

Sewage Sludge in Portland Cement

Closing the loop of material flows in construction industry

Sector: construction

Overall budget: 1.4 M EUR

Countries involved: PL

Funding: Horizon 2020

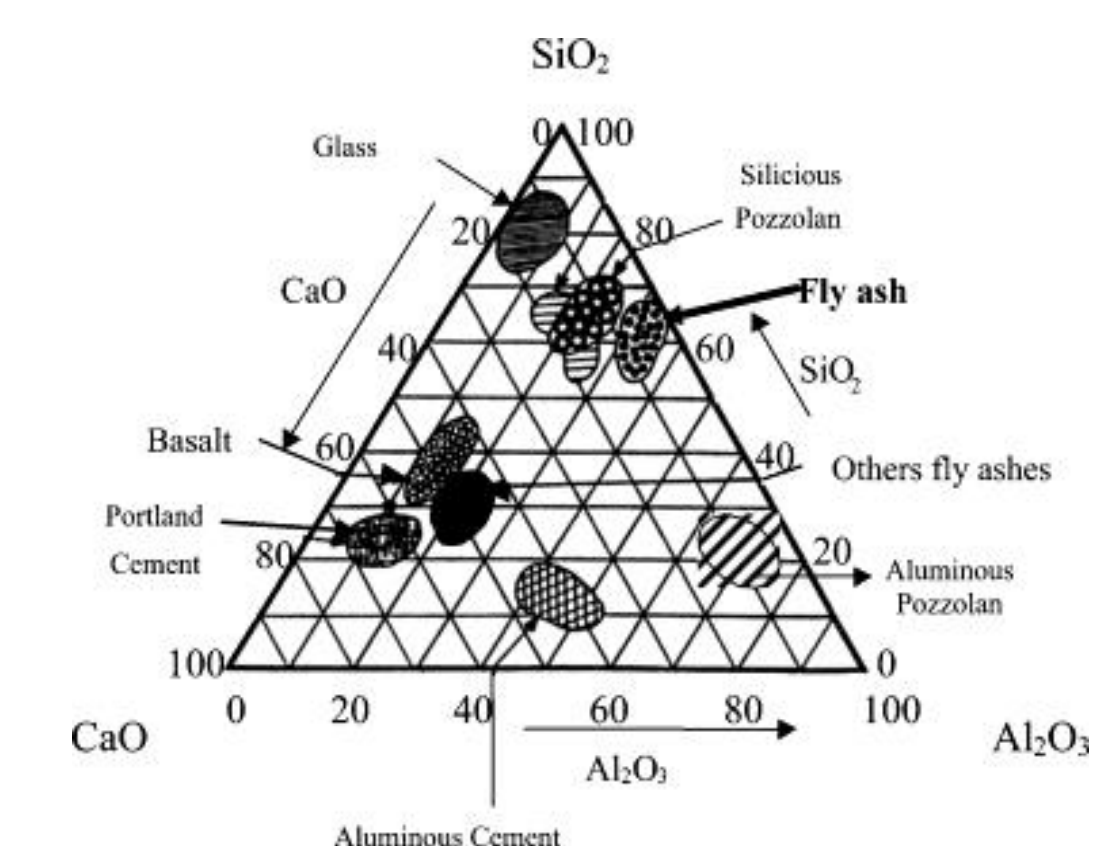
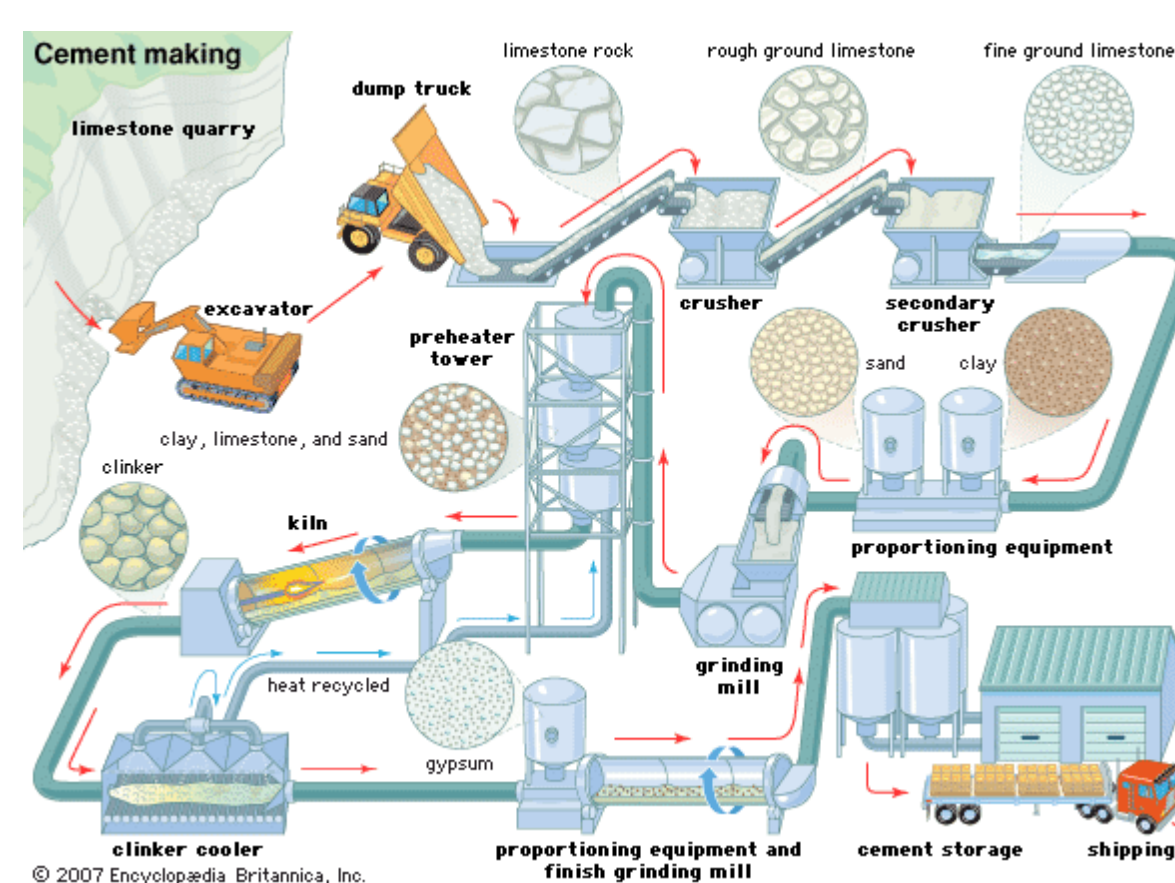
Duration: 2017-2019

