INSTITUTO NACIONAL DE ENGENHARIA E TECNOLOGIA INDUSTRIAL

INETI

The Fate of Hg During Co-Firing of Coal and Sewage Sludge

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Abstract

- **The aim of this work was to study the fate of Hg during Co-Firing of Coal and Sewage Sludge. It was also studied the performance of activated carbon on Hg removal.**

Experimental

- Hg emission and adsorption data acquisition in the FBC during co-combustion of the coal and Sewage Sludge:
  - Sewage Sludge (Biogran®)
  - Mixture of sludge and coal
  - Coal (Carbocol - Colombia)
  - Activated Carbon:
    - Prepared from Paper Industry Wastes
    - Mersorb® from Nucon Internacional, Inc

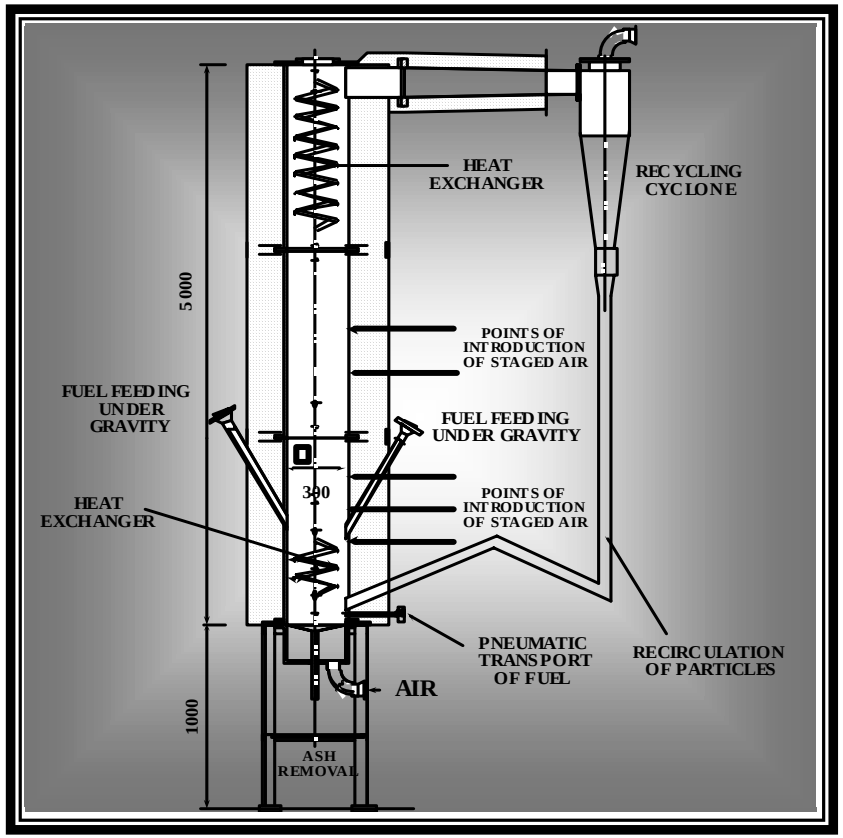
Fuels

	Carbocol	Sewage Sludge
Proximate analysis		
Moisture (a.r., Wt%)	3.6	8.0
Ash, (d.b., Wt%)	7.5	34.0
Volatile matter, (d.b., Wt%)	36.6	50.0
Fixed carbon, (d.b., Wt%)	52.3	8.0
Gross Calorific Value, (MJ/kg)	29.5	13.8
Elemental analysis (d.b., Wt%)		
C	74.7	33.0
H	5.1	4.8
N	1.4	4.2
S	0.6	0.8
Cl	0.03	0.10

