

# Reducing fuel costs

## An energy-saving combustion method for aqueous wastes

Dipl.-Ing. (FH) Rüdiger Steinbach

*Aqueous waste streams, which are a waste product of chemical or pharmaceutical production processes, such as washing steps, often contain high concentrations of organic or halogenated components, which due to their toxicity cannot be treated in biological waste-water treatment processes. The specific type and concentration of pollutants therefore frequently results in combustion being the preferred disposal method for such wastes.*

In order to burn the oxidisable elements in the waste water, the latter must either be evaporated outside the combustion chamber or allowed to evaporate inside the combustion chamber. The considerable heat necessary to evaporate water, which normally has to be achieved using primary energy, is synonymous with a high specific energy requirement. A method known as Calsave has been developed to facilitate pre-evaporation of the liquid waste without external heat, thus permitting drastic fuel savings. At the same time, the required size of the plant and therefore also the capital investment are reduced.

### Features of the Calsave process

The major part of the sensible heat in the hot flue gas that comes out of the combustion chamber can be utilised in a waste heat boiler to generate steam or to heat thermal oil. The remaining energy in the flue gas is made up of the sensible heat plus the evaporation heat of the water vapour component. The latter dominates in the combustion of waste water. With the Calsave aqueous waste disposal method, the flue gas is brought into contact with counter-current circuit water downstream of the waste heat boiler or the quenching system. In this process, the flue

gases cool down significantly below their water-vapour dew point, and thereby transfer not only their sensible heat but also a major amount of condensation heat to the circuit water. The circuit water transfers the absorbed heat via a heat exchanger to the aqueous waste which must be burnt. The warm aqueous waste leaving this heat exchanger is evaporated in counter-current with the combustion air and simultaneously cooled (similarly to an evapora-

tion cooler). The concentration of the aqueous waste by means of evaporation at temperatures below 100 °C makes it possible to utilise the remaining heat of the flue gases, including the evaporation heat, and thereby economises on resources.

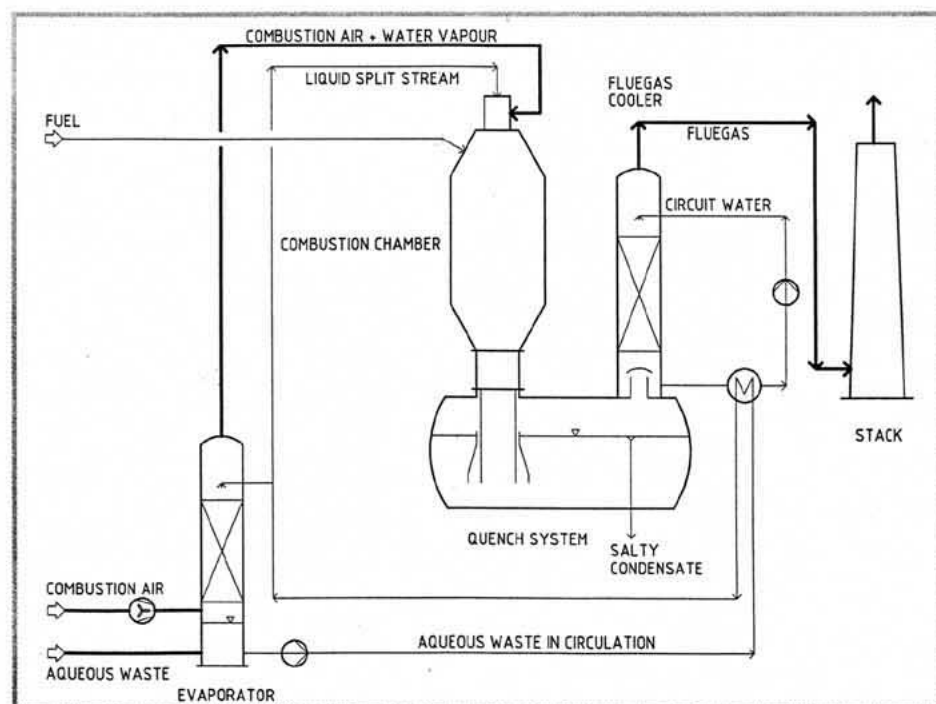
The Figure shows the Calsave process for the combustion of aqueous waste containing anorganic salts to an extent which rules out heat recovery via heating surfaces. The illustrated process obtains sufficient energy from the flue gases, which it transfers to the aqueous waste in order to fully evaporate its water content. In practice, however, limits are imposed by the type and concentration of the waste components due to the increase in viscosity or exceeded solubility, so that a split stream of the waste water is spray-injected into the combustion chamber in liquid form.

### Example

The fuel consumption in a conventional process with direct combustion of 1000 kg/h liquid waste at a combustion temperature of 1000 °C is equivalent to approximately 300 Nm<sup>3</sup>/h natural gas. The volume of the combustion chamber for a dwell time of 2 s is 13.7 m<sup>3</sup>.

At the same combustion temperature the fuel consumption of the Calsave process is equivalent to approximately 145 Nm<sup>3</sup>/h natural gas, while the volume of the combustion chamber for a dwell time of 2 s need only be 8.3 m<sup>3</sup>. The volume of the treated liquid waste is likewise 1000 kg/h: 950 kg/h pre-evaporated and 50 kg/h spray-injected in liquid form.

Further information **cpp 256**



Calsave process for the combustion of salt-containing aqueous waste