific research shows that sewage sludge ash can be used in concrete. By acid washing the sewage sludge ash most of the phosphorous can be recycled.
This project will examine whether it is possible that ash washed in acid can be used as replacement for cement in concrete. It is a fact that 20% of the cement can be replaced by ash washed in acid. All in all an up to now unused secondary source of phosphorous and the mineral residue will be used in concrete.
When waste water is cleaned, filtered and burnt by high temperature we have a product called sewage sludge ash.
When iron is used the ash gets a reddish colour, aluminum a neutral color. This project uses iron based ash, “Avedøreaske” and aluminum based ash, “Lundtofteaske”.
Sewage sludge ashes are washed with 2 types of acid: $H_2SO_4$ and $HNO_3$
“Avedøreaske” and “Lundtofteaske” are both tested for pressure. A mould made of morter is made *with* and without crushed ashes, and with different amounts of ash according to the cement they replace. These moulds are tested for strength and compared with each other and with references.
Tests are made in order to show the amount of elements in the ashes. By examining the ash before and after the acid wash it is possible to establish what has happened to the ash, for example how much phosphorous has been removed.
Provisional conclusion: Ash washed in acid can be used in concrete. This concrete, however, has diminished strength and must therefore only be used in cases where very strong concrete is *not* a necessity. The ash ought to be washed in acid so that the recovered phosphor in the ash can be recycled.
“Avedøreaske” might create a problem because it gives the concrete a reddish colour. “Lundtofteaske” with its neutral colour it is preferable. Also because:
No or little deposition is needed, Recycling of phosphorous and $CO_2$ reduction because of shorter transport of the ash.