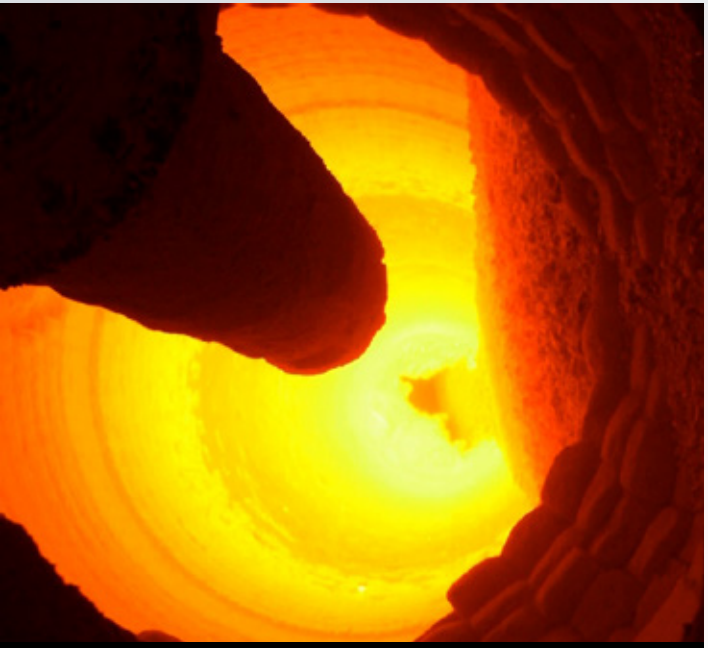
KHEME OPT [S]

BOILER & FURNACE

khemechemical



<Furnace and boiler obstruction>

<Use of fuels that contain heavy metals, alkaline metals and sulphur in their chemical composition>

Symptoms

▲ **FOULING:** Fouling of the internal surfaces in boilers and furnaces as a result of the formation of different substances that cover the walls and the deposition of the ashes from the fuel.

▲ **SLAGGING:** Process of formation of hard, dense and vitreous slag deposits on the refractory surface in furnaces or on metallic surfaces external from this process (precalcination tower).

▲ **CORROSIÓN:** FOULING or SLAGGING may originate the formation of corrosive compounds that may rapidly deteriorate and erode metallic and refractory surfaces in furnaces and boilers.

Cause

▲ The **use of low-quality fuels (coal, pet coke or others)** with ashes or mineral matter with a low melting point and a high corrosive potential. These fuels are characterized by having ashes rich in heavy metals, alkaline metals and sulphur. In favourable temperature conditions, these compounds are sintered and melted on metallic or refractory surfaces, remaining in plastic state and activating the cyclical mechanism of crust growth by the adhesion of gas particles, and their melting and cooling.

▲ Low-quality fuels are significantly cheaper than other purer fuels, therefore the need to reduce costs or the difficulty to access high-quality fuels force different industries to use low-quality fuels, with the consequent derived problems.

<Decreased production>

<Increased fuel consumption>

<Downtimes of furnaces and combustion equipment>

<Increased risk of accidents>

Associated problems

▲ **Lower efficiency of production processes:**

Decreased production in furnaces and steam generators.

Increased fuel consumption to maintain production.

Decreased energy performance of fuels due to inadequate combustion conditions (alteration of air flows).

Increased fuel consumption due to the increased duration of transient processes (on and off states).

Increased contaminant emissions (NOx, SOx, COx).

▲ **Unwanted alterations in production processes:**

Downtimes of furnaces and combustion equipment.

Increased number of maintenance and cleaning operations of ducts and premises, with the consequent increased costs of staff and equipment.

Increased consumption of refractory materials, due to the increased number of thermal shocks in transient processes.

Increased risk of accidents in hazardous operations due to the need to access premises with high temperature.

INDUSTRIES AFFECTED

- **Producers and suppliers of low-quality fuels**, which contain sulphur in their chemical composition:

  - Oil companies
  - Coal mining industry

- All **industries that have lime and cement furnaces, pre-heaters, high-pressure pre-calcinators or steam boilers in their facilities:**

  - Comprehensive cement factories with clinker furnaces.
  - Factories with lime furnaces.
  - Plants with steam boilers.
  - Thermal power stations.
  - Ceramic industries.
  - Factories of spirit drinks.

