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Utilization of biomass ashes

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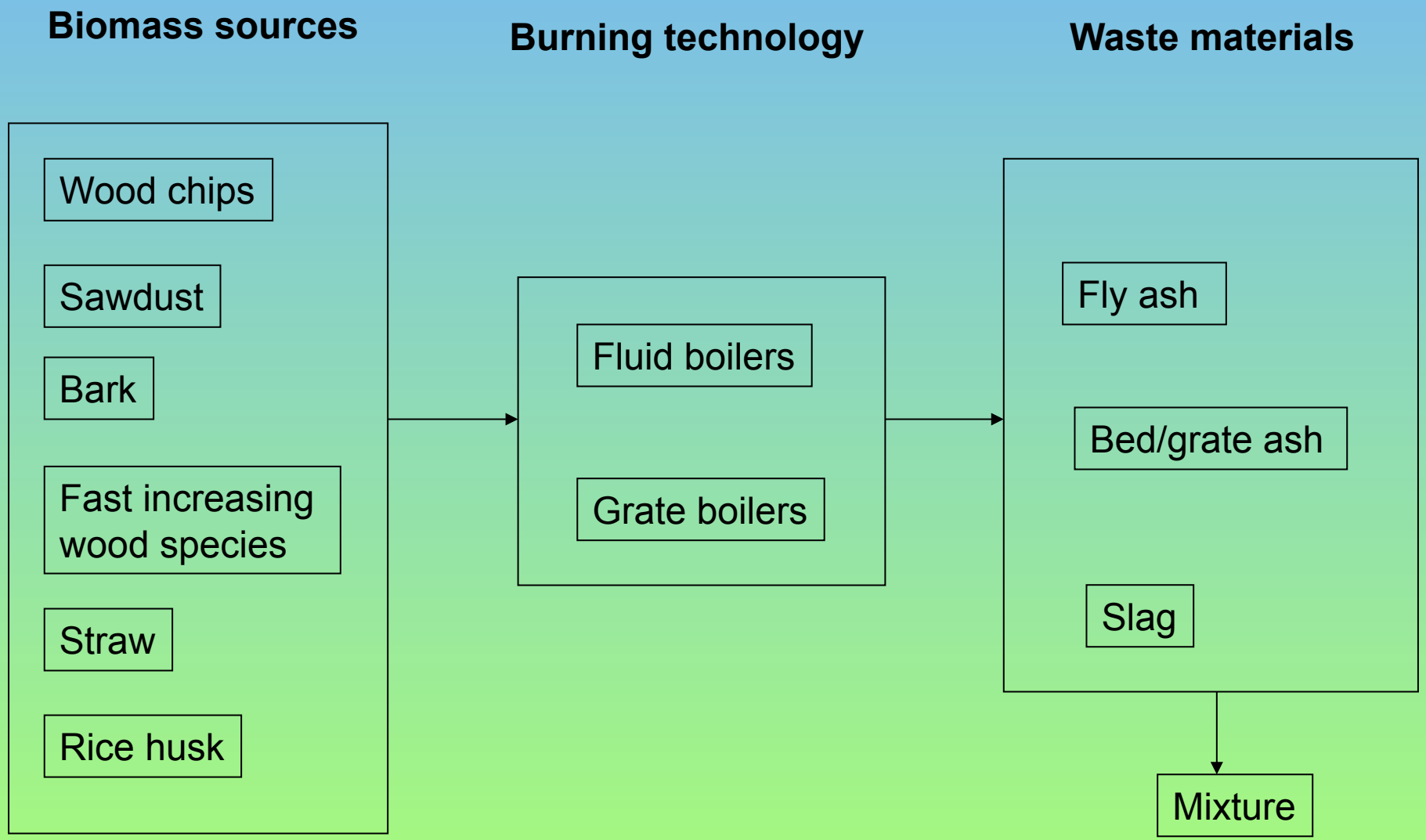
Burning of biomass



Wastes and following problems

- Czech Republic: more than 60 biomass heat stations (more than 2 MW)
  ⇒ 40,000t of wastes per year

- High pH value of water extract pH>11

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- Necessity of special deposition

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- Increasing of operating and heat costs

Possibilities

1. Deposition of wastes – increasing of deposition costs, necessity of new storage areas
2. Recycling of proportion of biomass ashes back to the soil as fertilizer
3. New materials – additives to the special mixtures and composites created by geopolymer technology

Materials

- Metakaolin – 750°C

A) Sodium Silicate + Sodium Hydroxide

B) Potassium Silicate + Potassium Hydroxide

Additives – wood cinder

- Czech Heat Power Plants - burn wood chips and sawdust (90 % conifers and 10 % broadleaved trees).
  - Average chemical analysis of cinder from wood (wt. %):

