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**REDUXCO CATALYST APPLICATION TO INCREASE THE FUEL BURNING
EFFICIENCY, REDUCE THE POLLUTANT DISCHARGE AND IMPROVE THE QUALITY
OF THE CLINKER PRODUCED IN CEMENT KILNS**

Since July 2014, several tests had been conducted to provide our clients with all necessary data concerning the benefits of the REDUXCO catalyst for their production units.

The tests aimed at showing:

- The benefits of applying the catalyst to the fuel during the combustion process.
- The benefits of using the catalyst for the stability of the kiln.
- The benefits of using the catalyst for the reduction of the pollutant discharge.
- The improvement of the efficiency of the kiln by reducing the specific consumption of fuel (coal or petcoke) per kilogram of clinker produced.
- The assessments of the quality parameters of the clinker produced with Reduxco.
- The possibility of burning coals with higher sulphur content.

All these assessments were made during several weeks of tests in:

- Croatia (from 29.06.2014 to 08.07.2014),
- Vietnam (19.10.2014 to 4pm on 30.10.2014),
- Italy (from 05.05.2015 to 18.05.15).

Due to confidentiality agreement we cannot reveal the names or the exact location of the client's factories.

REPORT I

Test results of REDUXCO catalyst in a cement plant in Croatia.

In the period from 29.06 to 08.07.2014, the tests were conducted to determine the effectiveness of the combustion catalyst REDUXCO with petcoke firing.

The purpose of the tests was to determine the impact of the application of the REDUXCO catalyst for the combustion process in a cement plant. The main objective of the implementation was to improve the efficiency of the kiln by reducing the specific heat consumption per kilogram of the raw materials (clinker).

During the test, six experiments were conducted to determine the technical performance of the kiln. Those experiments were carried out in two stages.

The first phase included the removal of the parameters of the kiln to determine the initial state of the kiln.

The second phase involved conducting test with a continuous dosing of REDUXCO catalyst for 7-10 days. During this period, changes in the operation of the kiln were recorded and petcoke was analyzed in the laboratory.

Conclusions

- Sintering temperature increase for a +30 °C,
- Clinker quality was slightly improved, (Higher C3S quantity for the same raw material quality (from 69,73% without Reduxco to 70,19% with Reduxco).
- Raw material entering in the kiln was increased from 230 t/h to 233 t/h, but in the mean time we see decreasing of Pet Coke consumption (Coriolis info on the screen decreasing from 8385 kg/h to 8181 kg/h).
- Because of objectively reasons there were not possibilities to find a strong effect of combustion catalyst on specific heat consumption:
- more time needed to be spend to define injection points for catalyst combustion,
- the best point so far was in transport air for petcoke under the SILO 3,
- the same point have to be also for a SILO 2,
- the method for calculating specific heat consumption was on asilo level base, what was also use for making correction on Coriolis info on the screen. Those two parameters were not in the same value.
- For better and final conclusion we need more time for testing. A continuous dosing combustion catalyst in cement kiln for a period of 30 days should be enough.
- There is also a possibility to work together on decreasing of CO & NOx level on precalcination block (by adding 12 new points for injecting Reduxco catalyst).

REPORT II

Test results of REDUXCO catalyst in a cement plant in Vietnam.

The tests were conducted during the period from 12pm on 19.10.2014 to 4pm on 30.10.2014 to determine the effectiveness of the combustion catalyst Reduxco (hereinafter referred to as Catalyst) for coal (anthracite) combustion in the burner.

The purposes of the tests were:

1. Determination of the impact of the use of Catalyst on the combustion process.
2. Determination of the increase of effectiveness of the furnace due to reducing the specific fuel consumption per kg of clinker.
3. Assessment of changes in chemical parameters of the clinker produced.
4. Possibility of replacing the coal containing 0.58% of sulfur by the high-fusing ash coal containing 3% of sulfur.

The analysis of the furnace functioning was carried out in two stages.

The first stage included the analysis of the technological functioning of the furnace before the use of the catalyst during the period from 12pm on 01.10.2014 to 12pm on 18.10.2014.

The second stage involved the experimentation with a continuous supply of Catalyst from 19.10.2014 to 31.10.2014. Six experiments have been conducted during the tests to determine the technical parameters of the functioning furnace with all the changes recorded. The operating mode monitor of the furnace has been used for device readouts with the data provided by the factory specialists and tests carried out in the factory laboratory.

Conclusions

1. The catalyst is effective for the combustion of the coal fuel in the furnace of a cement factory and allows burning the high-fusing ash coal containing 3% of sulfur.
2. The catalyst ensures an increase of temperature in the synthesis zone, which improves the quality parameters of the clinker S3S from 56.1% to 68.48%.

3. The direct balance of reduction of specific fuel consumption for production of 1 kg of clinker is around 3.6%, from 724 Kcal / kg of clinker to 698.77 kcal / kg of clinker.

REPORT III

Test results of REDUXCO catalyst in a cement plant in Italy.

During the period 10:00 05.05.2015 till 10:00 18.05.15, the tests were conducted to determine the effectiveness of the combustion of REDUXCO catalyst (hereinafter referred to as the "Catalyst") by burning petcoke (hereinafter referred to as the "PC") in a cement kiln.

The tests were aimed at:

- Determination of the effect of applying the catalyst to the fuel combustion process.
- Determination of the effect of applying the catalyst to the stability of the kiln.
- Determination of efficiency improvement of the kiln by reducing the specific consumption of PC calories per kilogram of a clinker produced.
- Assessment of changes in the parameters of a clinker produced.
- Determination of changes in the emission of exhaust gases.

Analysis of the kiln was carried out by determining the changes (trends) in the application of the catalyst in comparison with the moment of its turning on.

Readings of operating parameters of the kiln were recorded on the operational control monitor in the control room, the data was provided by operating personnel of the plant, analysis was conducted in the plant laboratory.

Conclusions

1. The catalyst allowed an increase of temperature in the synthesis zone about 100°C.
2. The catalyst ensured a more stable operation of the kiln.
3. The catalyst did not have any impact and did not induced any changes in the quality of the clinker. It enabled an increase in the amount of sand by 107% - 5.7 t/h (5.3 t/h to 11t/h).
4. The catalyst was effective to reduce the emission of exhaust gases:
 - CO by 55%, from 621 ppm to 280 ppm.

- NOx by 31%, from 857 ppm to 586 ppm.
5. The catalyst was effective at burning Petcoke (PC) and allowed a reduction of Kcal of PC burned to produce of 1 Kg of a clinker by 3.4% from 765 Kcal/kg to 739 Kcal/kg.
 6. The most efficient use of the catalyst was in the range of 1400-1600 ml/h.
 7. To calculate full economic effect including: reducing the cost of own needs (electricity, due to the stable operation of mechanisms, motors, reducing the electricity through the increase in fines after the kiln, the costs for fewer launches of the kiln and other aspects), it is required to conduct an operation of the catalyst within 6 months.

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