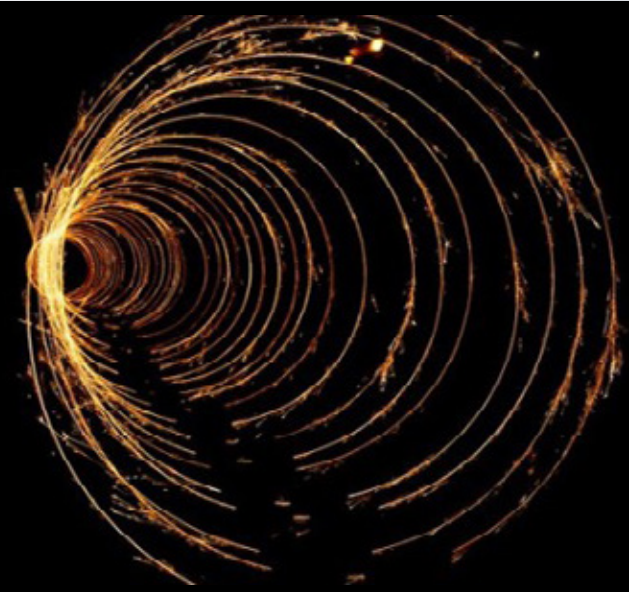
KHEME OPT [S] TECHNOLOGY

The high-technology admixture **KHEME OPT [S] efficiently solves the problems** mentioned above.

KHEME OPT [S] intervenes in reactions with sulphur, heavy metal and alkaline metal compounds of the ashes, to favour the formation of compounds with a higher melting point.

KHEME OPT [S] not only acts on the ashes released during combustion, which will rapidly cool down until they reach an inviscid state with minimal slagging, but it will also act on already formed depositions, altering the physical and chemical properties of such depositions in order to eliminate them during the first weeks of application of the admixture.

The improvements achieved with the use of KHEME OPT [S] will affect the **recovery of the optimal conditions of combustion processes** and consequently, of the production process.



Appearance: Liquid suspension of inorganic substances.
State/Colour Liquid suspension/Cream colour.

<KHEME OPT [S] IS AN ADMIXTURE TO INCREASE ENERGY EFFICIENCY AND PRODUCTION PERFORMANCE OF FURNACES AND BOILERS>

KHEME OPT [S] TECHNOLOGY

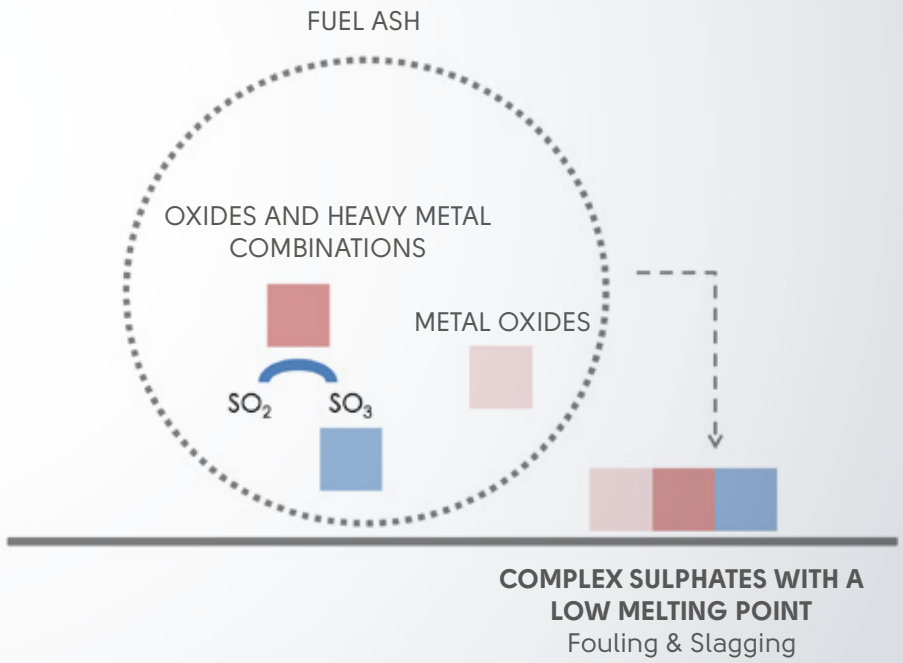
¿How are the problems created?