Mercury content

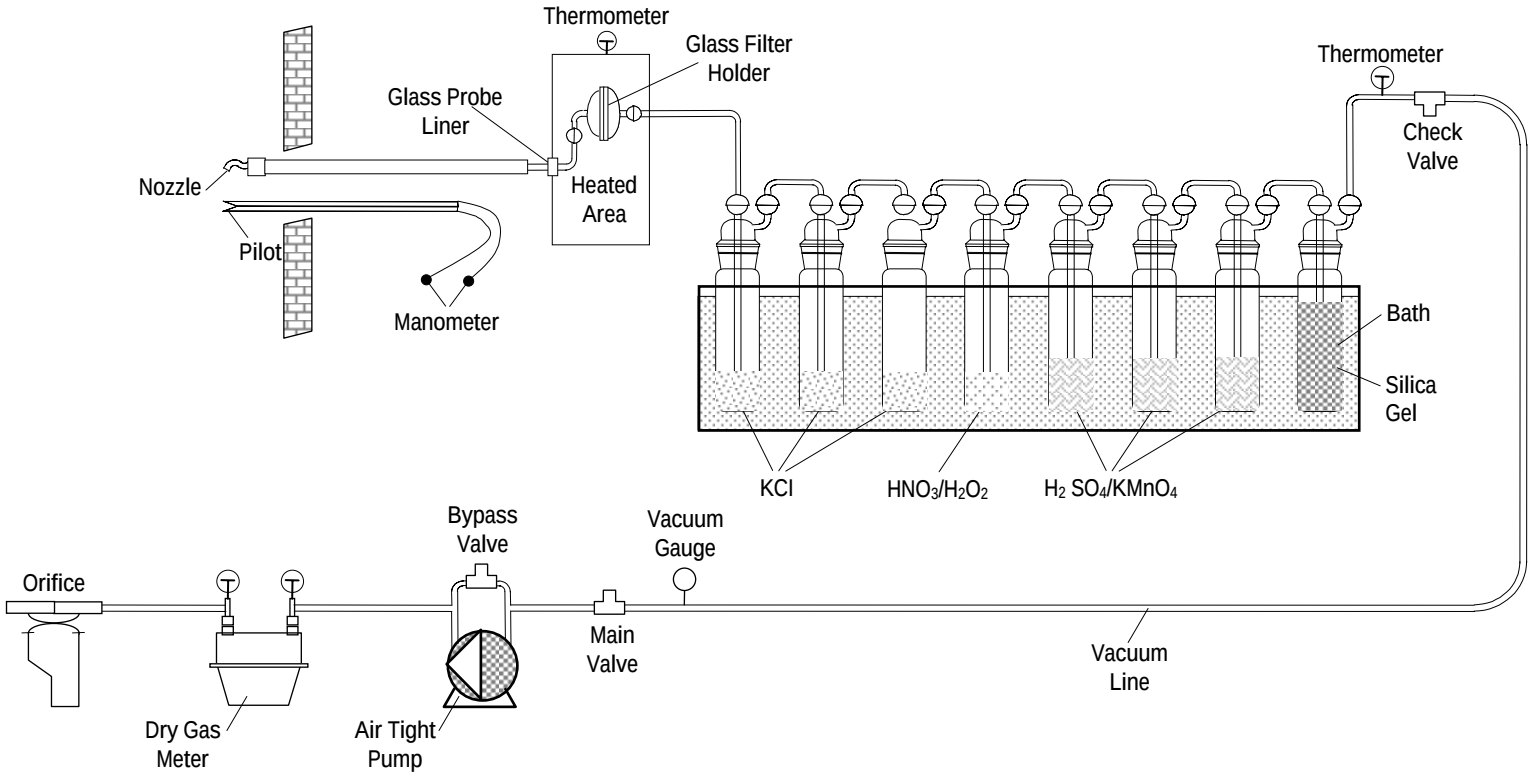
	Carbocol Coal	Sewage Sludge
Hg (mg/kg)	0.04	2.24

Fluidized Bed Combustor (FBC)



