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REDUCTION OF SO_2 EMISSIONS IN SINTER PLANT STEELWORK ZENICA

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ABSTRACT
A number of chemical and metallurgical reactions take place during the sintering process. The gaseous emission from the sinter plant especially from the strand has high environmental significance. Sulphur oxides SO_x in the waste gas originate from the combustion of sulphur compounds in the sinter feed. Minimization of SO_2 emissions in sinter plant Steelwork Zenica are achieved by using raw materials with low sulphur content and by minimizing the coke breeze consumption. Additional reduction of SO_2 emission involves the installation of new technologies for waste gas desulphurization according BAT technologies planned for 2013.
Keywords: BiH sinter plant industry; sustainable development; sulphur flow analysis; SO_2 emission

1. RECYCLING OF IRON-CONTAINING MATERIALS INTO THE SINTER PLANT
Modern blast furnaces achieve improved performance by prior physical and metallurgical preparation of the burden which improves permeability and reducibility. This preparation entails agglomerating the furnace charge by sintering process. A number of chemical and metallurgical reactions take place during the sintering process. These produce both the sinter itself, and also dust and gaseous emissions. Steelwork Zenica, BiH, has been in existence for more than 115 years. Steelwork Zenica produced nearly 1,9 Mt/a of sinter - state 1990.; today it produces 1,2 Mt/a of sinter, a key ingredient in the feed for the blast furnace process.

Figure 1. Sinter plant of Steelwork Zenica

2. SULPHUR CONTENT OF THE SINTER FEED BEFORE 1992.

The sinter plant has an important function in an integrated iron and steel plant. An integrated steel plant generates by-products, mainly consisting of iron scale from the rolling mills and a wide variety of dusts and sludges from waste gas treatment devices. In a sinter plant, a mixture of iron ore fines, recycled process materials and other feedstocks coalesces into a form suitable for use in a blast furnace [1].

Waste gaseous emissions from the sinter plant especially from the strand are of high environmental significance. The sulphur input with the raw materials influence the quantity of SO_2 emitted. Part of the sulphur remains in the sinter product (in the order of 13 – 25%) depending on the sinter basicity and the grain size distribution.

Sulphur oxides mainly SO_2 in the waste gas originate from the combustion of sulphur compounds in the sinter feed. These sulphur compounds are primarily introduced through the coke breeze. The contribution from iron ore is normally about ten times smaller. The emission concentrations for SO_2 normally are 400 - 1000 mg SO_2/Nm^3 or 800 - 2000 g SO_2/t sinter [2].

Using the mass stream overview both specific input factors and specific emission factors can be calculated. In this work the sulphur input with raw materials and parameter such as SO_2 are calculated with appropriate mass stream [3].

Figure 2 shows the sulphur content of the sinter feed for "old state". "Old state" refers to the state of sinter plant and materials input for 1990. The Steelwork Zenica ceased its work during the war in Bosnia and Herzegovina from 1992. to 1995.

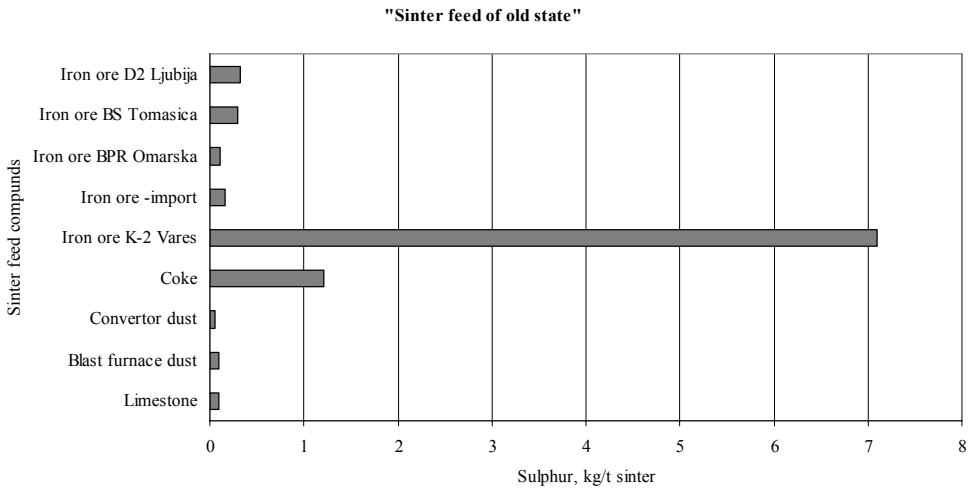

Figure 2. Specific sulphur input with sinter feed compounds for "old state", kg/t_{sinter}.

In the pre-war time production of the Steelwork Zenica plants ecologically unsuitable raw-materials and fuel were used. Especially Vares iron ore from sinter feed had considerably input of sulphur more than 7 kg/t sinter.

3. SULPHUR CONTENT OF THE SINTER FEED SINCE 2008.

The full re-initiation of the Steelwork took place in the summer of 2008. It raises the issue of future waste gaseous emissions. Today, the capacity of sinter plant is nearly 1,2 million metric tons of sinter pro year.

After the full re-initiation of the Steelwork ecological sinter feed named “new state” has been used. Existing measures for reducing raw materials to the minimum imply use of the high quality coal and iron ores. Measures include: quality iron ore BPR-Omarska and imported iron ore instead of iron ore Vares K-2, iron ore BS- Tomasica and iron ore Ljubija. New sinter feed includes iron ores with lower %S, like as imported iron ore, which significantly decrease total input of sulphur, figure 3.