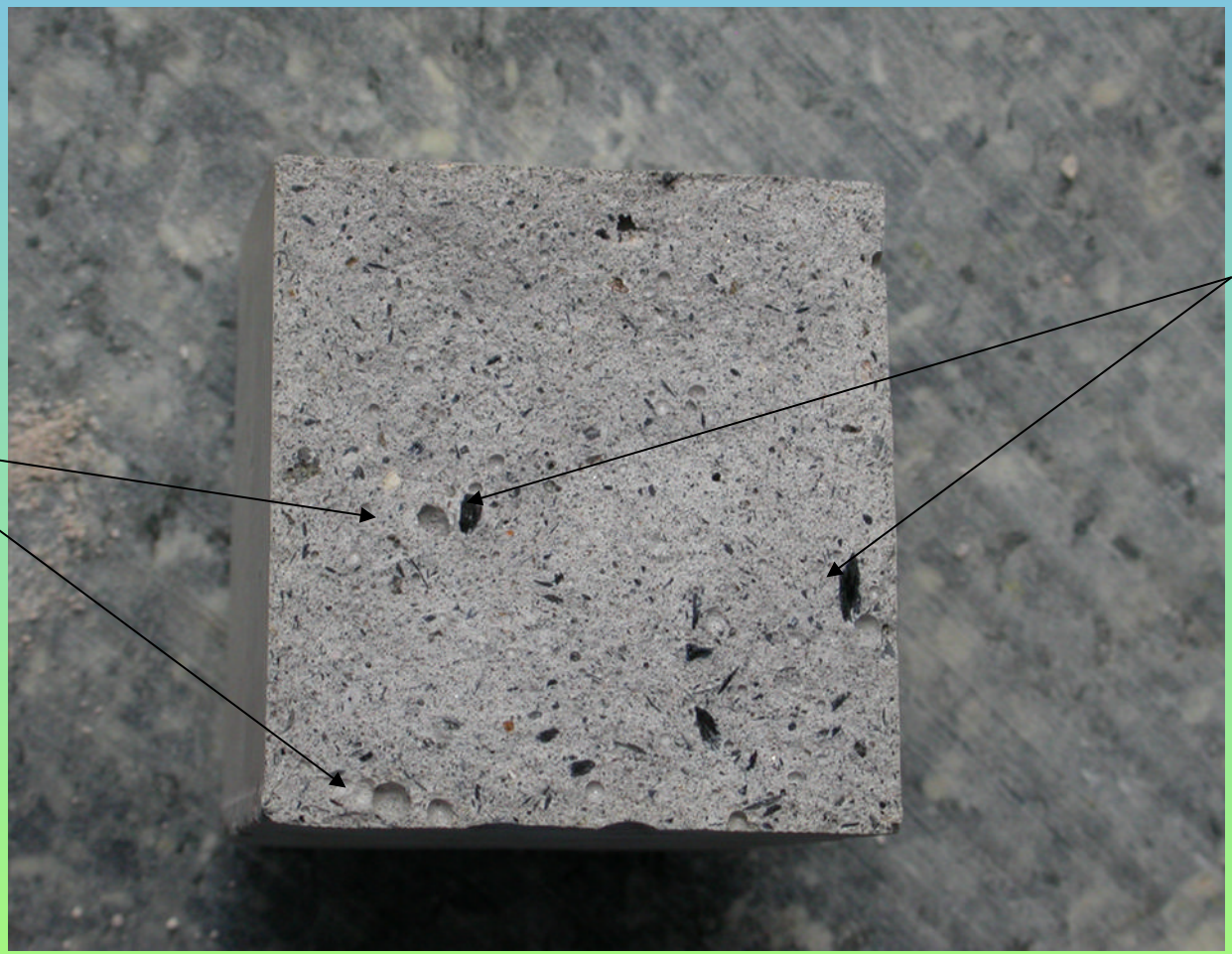
Oxides	SiO_2	Al_2O_3	CaO	SO_3	K_2O	Fe_2O_3	LOI
Wooden cinder	56.1	10.59	14.17	0.06	5.55	8.47	0.1

- Bystřice nad Pernštejnem
- Třebíč
- Trhové Sviny

Mechanical properties of 28-days-old samples

Geopolymer with ash addition		Filling (Wt. %)	Flexural strength (MPa)	Compressive strength (MPa)
Na^+ solution	Třebíč	29	0.86	56.88
		41	1.17	39.69
		62	0.47	11.04
	Trhové Sviny	58	2.07	49.79
		61	1.27	24.38
		66	2.60	33.96
	Bystřice nad Pernštejnem	38	5.15	35.88
		43	4.21	36.72
K^+ solution	Třebíč	33	1.01	67.50
	Trhové Sviny	55	4.48	60.8