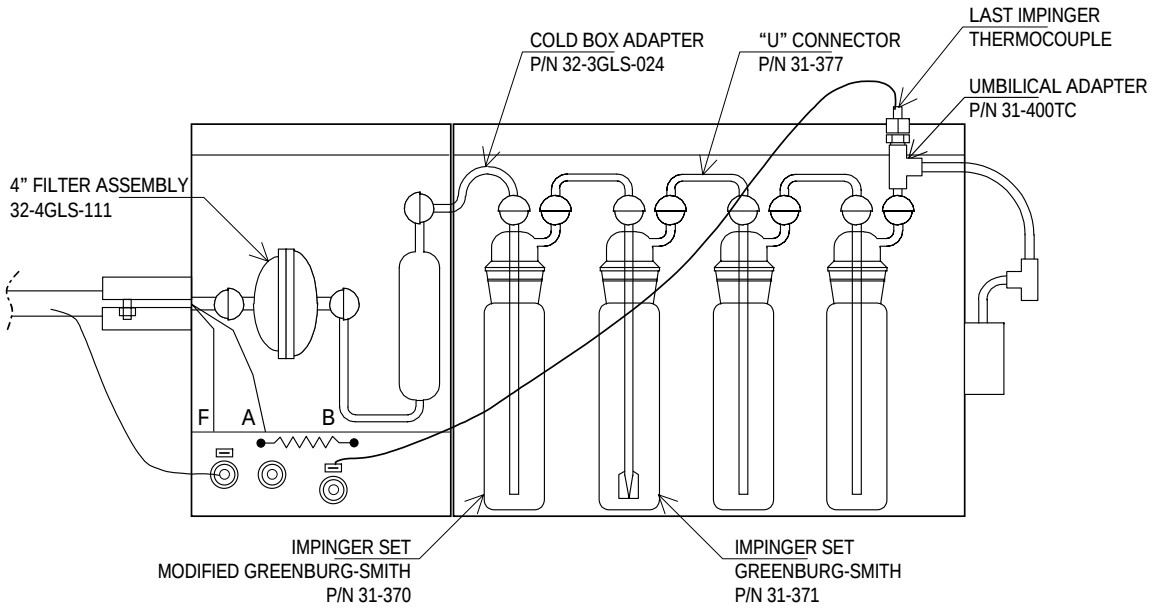
- Air feeding system:
  - primary air - two ventilators
  - secondary air - compressor
- Combustible feed system:
  - screw feeder
- Bed temperature:
  - cooling surfaces

Sampling Train Set-up



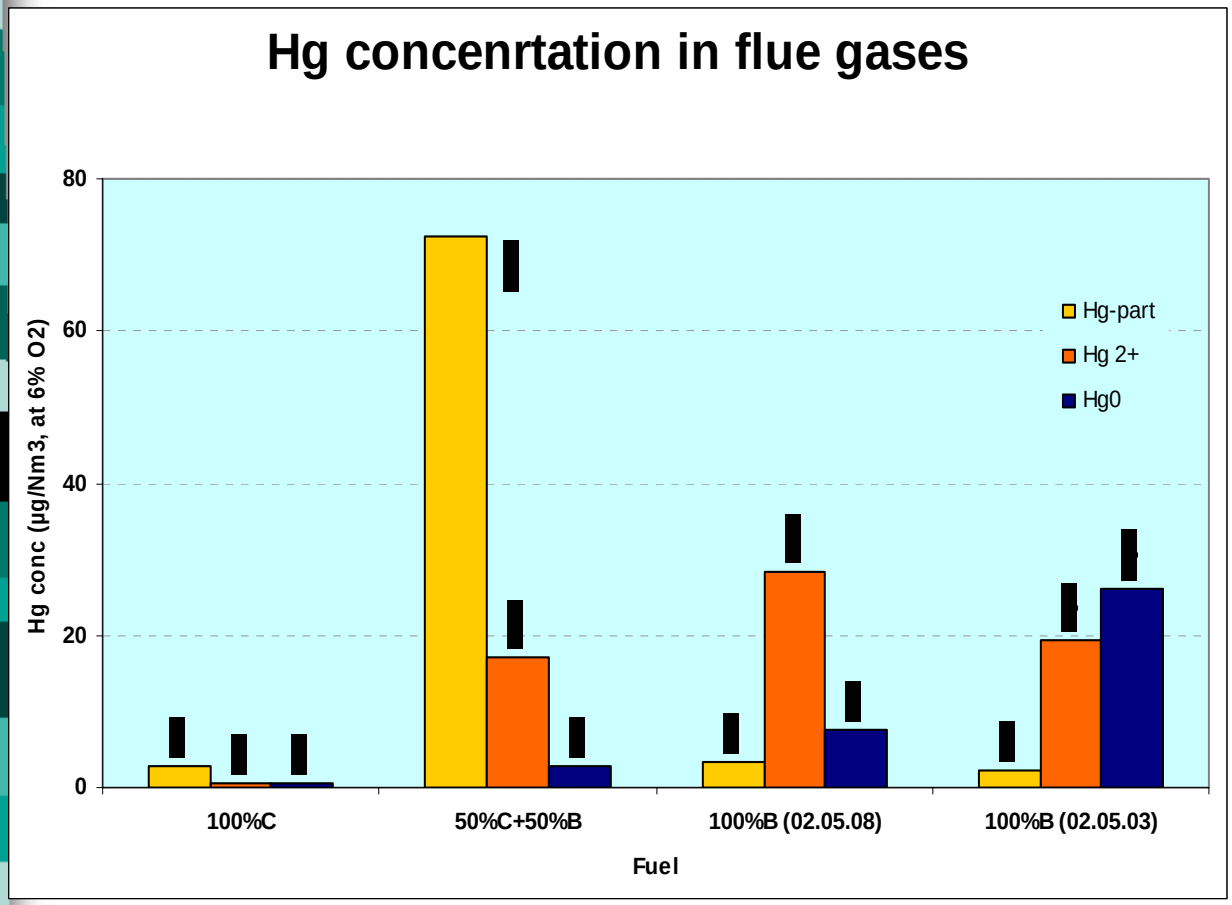
Sampling Train Set-Up is preparing to be used in a test