Lowering the sulphur content of the sinter feed for “new state” can minimize sulphur inputs more as five times. Consequently the use of iron ores with lower sulphur content directly correlate with lower SO_2 emissions.

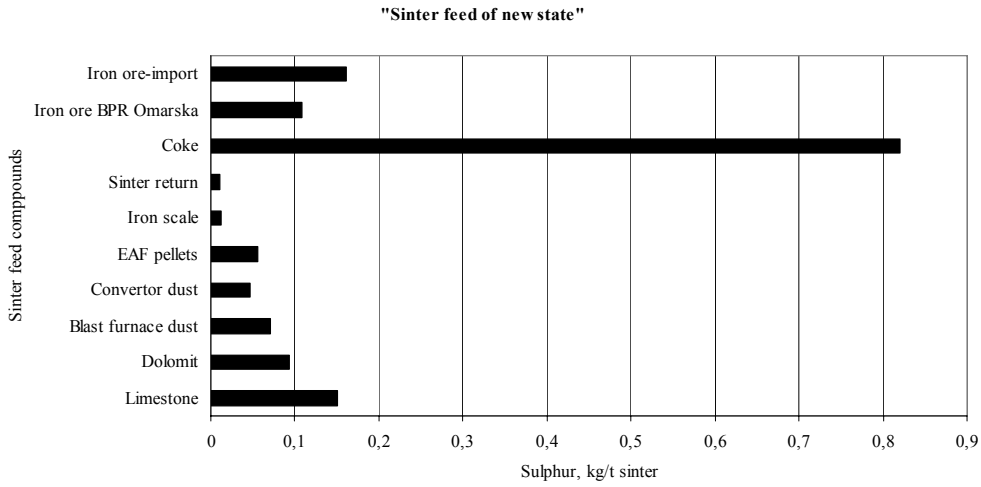

Figure 3. Specific sulphur input in sinter feed compounds for new state, kg/sinter [2]

In “new state” the sulphur compounds are primarily introduced through the coke breeze. The contribution from iron ores is with much smaller percentage.

In this case minimization of the specific coke breeze consumption is also very important and consumption of the specific coke breeze in the Steelwork Zenica has been reduced from about 110 kg/t sinter to 80 kg/t sinter.

Apart from the sulphur input with the raw materials, there are other factors which influence the quantity of SO_2 emitted. One of these is the degree to which sulphur is included in the sinter. This depends on the basicity of the sinter feed. At basicities up to 1, more than 90% of the sulphur volatilizes. At a basicity of 1 about 87,6 % of the sulphur is released. In Steelwork Zenica the basicity of sinter has been increased to an average of 1,7 in order to achieve a self fluxing burden and this is representative for Europe as a whole. This has contributed to decreasing SO_2 emissions (90% of the sulphur), but only slightly.

4. ENVIRONMENTAL TECHNOLOGY FOR SINTER PLANTS OF “NEW STATE”

The key environmental issues for sinter plants are dust, SO_x, NO_x, dioxins, heavy metals, and energy-heat efficiency. Selection of the best available techniques (BAT) and the associated emission and consumption levels for this sector in a general sense.

Much of the challenge in cleaning up the offgas stream from a sinter plant lies in the specific make-up of the emissions. The main components of the gas cleaning system SO_2 emissions can be removed with high efficiency if facilities with injection of additives are installed.

In order to have the complete overview on influence of air emissions from plants in Steelwork Zenica it is necessary to systematically monitor quality of air.

Before the war SO_2 emissions and amount of dust in the air were measured from time to time.

Since 2005, municipality of Zenica initiated project aimed at monitoring air quality in Zenica valley. The program includes monitoring and measuring concentration of SO_2. The project also foresees providing equipment for automatic system of measurement and archiving of data. **Continuous measurement of SO_2 concentration was also introduced in the agglomeration plants**. Once the measurement reports are received, and in case of deviation from the allowed quantities, improvement measures will be introduced. Additional reduction of SO_2 emission involves the installation of new technologies for waste gas desulphurization according BAT technologies planned for 2013.

Given that the law on environmental protection foresees sharing information with public, there are efforts to set up equipment which would allow presenting concentration of pollutants in atmosphere on the city display.

5. CONCLUSION

The chemical composition of sinter feed compounds has a significant influence on SO_2 emissions. The use of coke breeze and iron ores with lower sulphur content and minimization of the specific coke breeze consumption directly correlate with lower SO_2 emissions.

Minimisation of SO_2 emissions in Steelwork Zenica for "new state" is achieved with:

- The change of structure of iron ores in sinter process. The consumption of iron ores with high quanitities of S (iron ore Vareša K-2, iron ore BS- Tomašica and iron ore D-2 Ljubija) are not planned;
- Reduction of specific consumption of coke. The consumption of the specific coke breeze has been reduced from about 110 kg/t sinter to 80 kg/t sinter
- Production of sinter with increased basicity - average of 1,7 (early basicity was about 0,9-1,1).

The above-mentioned changes will be reflected through reduction of SO_2 emissions and the reduction of quanitity of dust released into the air through the chimney.

6. REFERENCES

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