During combustion, different oxides are formed:

- Heavy metal oxides and their combinations with low melting points.
- Heavy metal oxides catalyse the formation of sulphur oxides that react with metallic oxides, creating alkaline sulphates combined with heavy metal oxides, all of them with low melting points (complex sulphates).

The result is a liquid, viscous film with strong adherence that favours the cyclical formation of fouling and slagging.

Graphic example WITHOUT KHEME OPT [S]:



KHEME OPT [S] TECHNOLOGY

¿How does KHEME OPT [S] act?

Graphic example WITH KHEME OPT [S]:

COMPOUNDS WITH A HIGH MELTING POINT
(easy removal from the production cycle)

KHEME OPT [S] interferes on the reaction mechanisms of oxides from heavy metals, avoiding catalytic action on gas sulphur, avoiding the formation of complex sulphates and forming compounds of high melting point with heavy metals and sulphur.*****

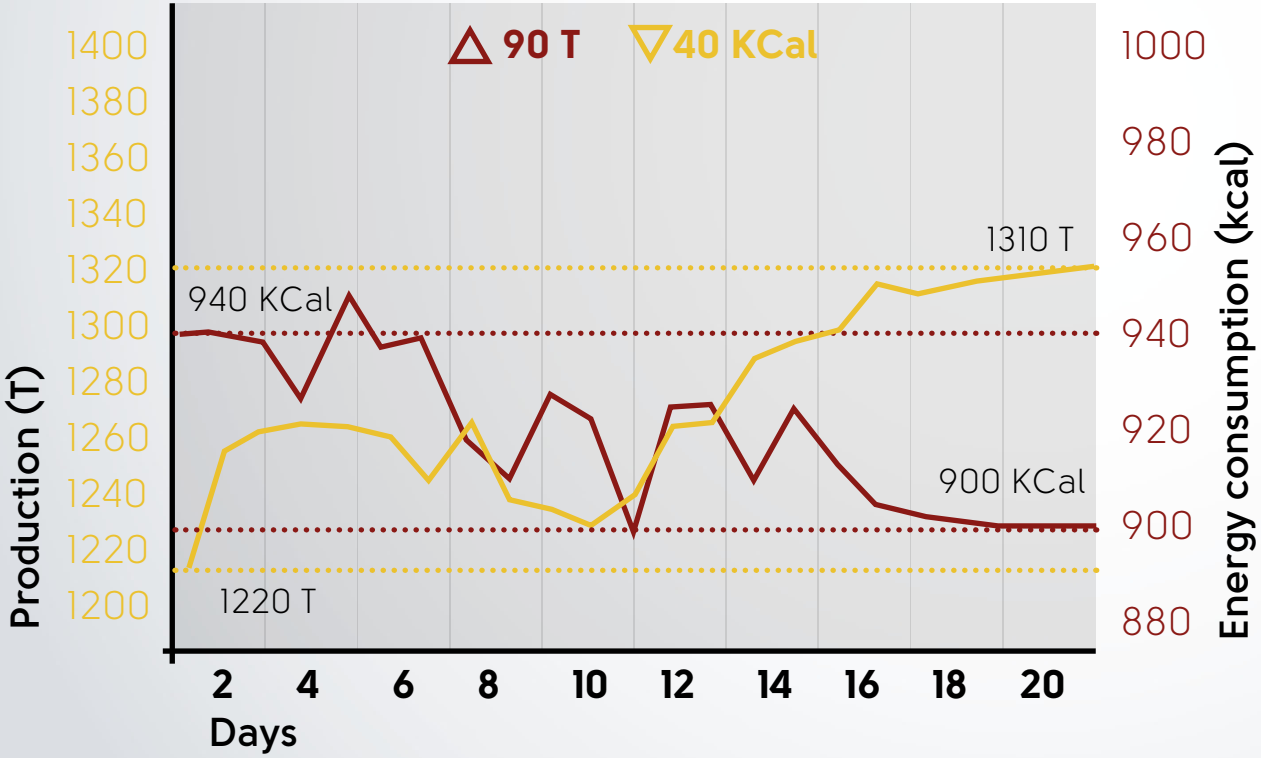
***Thus, compounds are solid and may be eliminated easily from the production cycle.**