Mercury Adsorption Reactor



Adsorption Reactor

Hg Emissions with Flue Gases



- Test 100% B

Concentration of particle-bound mercury is low because particulate matter is poor in carbon

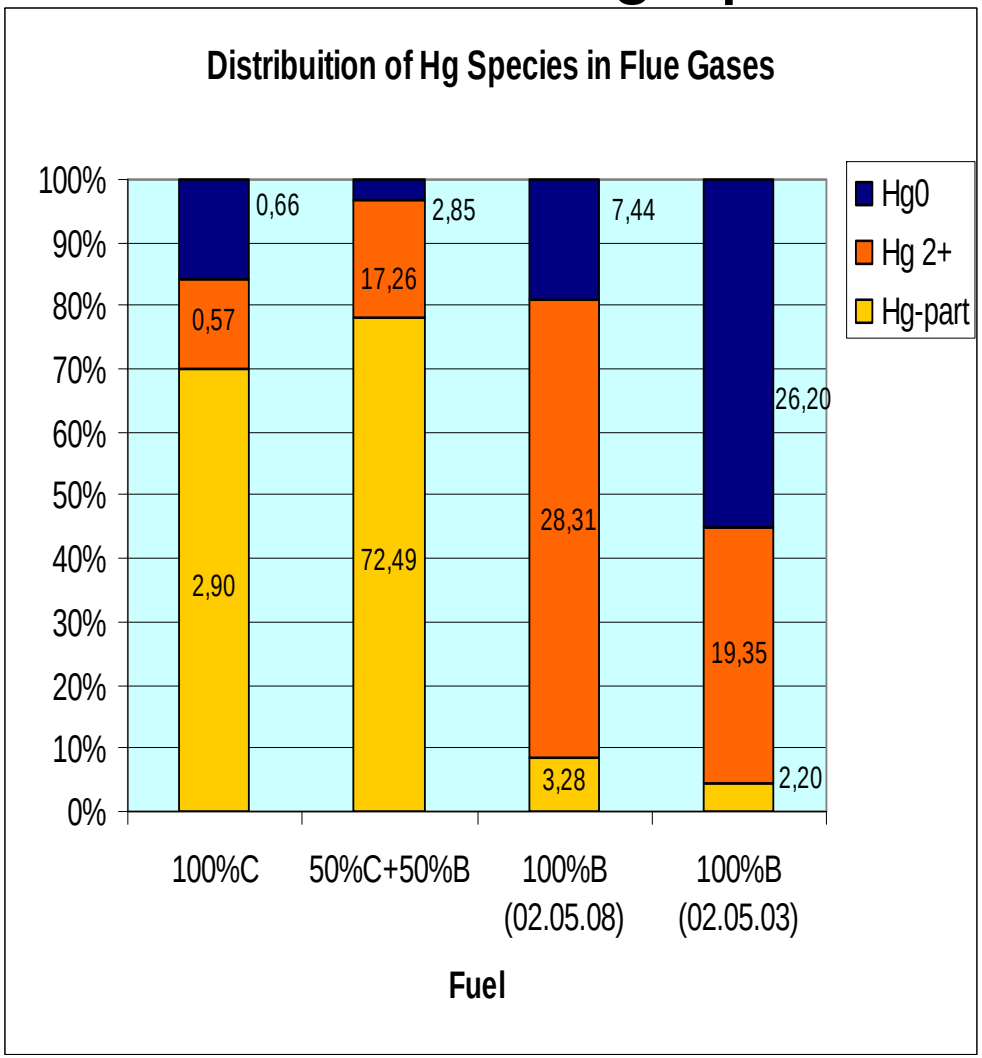
- Test 50% B+50% C

