CAPITALIZATION OF INDUSTRIAL WASTES IN ECONOMIC CIRCUIT – A WAY TO REDUCTION THE IMPACT UPON ENVIRONMENT DUE TO ITS STORAGE

Prof.univ.PhD Luminita Georgeta POPESCU, luminita.popescu69@gmail.com **,**
Assoc.univ.PhD Florin GROFU, gf_florin@yahoo.com**,**
"Constantin Brancusi" University of Targu Jiu

Abstract: *In our country are generated millions of tons of industrial wastes annually. These wastes are stored in industrial wastes deposits which occupied the large surface of soil and also affected the environmental quality, specially the quality of groundwater and surface water. The research activity develop up now, has demonstrated the possibility that these wastes to become the alternative source of raw material for building material industry, based on physical and chemical characteristics similarities with traditional raw material. The paper presents the results of research activities regarding to the use of bottom as raw material in the manufacture of building materials. The use of bottom ash in building material industry is the best way to reduce the huge amounts of this waste that is storage in the historical deposit of thermal power plant. The paper presents the ash deposit of thermal power plant impact upon the environment and some possibilities of ash capitalization in order to reduce of its impact.*

Keywords: *industrial wastes, ash and slag, water and soil pollution, heavy metals, environmental risks*

1. Introduction

Electricity production in thermal power plant generates the important issue in term of environment pollution such as: atmospheric pollution through release of large volume of greenhouse gas, acidifying gas, dusts or it is about of large amounts of wastes (ash and slag) deposited in landfills which are occupying large areas of land.

By the technological process of electricity production results two kind of ash: fly ash (with a diameter <0,25 mm), which is collected from flue gases through electrostatic precipitators (ESP), and from there it is mixed with water and sent to a pumping station or is collected in silo in order to delivery in cement industry; bottom ash, with a diameter (0.25 – 1) mm and more, which is collected at the furnace bottom (Figure no. 1).

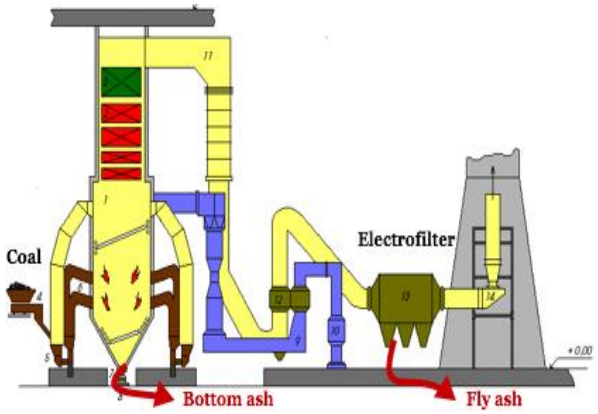

Figure no. 1. Ash generation in thermal power plant

Both of them - bottom ash and slag (this last one after crushing) and fly ash - are transported in the form of hydro-mixtures (solid/liquid 1:8 and 1:10, respectively, *Figure no. 2, 3*) or dense slurry into landfills, generating a strongly impact upon environment [1, 2, 3].

a) b)

Figure no. 2 Ash and slag deposit of Rovinari thermal power plant
a) Cicani-Beterega - ash and slag deposit
b) Gîrla – ash and slag deposit

Figure no. 3. Ash and slag deposit of Turceni thermal power plant plant

Due to high ash content of the lignite (Ash A: 39,5%) the evacuated and storage ash quantities are huge (approximately 3 mil. tones from Rovinari thermal power plant and approximately 2,3 mil. tones from Turceni power plant). As consequences, the land area occupied by these deposit are very high, respectively:

- Deposits of Rovinari thermal power plant [4]:
  - Gîrla Dump: 160 ha, with a storage capacity of about 32 millions m^3,
  - Cicani – Beterega Dump: 284,7 ha, with a storage capacity of about 74 million m^3,

- Balta Uncheaşului Dump: 34,2 ha, with a storage capacity of about 6 millionm^3 (closed dump and covered with natural vegetation).

