ACTIVE METHOD OF MERCURY CAPTURE FROM SUBBITUMINOUS AND LIGNITE COAL COMBUSTION

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INTRODUCTION

The fossil fuels combustion, in particular coal, is a major source of emissions of pollutants into the environment. Out of many pollutants with the specific threat for the environment, heavy metals, including mercury are of higher importance [1]. Mercury is one of the few elements, on which the human body does not show any physiological requirements. Due to its toxicity, global distribution of emission sources, long residence time in the ambient air, ease of ingress into the aquatic environment and ability to penetrate the trophic chains, mercury and its compounds have been recognized by the US Environmental Protection Agency (US EPA) as a special threat air pollution [1.2].Global research, commissioned by the UNEP (United Nations Environment Programme), confirmed the high impact of mercury on the environment and fully justify taking action on an international scale, which is aimed at reducing its emission [3]. According to estimates [3], in 2010 in the world, approximate 1960 Mg of mercury from anthropogenic sources has been issued, of which 45% accounted for emissions from the combustion of coals [4]. Poland is a country with one of Europe's largest mercury emissions to the atmosphere. The main source of mercury emissions is the burning of fossil fuels, particularly coal. It is the main, by more than 50% of the share, the source of mercury emissions to the atmosphere.

EXPERIMENTS / FUNDAMENTAL OF THE PROBLEM / EXAMINATIONS

The aim of the experiment was to determine the impact of the selected emission reduction process waste sorbents of mercury from the flue gas. For the incineration of selected bituminous coal and lignite-derived from Polish mines. The samples were air-dried into analytical state and were analysed with a mercury content on the DMA-80. Characteristics of selected Polish coals was presented in [5]. Specified fuel parameters (Proximate and ultimate analysis) affecting the behaviour of mercury in coal combustion process were determined. The sorbent with low levels of mercury in the flue gases emitted during the combustion of coals, coke dust was coming from the process of dry coke cooling. Coke dust are macroporous materials. The influence of size faction of the particles on the reduction of mercury emission in flue gases. Dust and coke with a diameter of grains above 0.2 mm, below 0.08 mm were used. The scheme of the mercury emission reduction experiment is shown in Fig. 1. A sample of coal to the furnace was placed at a temperature of 850 °C and was burned in the air stream with the movement of 8 $m^3 \cdot h^{-1}$. The sorbent was placed at the exit of the flue gases. The concentration of mercury measured in the ash was determined in sorbent before and after the process and flue gas going into the air.

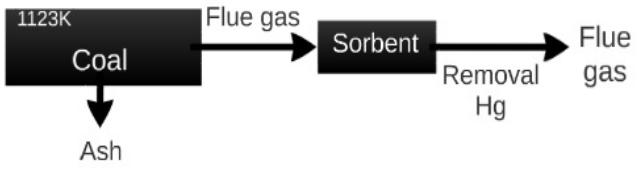

Fig.1: Laboratory scale mercury emission reduction system

RESULTS AND DISCUSSION

Application of coke dust in order to reduce the concentration of mercury in the exhaust gas during combustion of coal turned out to be effective (Table 1). Depending on the diameter of grains, it lowered emissions of Hg by 80-90% for subbituminous coals combustion. Despite the fact that lignite is characterised by much higher mercury levels and unfavourable composition of the example equation, the use of coke dust, in this case, was effective and lowered the concentration of Hg in the flue gas by 60-70% (Table 1).

Table 1. Contents of mercury in the sorbent after the cleanup process, the ashes and the concentration of Hg in the flue gas.

Type of used coal	**Coke dust fraction, x [mm]**	**$\Delta C_{Hg,sorbent\ after-before}$ [µg·kg^{-1}]**	**$C_{Hg,coal}$ [µg·kg^{-1}]**	**$C_{Hg,ash}$ [µg·kg^{-1}]**	**$C_{Hg,flue}$ [µg·m^{-3}]**	**Removal [%]**
Subbituminous	x > 0,2	85,61	103,70	1,56	1,01	**82,6**
	x < 0,08	95,20	103,70	2,40	0,43	**91,9**
Lignite	x > 0,2	270,20	443,50	2,67	6,96	**61,1**
	x < 0,08	319,5	443,50	1,29	4,92	**72,1**

CONCLUSION

Proposed in the experiment method of application of coke dust to reduce mercury emissions in the exhaust gases as the several tens of times cheaper substitution of commercial activated coal with much less polluting the environment at the production stage and with a very interesting property aspects of its sorptive surface. The results obtained in laboratory studies have shown reduction Hg in the flue gas during combustion of subbituminous and lignite coal respectively level 80 - 90% and 60 - 70 %.

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