

conference poster

# Utilization of Recycled and Secondary Materials in Concrete Production - LCA

Anna HORÁKOVÁ, Alena KOHOUTKOVÁ and Iva BROUKALOVÁ

# Motivation

In past years, the issue of sustainable development and the impact of construction activities on the environment are gaining importance. It is desirable to minimize negative environmental impact by suitable design, optimal manufacturing process and material selection. The environmental aspects of sustainable development in the construction industry consist also in the utilization of secondary raw materials in the design and construction of new structures.

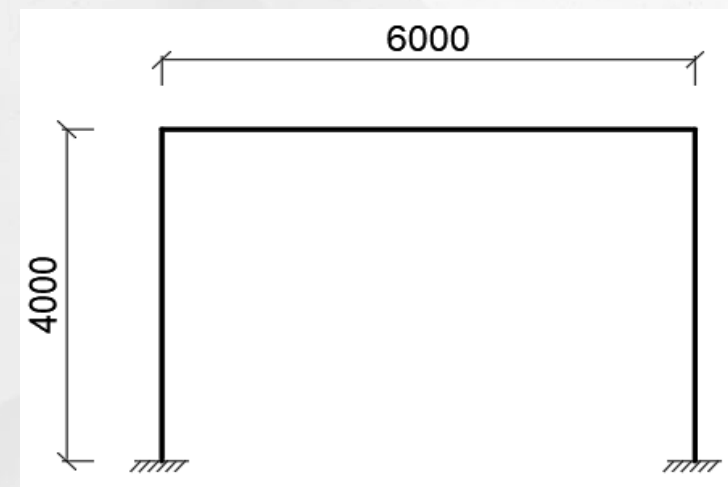
## Life cycle analysis

- ❑ Whole life-cycle of the investigated product or at least its significant part (in case that prediction of the course of the phase of use is sometimes not possible)
- ❑ LCA performed for
  - ❑ 7 variants of concrete
  - ❑ a simple structural member
- ❑ The most significant environmental impacts were considered: consumption of raw materials, global warming and climate change, acidification and eutrophication of the environment and photooxidant formation