- Deposits of Turceni thermal power plant:
  - *Compartment number 1* – surface of 250 ha and capacity of 42 million m^3,
  - *Compartment number 2* – used as buffer or emergency dump. Now this dump is used to discharge the slag and the ash in coal sludge technology. It has a surface of about 200 ha with a capacity of 32 million m^3.

The fine particle of ash, moved by wind from dry surface of deposit affects all environmental factors: water, growth, living bodies, soil, human settlement (figure no. 4).

Figure no. 4. The ash and slag deposit in a blustery day

These fine particles of ash affects animal bodies and plants even far from deposit. Are affect, also, digestive and respiratory tract of human and animals [5].

The flora from deposit area both the spontaneous and the cultivated, specially, suffers negative effects by the fine fractions of ash which will lead to reduce the plant vitality and the crop production. Ash and slag have a high content of heavy metals and other substances that are known to be harmful to health (Table no. 1).

Table no 1. Heavy metals content of ash sampling (ppm) [6]

Heavy metal	Concentration (ppm)
Zn	111,3
Pb	26,8
Co	24,2
Ni	60,7
Cd	1,76
Mn	194
Cu	67,1
Cr	41,4

In relation with this, another effect of pollution is accumulation of quantity of heavy metals (chrome, plumbum, arsenic, molybdenum) to toxically level with implication for human and animals health. Because of the absence of the no permeability and inappropriate drain of deposit tank, the infiltration from deposit affects ground water sheet. These determine the increased mineralization of ground water. These determine the increased mineralization of ground water sheet and soil salinization considering the cumulative aspect. In the case of damage and other incidents by overflowing of hydro mixture is affected quality of surface water.

2. Materials and methods

In order to identify the use possibilities of ash is essential to know the ash characteristics, in term of physical, chemical and mineralogical characteristics. The total moisture of the ash samples was determined by using the thermo balance, and the soaking moisture, by oven-dying at 105^0C, according to STAS 1913/I-82. The volume density was determined using the lab balance according to the STAS 1913/3-76. The determination of the grading composition was made in accordance with STAS 1913/5-85, using the AS 200 Basic sieve machine.

The chemical composition of ash depends on the quality and composition of lignite as well as on combustion condition. Chemical properties of ash samples reveal adequate characteristics in comparison with those of the ceramic raw materials usually used in the ceramic industry.

The most important ash characteristics for the building material industry are present in the Table no. 2.

Table no. 2 Admissible limit of the bottom ash for industrial application

Characteristic			**Value**
Oxidic chemical composition (%)	Al_2O_3		12 – 22
	SiO_2		40 – 50
	Fe_2O_3		6 – 10
	CaO+MgO		8 – 14
	Na_2O+K_2O		1,5 – 2,5
	P.C.		5 – 12
Grain size, max. (mm)			5
Bulk density, max. (g/cm^3C)		Netasat	0,85
		Tasat	1,05
Moisture, max. (%)			30
Mineralogical composition, majority			Quarț, Anortit, Hematit
Delivery way			Bulk

3. Results and discussions

The best way to solve the disposal issues of ash is to decrease the quantity for disposal with utilization of ash in the industry [5, 7]. In this regard a recovery possibility is to use it as granular aggregate in the manufacturing of building materials based on hydraulic binder (cold-straining briquettes, concrete blocks and precasts). The different technological applications that used the industrial waste (bottom ash, drilling sludge, metallurgical slag) were tested Within the Project LIFE ENV 729 RO [1]. On the technological flows at the level were obtained [1, 5]:

1. using the hydraulic binding technologies ("cold-straining')of the products:

- briquettes with high ash content (over 60%);
- building blocks with a minimum 15% ash content;
- building blocks (precasts) with a minimum of 50% ash content and of 20% slag LF;
- building elements for roads and footways (borders and pavings);

2. *using high temperature binding technologies (sintering):*

- briquettes with (50-70)% ash content, molded of semidried mixtures;
- briquettes with (15-35)% ash content and (10-20)% slurry, molded of plastic and semi plastic mixtures;
- thermal insulating concretes with maximal using temperature of (800-1100)^{0}C with (40-70)% power plant ash content.