- „END-OF-WASTE” criteria applied to sewage sludge (SS) waste streams from Municipal Waste Water Treatment Plant „GOŚ-ŁÓDŹ” in Poland
- Final sewage sludge ash (SSA) product classified as active and/or non-active mineral addition to Portland cement based products

INTRODUCTION

BY-PRODUCTS AS MINERAL ADDITIONS TO PORTLAND CEMENT BASED BINDER:

Mineral additions in cement production for their inclusion in concretes are very **advantageous economically**, as they produce less Portland clinker, hence saving energy. **Technological benefits** from this title are related to the manufacturing of Portland cement (PC) based binders products with higher initial values of mechanical strength, workability and chemical durability of building structures. **Ecological benefits** are associated with reduced CO₂ emissions, which indirectly contribute to the reduction of the greenhouse effect.



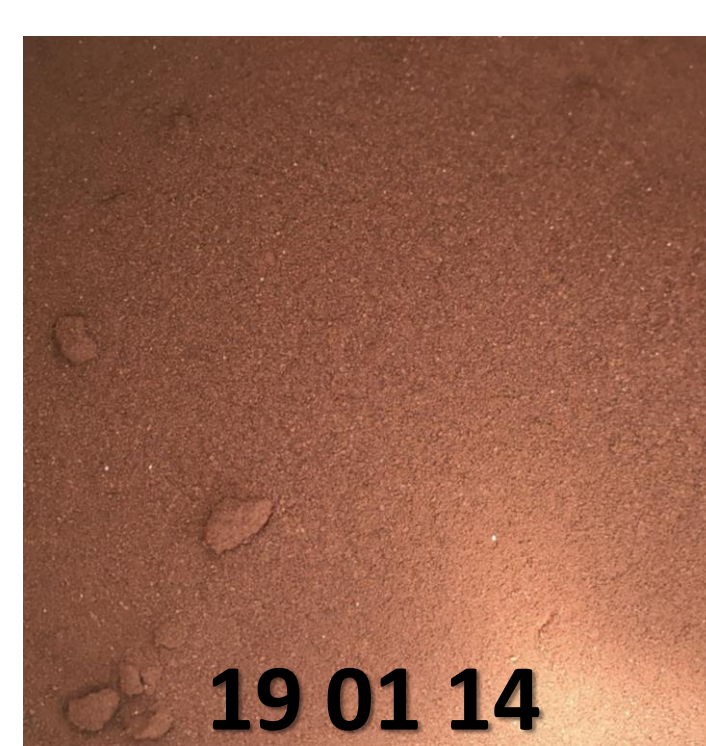
These mineral additions of PC have been in use for 4 decades. In principle, 2 types of mineral additions are used for direct mixing with Portland clinker or cement: **ACTIVE**, pozzolanic (natural and artificial pozzolans: thermally activated clays, fly ash, volcanic natural pozzolans, diatomite, silica fume) or hydraulically active additions (blast furnace slags), and **NON-ACTIVE**, crystalline fillers (siliceous or calcareous).

PRODUCTION OF SEWAGE SLUDGE AS WASTE:

Sewage sludge is a residual material left from waste water treatment processes, provided from both the municipal source or numerous other industrial production lines. The management of these wastes mostly depends on the organic and inorganic solids contaminants, which can be toxic to the environment and human health. The physicochemical properties of these materials on the stage of their production. In this project, the valorization is performed on sewage sludge from the first (physical and chemical) and secondary (biological) treatment stage of municipal sewage, carried out in the "GOŚ-ŁÓDŹ" Municipal Water Treatment Plant, which currently (2017) receives 51% of all waste water of the Łódzkie Voivodship.



Taking into account all the EU legislative regulations, sewage sludge from "GOŚ-ŁÓDŹ" is therefore stabilized in the **Sludge Thermal Treatment Plant**, which has been operating since 2009 and built on-site to address the problem of sediment and screenings management. The combustion process is carried out at 850°C in two parallel fluidized bed furnaces with a combined capacity of 159 Mg/d. The pre-step of drying applied to already dehydrated sludge is implemented in disc dryers, yielding 30 - 32% S.M. In fluidized-bed furnace, sludge is then burned in the sand deposit, as well as the resulting exhaust gas is recycled to the process.



Originated during incineration fly ash (19 01 14) (9,0 Mg/d) and solid wastes from off-gas treatment (19 01 07*) (0,5 Mg/d) are appropriately deposited at the "GOŚ-ŁÓDŹ" "Laguna" landfill site. Stabilized in this way sludge from treatment of urban waste water (19 08 05) (223 Mg/d) is deposited on the main square of the facility as non-toxic waste.

ABOUT THE PROJECT

END-OF-WASTE TECHNOLOGY FOR SEWAGE SLUDGE OF „GOŚ-ŁÓDŹ”:

A **case study** carried out within the project on one of the production lines of "GOŚ-ŁÓDŹ" plant is expected to allow the development of a **new End-of-Waste technology** for sewage sludge that is currently being incinerated, stabilized and deposited as non-toxic waste. Developing of criteria for transforming the produced waste into by-product that can be included as a mineral addition to clinker or cement will enable its introduction to the market. In order to increase its competitiveness in the building materials sector of primary and natural available resources, technical guidance will be developed to support the use of the new product.

