ENVIRONMENTAL ASPECTS IN SECONDARY CONCTRUCTION MATERIALS PRODUCTION

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Abstract

In this paper some production processes and possibilities of alkaline activation of fly ash are examined. This fly ash is used as a binder in new type of concrete without cement binder, called POPbeton. Program was focused on „cold way“ preparation of POPbeton without necessity of heating. In this program same types of so called „intenzifikaror” were used. These „intenzifikátor“ causes hardening of POPbeton mixture. Samples of cold way prepared POPbeton were explored with electron microscope and they were compared with POPbeton samples prepared with heating. This technology is following step to use waste materials such as fly ash and slag.

Keywords: POPbeton® , Fly-ash, Slag, Brown Coal, Binder, Alcali activator

Introduction

In 2003 the close cooperation between the Department of glass and VŠCHT was set. Since that the examination of usage fly ash from a main hearth has been conducted. The core of the study is the geopolymer reaction. Researchers from department of glass had started this study several years before. The aim of the research is the application of acquired results into praxis. The activation from black as well as from brown cold was investigated gradually. However, the necessity of tempering of new concrete mixture still remained an obstacle for broader application of activated ash as an agglutinant. POPbeton® prepared in this way could have been used just for building prefabricated smaller elements such as interlocking pavement. Thus it seemd necessary to develop the new technology of preparation of POPbeton® which would avoid temperation. Hence so called regulator of solidification was searched. A goal of implementation of this substance is to start the whole process of geopolymer reaction without the necessity to supply energy in the form of heat.

1. Usage of Industrial Excrements (POM) at Production of Building Materials [2]

Important topic is pursuit of what most effective and the most thrifty exploitation raw materials sources regarding measure their non-renewability, non-relocatability and rarity, whence follows e.g. reduction surplus building matters on building site, spoil and support their recycling, as well as stress on the usage considerable quantity different bulk cargo industrial excrement that the it is possible with certain economic effect use in building industries like bonding agent, additives and filler especially for production light and expanded artificial aggregate, different class of concrete, concrete products, dry mixture, cement and below. This way it is possible use various types performances combustion, slags from metallurgical industry, recycled spoil, remnants from mining and mining mineral raw material, litterfall from glasswork, sediments, foundry hand sands, outlet gypsum wood-fibre plaster, outlet clay, wood waste etc. Performance excrement is given to the foreground focus of the three gists:

- environmental - outflow toxic materials, heat pollution, poverty of surfaces for merging tips and below.
- health - influence over quality of life inhabitant living in proximity tips or incinerators, in connection with previous standpoint possibility damage of the human health
- economical - waste sources that the can be again used, additional spending on waste disposal, combustion, solving old loading and so on

Excrements are in form secondary raw material beneficial for technological, environmental and economic aspects, use either instead classical (prime) raw materials, or bring into to the technology goal - directed, namely thanks its extraordinary features that the they may improve characteristics resulting building material than while using raw materials prime. Concrete is able to for example contain as far as 75 % choice excrement in practice aggregate. Usage some kinds performances combustion or slags makes it possible to cut cement content in concretes, neither would it negatively work their fort lower need marl then administer to to dispraise capacity issues carbon dioxide.

Waste from Power Plants Units and Heating Platns Units

Wastes that are caused by combustion in power plants and heating plants. Include fly - ashes and dross from high - temperature combustion and ash and fly - ashes from fluidized combustion. High - temperature fly - ashes and dross rise combustion coal at temperatures round 1200 - 1700 °C. Fluidizes combustion is technology, who principle is combustion firing together sorbent that the adds to the combustion space after content sulfur in coal. Both types of fly - ashes are used in production concretes, concrete products, lightweight concrete, in brick production, at production cement, dry plaster, build in brick, sealing and other special mixture and cements, artificial aggregate like talcum powder, packing of , soil stabilization and like filler and reclamation material. In the Czech Republic at present derive benefit from c. 10 - 15 % fly - ashes.

Slag

Slag is firm nonmetallic attendant produce metallurgical production that the rise melting - down deads of Rudy, additions slag-making materials and mineral shares from unyielding firings. To needs of building industries exerts especially blast-furnace slag, which is stiff solution nonferrous metals and next components, rising at production raw steeltrap. Is

