CIRCULAR EXTRACTION OF POTASSIUM, SODIUM AND CALCIUM SALTS

Cleaning flue gases during municipal waste incineration leaves behind fly ash, a hazardous residue with high concentrations of chlorides as well as unwanted heavy metals. This is problematic since both make the ash difficult and expensive to handle. It is not even suitable for landfills designated for hazardous waste. Moreover, its valuable salts go unused.

EasyMining's patented Ash2®Salt process washes this fly ash and extracts three valuable commercial-grade salts from it. Moreover, the ash residues can now be placed in common landfills for non-hazardous waste.

VALUABLE SALTS RECOVERED IN PURE FORM

The three salts extracted by Ash2Salt are *potassium*, *sodium* and *calcium chloride*. Potassium chloride is a macronutrient that also has many industrial uses. Sodium chloride (known to us as table salt) is one of the most used chemical compounds on the planet. Calcium chloride is primarily used for de-dusting and de-icing roads. All are commercial-grade quality.

A FRACTION OF THE CLIMATE IMPACT*

The Ash2Salt process as operated in Sweden drastically reduces climate emissions by approximately 90%: potassium chloride compared with open-cast mining of virgin potassium resources, sodium chloride compared with mining or sea water evaporation, calcium chloride compared with chemical methods such as reacting limestone with hydrochloric acid.

**Life Cycle Analysis needs to be established for each site.*

ADVANTAGES OF ASH2®SALT

Ash2Salt extracts pure potassium, calcium and sodium chloride salts from fly ash at the same time as it delivers significant environmental gains. Climate impact is greatly reduced and recycling encouraged.

- Recovers valuable commercial salts and replaces virgin mined salt with recycled products.
- Removes heavy metals from circulation.
- Fly ash residue suitable for ordinary landfill deposition or even reuse.
- Huge reduction in climate footprint compared with traditional production of salts.
- Reliable large-scale operation with zero liquid discharge.
- Treated process water can be reused within the process.
- Option for treating impure water from, for example, the site.

EasyMining

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202404

EasyMining
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ASH2®SALT

FROM FLY ASH TO COMMERCIAL-GRADE SALTS

WHAT IS ASH2®SALT?

Ash2Salt is a wet chemical process that extracts three commercial salts from fly ash, a hazardous residue of air pollution control at incineration plants. The process, which is zero liquid discharge, also recovers the ammonia content of the fly ash as a commercial product.

HOW DOES IT WORK?

Ash2Salt is a multi-step process. In the first step, fly ash is washed with water. This results in clean ash, which can be placed on landfills for non-hazardous waste, plus a brine containing mainly heavy metals and chloride salts. The leachate continues to the next step where sulphides precipitate out heavy metals and activated carbon removes organics. This leaves a chloride-saturated liquid that is treated by stripping followed by scrubbing in sulphuric acid, thereby forming commercial ammonium sulphate ($(NH_4)_2SO_4$).

The solution is then fed to an evaporation/crystallization-based salt separation step where potassium chloride (KCl), calcium chloride ($CaCl_2$) and sodium chloride (NaCl) are separated out. Water extracted from the evaporator is recirculated and used for initial washing.

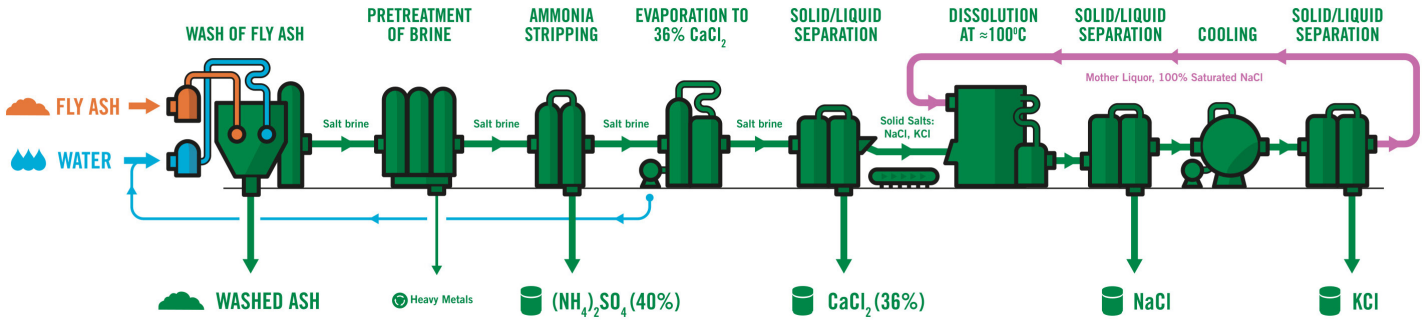
Ash2Salt is a robust process with high tolerance for variations in the chloride content of incoming fly ash. It improves the overall quality of the ash residue, which helps cut landfill costs.

LARGE-SCALE PLANT IN ROUTINE OPERATION

In April 2023, the Swedish Minister for Climate and the Environment, Romina Pourmokhtari, declared the world's first Ash2Salt facility open. The plant, located in Upplands-Bro, Sweden, and operated by EasyMinings' parent company Ragn-Sells, recycles commercial salts from up to 150,000 tonnes of fly ash per year, roughly half of all fly ash produced in Sweden.

On average, 200 kg of salt per tonne of fly ash is extracted and used commercially. At the same time, heavy metals are removed from circulation. Furthermore, the salt's climate footprint is approximately one-tenth that of traditionally produced salt.

EXTRACTS POTASSIUM, SODIUM AND CALCIUM SALTS PLUS OTHER COMMERCIAL PRODUCTS



KEY FACTS: Upplands-Bro Ash2®Salt plant

FOOTPRINT:	Plant 1600 m², site 11,500 m²
CAPACITY:	150,000 tonnes/annually
INAUGURATED:	April 2023
MAIN CONTRACTOR:	Hitachi Zosen Inova