REFERENCES

<KHEME OPT [S] ADMIXTURE HAS BEEN TESTED BY THE INSTITUTO TECNOLÓGICO DE LA ENERGÍA OF VALENCIA>

▲ Example of KHEME OPT [S] functioning in the furnace of a comprehensive cement factory (clinker):

Improved energy consumption and production in 3 weeks



It does not affect clinker quality

Clinker quality	Before	After Kheme OPT [S] technology
SiO2	20.9	21.0
Al2O3	3.7	3.7
Fe2O3	4.6	4.5
CaO	65.4	65.6
MgO	1.45	1.40
SO3	0.84	1,01
K2O	0.60	0.38
Na2O	0.46	0.38
TiO2	0.31	0.31
P2O5	0.11	0.11
Pérdida debida al fuego	0.2	0.2
CaO Libre	1.43	1.40
SC	97.5	97.1
MS	2.43	2.47
MF	0.80	0.82
C3S	66.3	66.8
C2S	10.5	11.5
C3A	2.1	2.3
C4AF	14.5	14.2
C3S + C2S	77.1	77.6
CaO/SiO2	3.08	3.06

INDUSTRIAL TESTING

1. CHECK LIST – DOSE AND PRODUCT QUANTITY ASSESSMENT
2. PREPARATION OF THE INDUSTRIAL DEVICE
3. KHEME OPT [S] RECEPTION
4. INDUSTRIAL TEST AND MONITORIZATION

▲ **1. CHECK LIST – DOSE AND PRODUCT QUANTITY ASSESSMENT:** To ensure the correct application of the product it is necessary to have the information of the determined parameters of the factory facilities. Such information will be treated with utmost confidentiality.

KHEME OPT [S]	KHEME OPT [S] - INITIAL INFORMATION TO EVALUATE POTENTIAL PERFORMANCE	khemechemical
Please attach lab analysis of (Technical data sheet)		
Pet Coke		
Coal		
Alternative fuels		
Consumption and characteristics		
Consumption of each of the fuels in Tn / h		
The sulfur content of the different fuels used (% S)		
The alkali content (% sodium and %potassium) of the different fuels used		
Chemical composition of kiln buildup/coating/rings		
% SI02		
% Al2O3		
% Fe2O3		
% MgO		
% SO3		
% Cl		
LSF		
% Na2O		
% K2O		
General Comments		

▲ **2. PREPARATION OF THE INDUSTRIAL DEVICE AND APPLICATION:** Peristaltic pump, flow meter, mixer and pipe without retention valve (minimizing the curves, since the material is dense).

DOSE: 1.0-1.3 l/t coal or pet coke (or fuels containing sulphur in their chemical composition).

TANK (KHEME OPT [S] IBC) *The product should be mixed → **PERISTALTIC PUMP** → **FLOW METER** → **ENTRY OF KHEME OPT [S]** *On the belt that supplies the fuel → **MILL** → **BURNER**

▲ 3. KHEME OPT [S] RECEPTION

▲ 4. INDUSTRIAL TEST AND MONITORIZATION

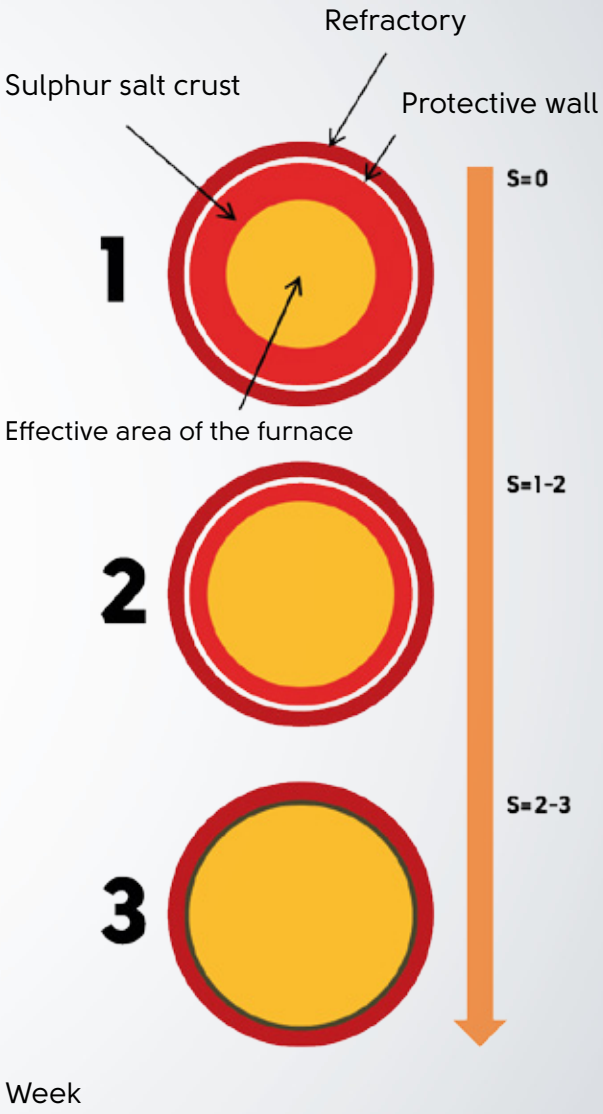
Example in a furnace of a comprehensive cement factory (clinker):