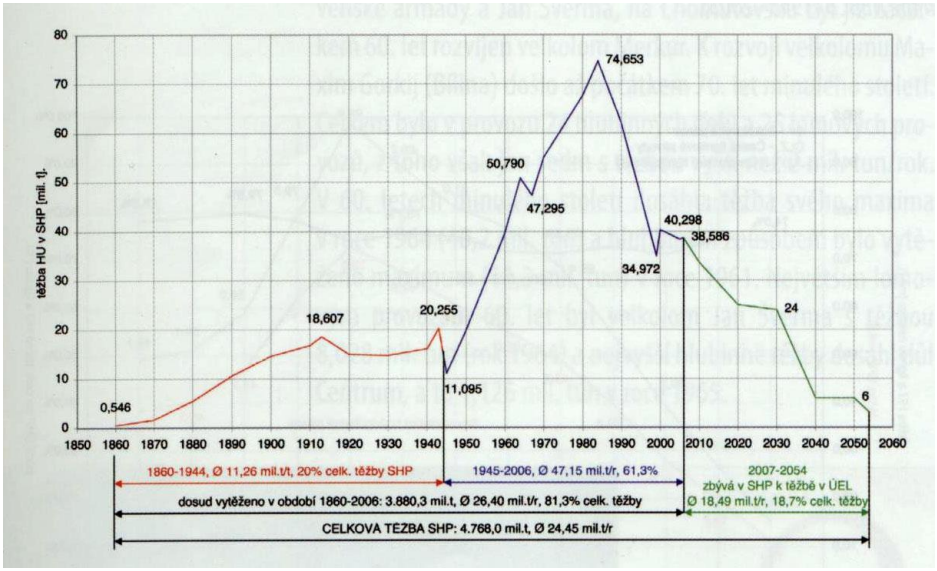
exploited like e.g. gravel aggregate, to construction carriage tracked bed, and it is adding to the cementite clinkers at production iron - Portland cement.

Energo-gypsum

Acts mostly about very chemically pure raw materials with content gypsum wood-fibre plaster and anhydrite above 90 %, that are from hygienic and ecological aspects (incl. ascertained natural radioactivity) considered behind unexceptionable.
Mostly exploited type outlet gypsum is at present energo-gypsum that the rises at flue gas desulphuration wet chalky pan out.
Presently are energo-gypsums exploited especially for production cement (like emulsifier solidification or like addition to the raw materials mixtures on binding bigger quantity alkali), to production gypsum wallboard boards, plaster mixture and less to production gas-concrete.

2. Coal Mining in Northern Bohemia [1]

Northern Bohemia lignite saucepan is most considerable bearing brown coal Czech Republic. In former times interlocked more than 150 years almost 80 % performance those native power raw materials and become base fast development electricity sector in Czech lands in phase after World War second. Also for ulterior almost 50, possibly as far as 120 years, is able next development mining brown coal.
Vacation limit on two active fractures, CSA and Bilina, will heighten load oriented control reserves about 407 mil. tons, i. e. about 37 % and will ensure yet in 40. letech hereof century mining at the level 20 mil. tons, and then at consumption 0,7 kg coal on 1 kWh and production 28,5 TWh seat power control energy yearly. Mining is able to go on and after a year 2060 at grade open three reserve localities on green meadow (Zahorany, Podlesice, Bylany) and next progress stope spherical wave fracture CSA to the pillar Zaluzi (III. and IV. period development), namely as far as per annum 2120, indeed with fall below 10 mil. Tons per year in phase after a year 2080.

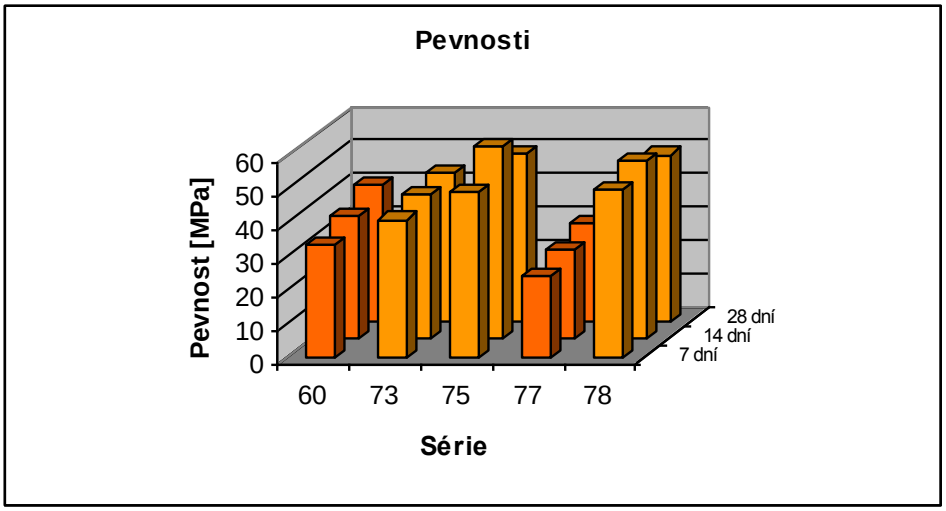


Pct. No. 1: Development of Caol Mining in Northern Bohemia [1]

It stands to reson, that if state like owner of mineral wealth of country leaves alone long term conception of coal mining , both lignite mining districts in northwest Czech are in final phase of mining. Exploitation coaly supply with blocked territorial ecological limits sometimes in distant futures is quite unreal appearance to way of final saving residual hollows of large mines, because the hydro reclamation were used.