All these products can see in the figure no. 5, where is present a demonstrative building that was realized within the LIFE project.

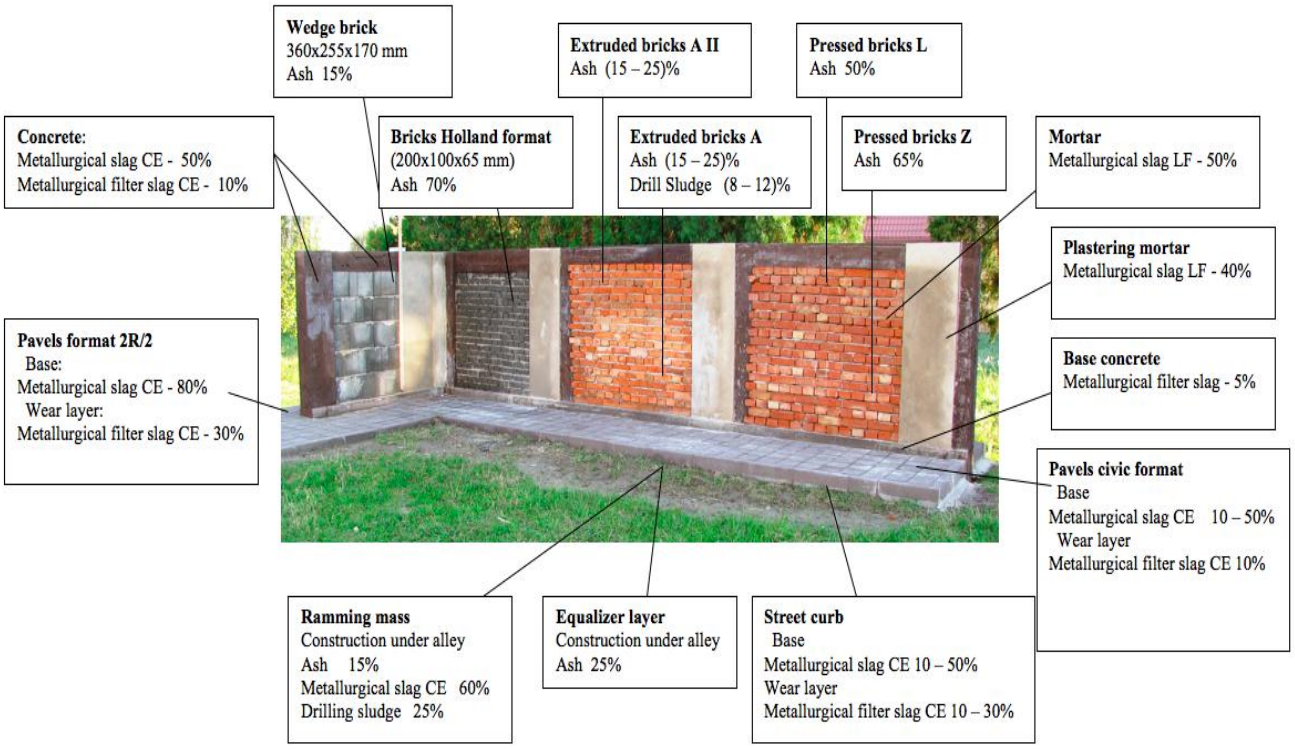

Figure no. 5. The demonstrative building realized inside of University Student's Campus

4. Conclusions

The use of ash as a granular aggregate in the composition of the mixtures for the pressed and burn bricks manufacture determines the decrease of the density of the finished products, respectively the increase of the thermal and acoustic insulation capacity.

The presence of the ash in the composition determines the modification of the basic mechanical properties, respectively the decrease of the compressive strength. This represent an important issue that should be take into consideration to design and execution of embedding with these kind of building materials based on ash. The application field will be established in according with basic phyzical-mecanical characteristics.

Also, an important aspect is represented by the heavy metal content, that is present in ash as minor element. It is very important that the heavy metal content of the final product to be under maximum admissible limits, in order to get the technical approval for manufacture, delivery on the market and use in civil works, according with national and international regulation.

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