Fracture area of geopolymer with bio-ash from Trhové Sviny



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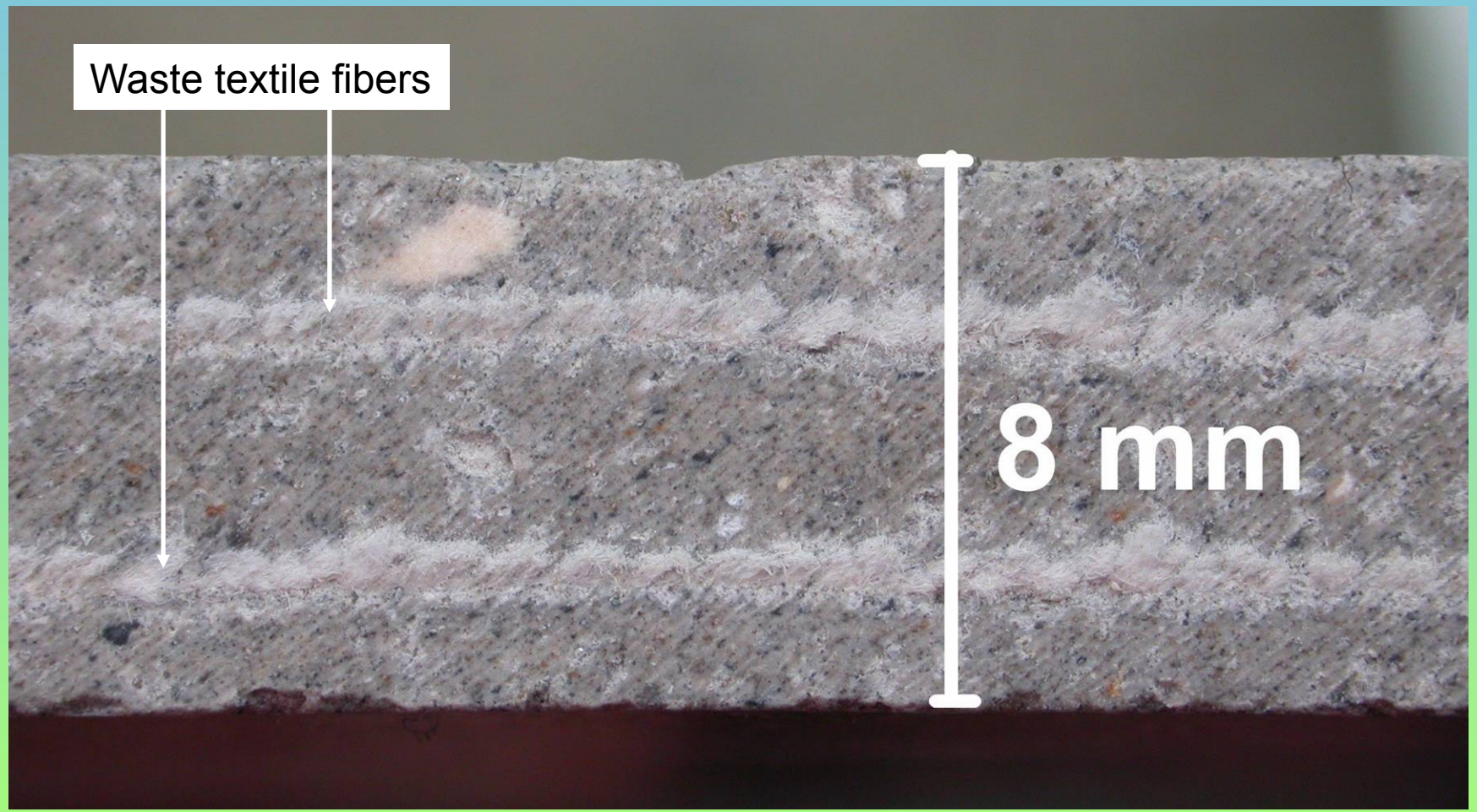
Multi-layered composite prepared from biomass ash Bystřice nad Pernštejnem



Multipurpose composite

- Paper layer – for final decoration of inner wall
- Foamed layer – heat and acoustic insulating function
- First supporting layer – geopolymer with addition of bio-ash and wood waste material
- Polystyrene layer – heat insulation of material protected from both sides against fire
- Second supporting layer – geopolymer with addition of bio-ash and wood waste material

Sound, heat and fire resistant material

Resistance to 1200°C without shrinkage or cracks

Heat conductivity factor
λ=0.331 $W.m^{-1}.K^{-1}$

Comparison:
Clay building brick: λ=1.2 $W.m^{-1}.K^{-1}$
Concrete block: λ=1.5 $W.m^{-1}.K^{-1}$
Slag concrete block: λ=0.7 $W.m^{-1}.K^{-1}$

Sound absorption coefficient
α = 0.69 – 0.74

Conclusion

- Ashes from biomass combustion could be easily used
- Utilization is focused on building industry
- Solid and resistant materials create by geopolymer technology
- Composite materials with specific properties

Thank you for your attention

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