QUALITY AND EFFICIENCY OF IMPLEMENTATION:

The H2020-MSCA-IF-2016-746830 Project is structured into **7 workpackages (WPs)**:

WP1: Conditioning of the raw input material of SS waste, supplied by the "GOŚ-ŁÓDŹ" facility, into SSA by-product of constant physical-chemical characteristics. **WP2:** Analysis and study of the SSA by-product, as artificial mineral addition to be incorporated in the new PC based binders manufacturing and their derived products: mortars and concretes, according to standard testing suitable methods. **WP3:** Manufacturing of the PC/SSA new binders cements: assessing of their mechanical strength, volume soundness and chemical durability behaviour. **WP4:** Possible application of the PC/SSA new cements products, mortars and concretes, with a view of the obtained results and the market demand. **WP5:** Project management. **WP6:** Training and career development. **WP7:** Dissemination and public engagement



EXPECTED RESULTS:

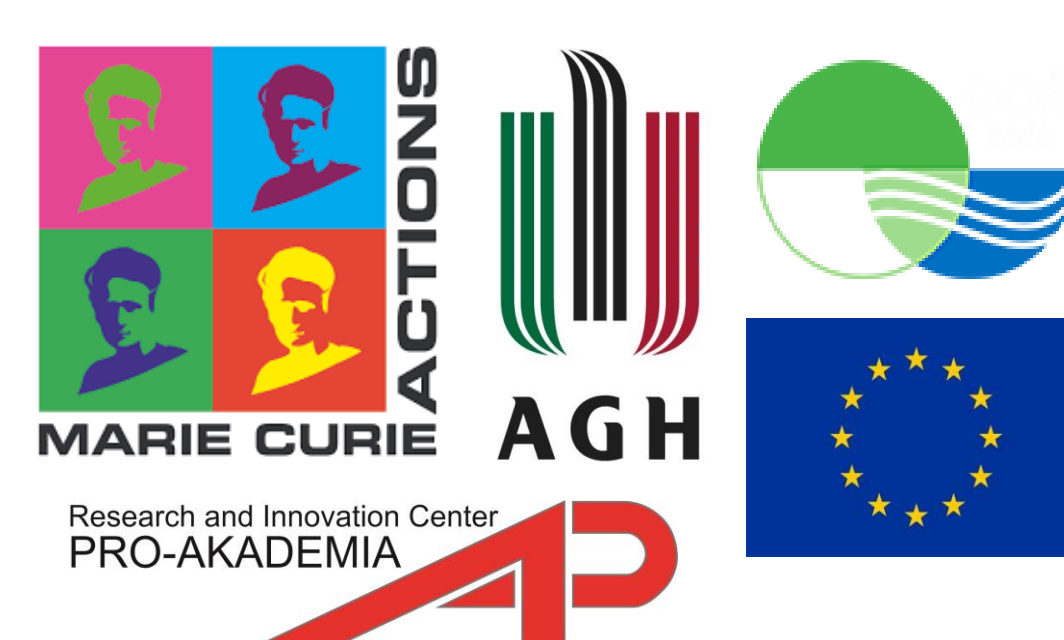
The project performs valorization of the SS waste stream (19 08 05) from the "GOŚ-ŁÓDŹ" Plant, as a subsequent supplementary cementitious material (SCM) in PC-based new binders production. The recovery chain of the SS input material implies all the processes and standard techniques of testing to quality control for the EoW candidate (SSA stream) in order to provide a good quality by-product with its potential application in the market, and well-defined technical and environmental minimum requirements to be fulfilled.

ACKNOWLEDGEMENTS

Project H2020-MSCA-IF-2016-746830 "SEWAGE SLUDGE IN PC" is 100% financed by the European Research Framework Program "Horizon 2020" under the Maria Skłodowska-Curie Action - "Individual Fellowship" awarded to Dr. Eng. Lidia Natalia Trusilewicz, on the basis of Grant Agreement No. 746830.

SCIENTIFIC SUPERVISION AND COLLABORATIONS

The research and scientific work of the project is carried out at the Research and Innovation Centre (RIC) "Pro-Akademia" and the RES Technology Transfer Centre in Konstanyń Łódzki. Scientific supervision of the performed works is realized within the framework of scientific-innovation-didactic cooperation with Prof. Eng. Wiesława Nocuń-Wczelik from the AGH University of Science and Technology in Cracow.



Maria Skłodowska-Curie Actions (MSCA) are dedicated to the development of research careers through training and international and cross-sector mobility of scientists in order to ensure the optimal development and dynamic use of European intellectual potential.



CONTACT:

Lidia Natalia Trusilewicz, Ph.D.
lidia.trusilewicz@proakademia.eu
www.proakademia.eu

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