3. Activation of Fly Ash by tempering

Examinational cubes of size 100 x 100 x 100 were created. Press strength after 7, 14 and 28 days was examined on them. Long term press strength was examined as well. An amount of water in mixture highly influences the length of hardening of POPbeton® as well as the reached level of whole long term press strength. It seems therefore crucial to maintain the level on the minimum point to maintain a workableness of concrete mixture. A smaller amount of added water was used due to characteristics of black-coal fly ash. The effect of different amounts of water can be seen on the mixtures number 73, 76 which were the same in the rest of characteristics.
The differences between black-coal and brown-coal POPbeton® are shown by press strength results. While press strength of black-coal fly ash are about 50 MPa press strength of brown-coal one are about 40 MPa. Levels of long time press strength were observed on these series. Press strength increases by around 10 MPa over time. This increase proceeds till the 40th day. Similar process was used for preparing of POPbeton® which was prepared without tempering.



Pct. 2 – Press strength of POPbetonu® - tempered

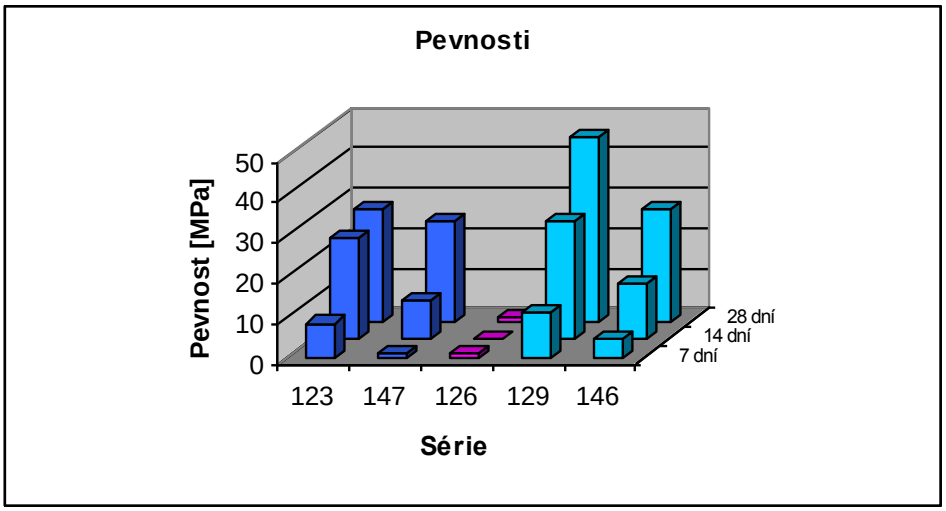
Tab. 1 – Tempered mixtures

60	Opatovice – brown coal
73	Freiberg - EFA fuller – black coal
75	Dětmarovice – black coal
77	Chvaletice - brown coal
78	Freiberg - EFA fuller - black coal

4. Activation of Fly Ash without tempering

It was necessary to find a different way of mixing for this alternate because of different technology of preparation of POPbeton® without heating. Thus fly ash itself was activated

first and it was then added to aggregate. The whole mixture was mixed. The examinal cubes of sizes 100 x 100x 100 mm were created again. Water ratios were chosen to fulfil a demand for the minimum amount of water in the mixture and to maintain the same workability for all of the series. Results from the set number 147 did not correspond with other results. The fluid fly ash from this set was therefore excluded from following examinations.
Press strengths of POPbeton® were examined 7, 14 and 28 days. Press strengths were measured over time as well. All of the mixtures showed more gentle grow than the mixtures prepared with tempering. The resulted press strength after 28 days are about 10 MPa lower comparing with the tempering alteration.



Pct. 3 – Press strength of POPbetonu® - non-tempered

Tab. 2 – Non-tempered mixtures

123	Opatovice – brown coal
147	Opatovice – brown coal
126	Kladno – fluid
129	Freiberg - EFA fuller - black coal
146	Dětmarovice – black coal

Conclusion

Investigating of long term press strengths provided us with interesting outcomes. The grow of press strengths is more gentle. To maintain the exact dosage of added water is very hard. Press strengths grow until 100th day. The reached press strengths are about 5 MPa lower that these of alteration prepared by tempering.

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