# The composition of the concrete mixtures

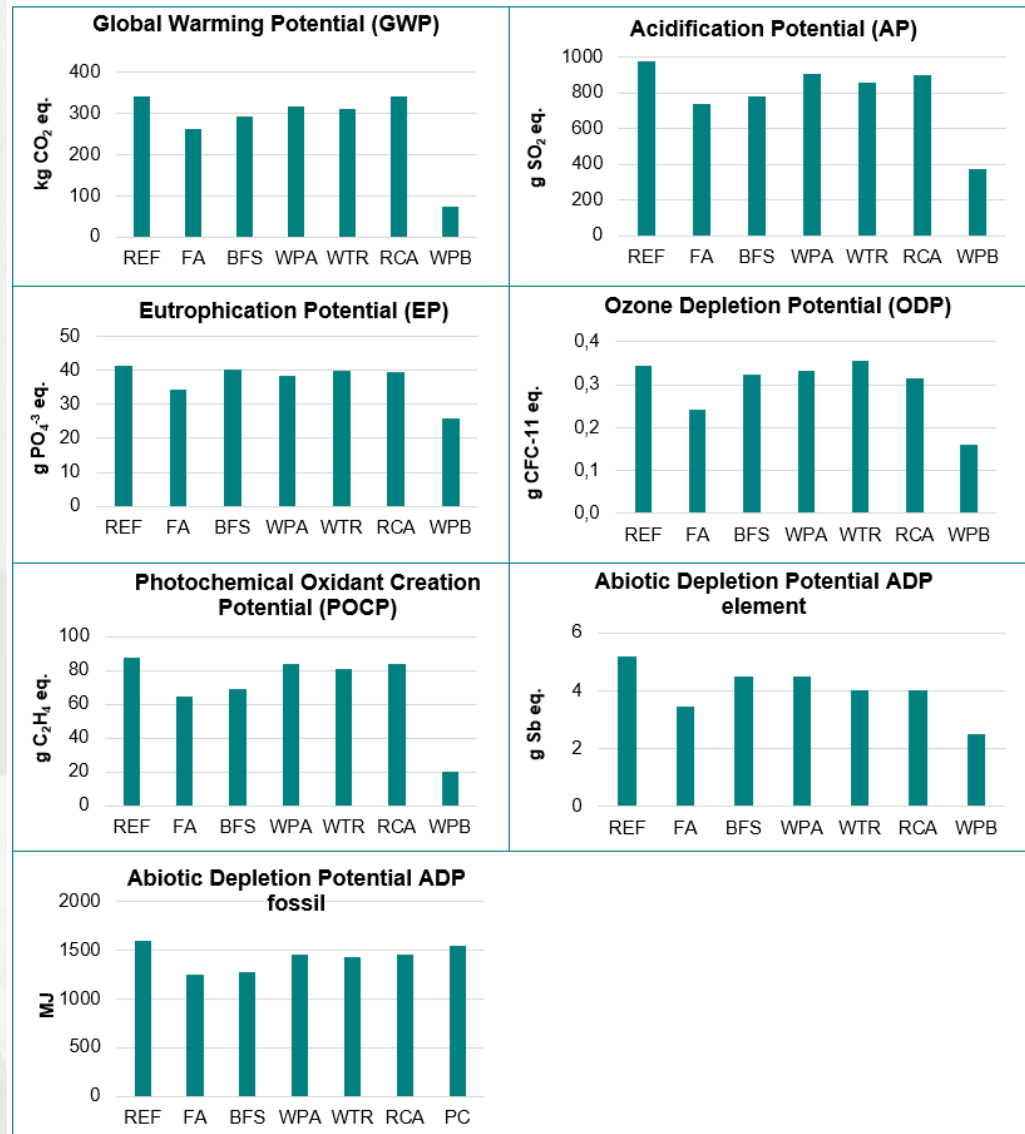
		REF	FA	BFS	WPA	WTR	RCA	PC
Cement	[kg/m <sup>3</sup> ]	380	280	324	380	410	380	0
Water	[kg/m <sup>3</sup> ]	190	236	180	200	200	190	0
Fine aggregate	[kg/m <sup>3</sup> ]	705	1142	681	572	840	705	1580
Coarse aggregate	[kg/m <sup>3</sup> ]	1100	493	1160	1020	960	0	0
Fly ash	[kg/m <sup>3</sup> ]	0	95	0	0	0	0	0
Blast furnace slag	[kg/m <sup>3</sup> ]	0	0	36	0	0	0	0
Waste plastic aggregate	[kg/m <sup>3</sup> ]	0	0	0	143	0	0	0
Waste tyre rubber	[kg/m <sup>3</sup> ]	0	0	0	0	40	0	0
Recycled concrete aggregate	[kg/m <sup>3</sup> ]	0	0	0	0	0	1100	0
Waste PET (as a binder)	[kg/m <sup>3</sup> ]	0	0	0	0	0	0	472
Superplasticizer	[kg/m <sup>3</sup> ]	2	1.8	0	0	0.8	2	0

