Alternative Ashes in Concrete

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INTRODUCTION

The ZeroWaste project students have been involved in classifying, testing, upgrading and developing new use of ashes, first of all focusing on sewage ash from sewage water treatment plants where the future global phosphate-shortage is taken into consideration since sewage ashes contain considerably large amounts of phosphor.

MAIN APPROACH

The ZeroWaste group at DTU Byg has developed methods for cleaning the ashes for pollutants (as heavy metal) and valuable materials (as phosphor), so the use of the ashes will have no environmental risk. In order to show, that cleaning the ash for heavy metals and phosphor, is indeed beneficial, phosphate has been added to a reference-mix, and tested for strength. As the phosphate affects the concrete in a negative direction, it will show how the cleaning-process is not only beneficial for the environment, but also for the compressive strength. The remaining ash can, however, not directly be used in concrete, bricks, road building or other applications as there may be problems with difficult mixing and mix designs, increase of porosity and loss of durability, strength development and final strength etc. The authors have in their project works focused on using ash in concrete and has shown that up to 20 % of the cement and up to 10% of the sand can be replaced with the sewage ash. This process reduces the water requirements, maintains the strength of the mix fairly well and still allows the mix to set and develop strength with the same speed as traditional concrete.

MAIN RESULTS

A range of ashes has been screened and used for concrete and mortar production and shows very promising results: There is at the moment no doubt that all the produced sewage ash can be applied in the concrete production and that the ground ash can replace a similar amount of cement.

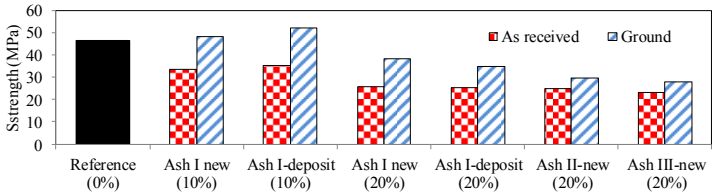

Figure 1 A few results with replacement of cement and/or sand in the mix.

The LCA must be completed later, when the process is fully known, howver, it should be mentioned that grinding of ash is the only energy consuming procedure and is expected to require less energy than the grinding of the traditional cements clinker. The concept of cleaning the ashes and upgrading them to be a renewable source of environment-friendly materials for concrete or other building materials is seen as a winning approach: It can replace cement and reduce sand consumption and still maintain or improve the quality of the building materials. Furthermore it will be possible to extract reusable phosphor during the cleaning process of the ash, which is both an environmental benefit as well as an economical.