Initial situation of the cement furnace (week 0)

At the start of the use of the admixture, in two weeks, the sulphur salt crust formed in the furnace is slowly decomposed. Therefore, the values of free lime will usually increase, while the crust formed by sulphate salts is separated. Material (crust) outburst may occur in the furnace cooler.

At week 2-3, the crusts of the furnace practically disappear leaving the refractory protection wall. Free lime values are re-established and the function stays in a state of balance.

It should be included closely with the fossil fuel or the alternative fuel to ensure an effective reaction in the combustion chamber.



BENEFITS

TECHICAL BENEFITS
ENVIRONMENTAL AND EMPLOYMENT BENEFITS
ECONOMIC BENEFITS

TECHNICAL BENEFITS

▲ CEMENT FURNACES, PREHEATERS, PRECALCINATORS

Decreased energy consumption due to decreased crusts and rings in the equipment.

A **higher stability and a better combustion**. Furnace efficiency increases with a stable and homogeneous production quality.

Decreased indirect emissions of NOx and SOx (better combustion, less air consumption and less corrosive attack in the equipment and the environment).

Increased use of alternative fuels and increased use of pet coke with a higher amount of SO3.

Increased equipment availability since furnace downtimes are not necessary for its cleaning and maintenance.

Decreased cleaning cycles, maintenance cycles and improvement of staff safety.

▲ HIGH PRESSURE STEAM BOILERS

Increased steam production.

Decreased energy consumption due to decreased crusts in the equipment.

Decreased cleaning and maintenance cycles in the boiler.

Inhibited corrosion in high temperature areas, as well as corrosion caused by the formation of sulphuric acid in cold areas.

Homogenised fuel, avoiding the formation of sediments and sludge in the fuel tanks.

It maintains clean fuel pipes, filters and pumps, **without sludge or sediments**.

It reduces viscosity and surface tension of the fuel, **improving the efficiency** of the burner and the boiler.

Decreased fuel consumption and emissions in excess air COx, NOx, SOx, soot and acid fumes.

Increased pH of the ashes.

ENVIRONMENTAL AND EMPLOYMENT BENEFITS

▲ ENVIRONMENTAL BENEFITS AND BENEFITS REGARDING OCCUPATIONAL RISK PREVENTION

Just as important as previous benefits, also depending on the specific circumstances of each plant, significant environmental and safety improvements may derive from the decreased number or duration of processes with incidences and of hazardous maintenance operations that these process may entail.

ECONOMIC BENEFITS

▲ Savings obtained in the production process

Improved energy performance.

- Direct decrease in fuel consumption per process unit.
- Decreased energy losses due to the lower number of downtimes and start-ups in the process.

Use of a more economical fuel.

- Possibility of using fuels with higher sulphur content.
- Use of fuel mix with a higher percentage of this type of components.

Operation costs.

- Lower costs in maintenance and cleaning operations and staff.
- Lower consumption of refractory materials or special steels.

<In the case of clinker manufacturing plants,
benefits around 0.5 to 1.5 €/t can only be obtained as savings>

▲ Benefits derived from increased production and improved product quality

May be very significant in plants whose market circumstances allow them to reach a higher sales volume or better prices per quality in this sense.

<Depending on the specific circumstances of each plant, these benefits may be obtained to a greater or lesser extent>

Strategic location

For further information, please contact us

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