# A simple structure for the case study (concrete frame)

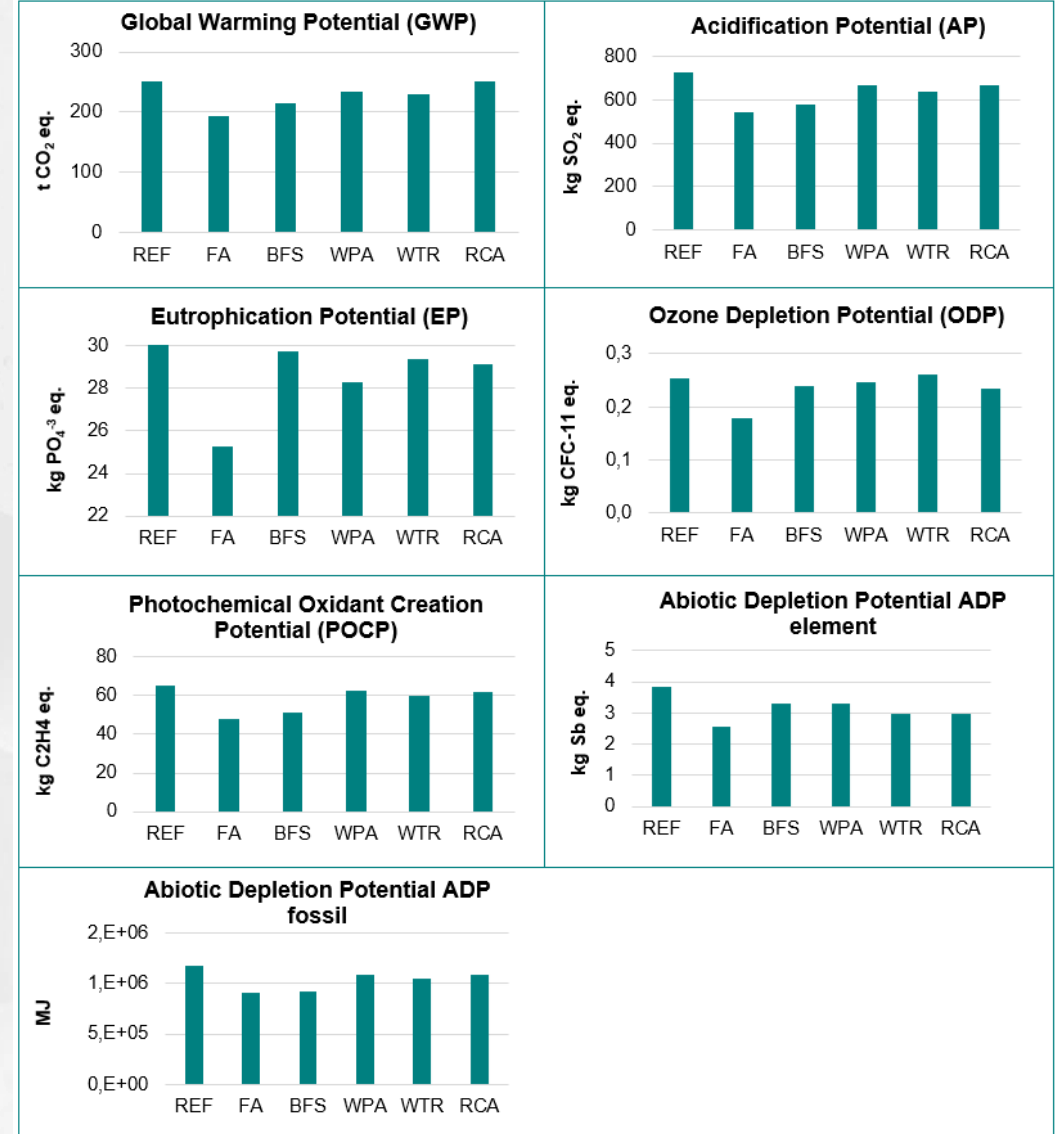


Variant	The compressive strength [MPa]	The volume [m <sup>3</sup> ]
REF	32.3	740.00
FA	36.2	728.40
BFS	36.2	728.40
WPA	29.5	749.86
WTR	33.8	735.36
RCA	29.2	751.60

# Results for 1 m<sup>3</sup> of concrete



# Results for concrete structure



- ❑ The utilization of recycled material in concrete brings benefits in terms of environmental impacts
- ❑ The influence of the use of recycled materials on the mechanical properties of concrete must be considered
- ❑ It is necessary to investigate the influence of the transport of recycled materials to the structure site
- ❑ It is very advantageous to replace a part of cement by supplementary cementitious materials (fly ash or blast furnace slag)
- ❑ Polymerconcrete is favourable from the environmental point of view with the exception of energy consumption (due to the melting of waste plastic)

#### **Acknowledgments**

This outcome has been achieved with the financial support of the Ministry of Education, Youth and Sports, project: Durability of concrete structure and assessment of its life cycle, SGS19/149/OHK1/3T/11.

**Anna HORÁKOVÁ, [anna.horakova@fsv.cvut.cz](mailto:anna.horakova@fsv.cvut.cz)**