Hg(part) concentration increases because particulate matter contains more carbon

- Test 100% C

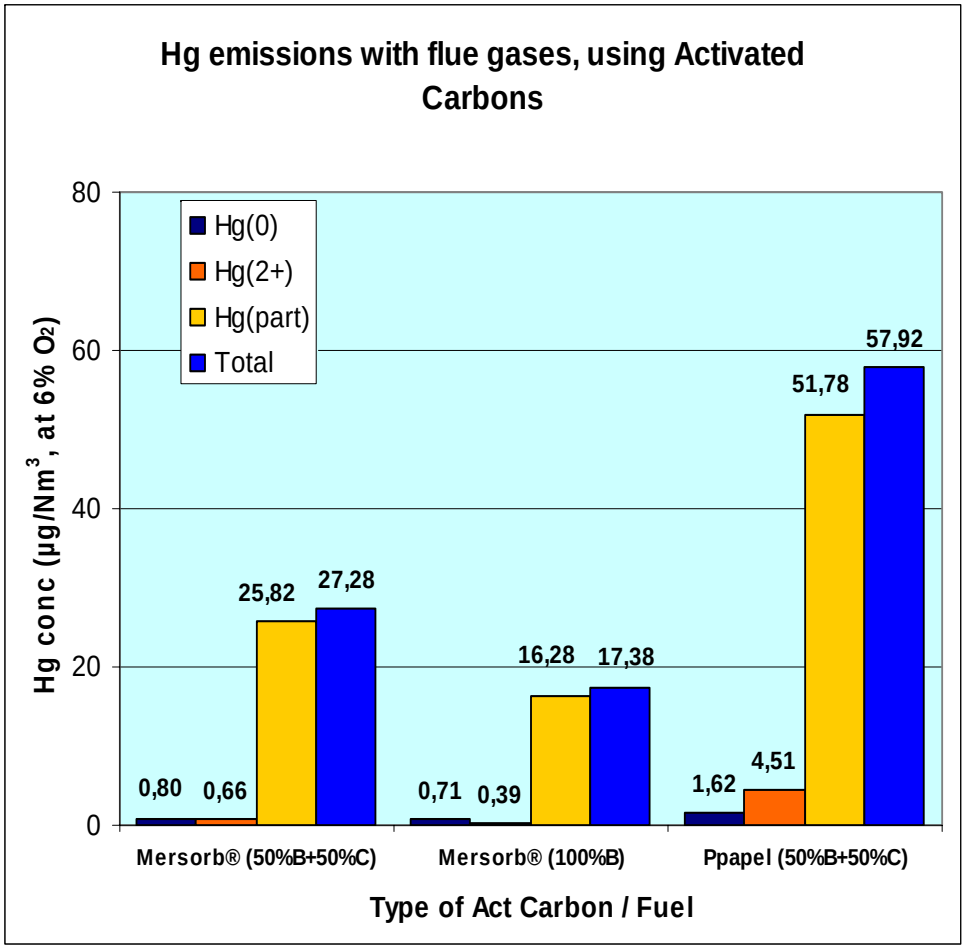
Concentrations of all Hg species are relatively low

Distribution of Hg Species in Flue Gases



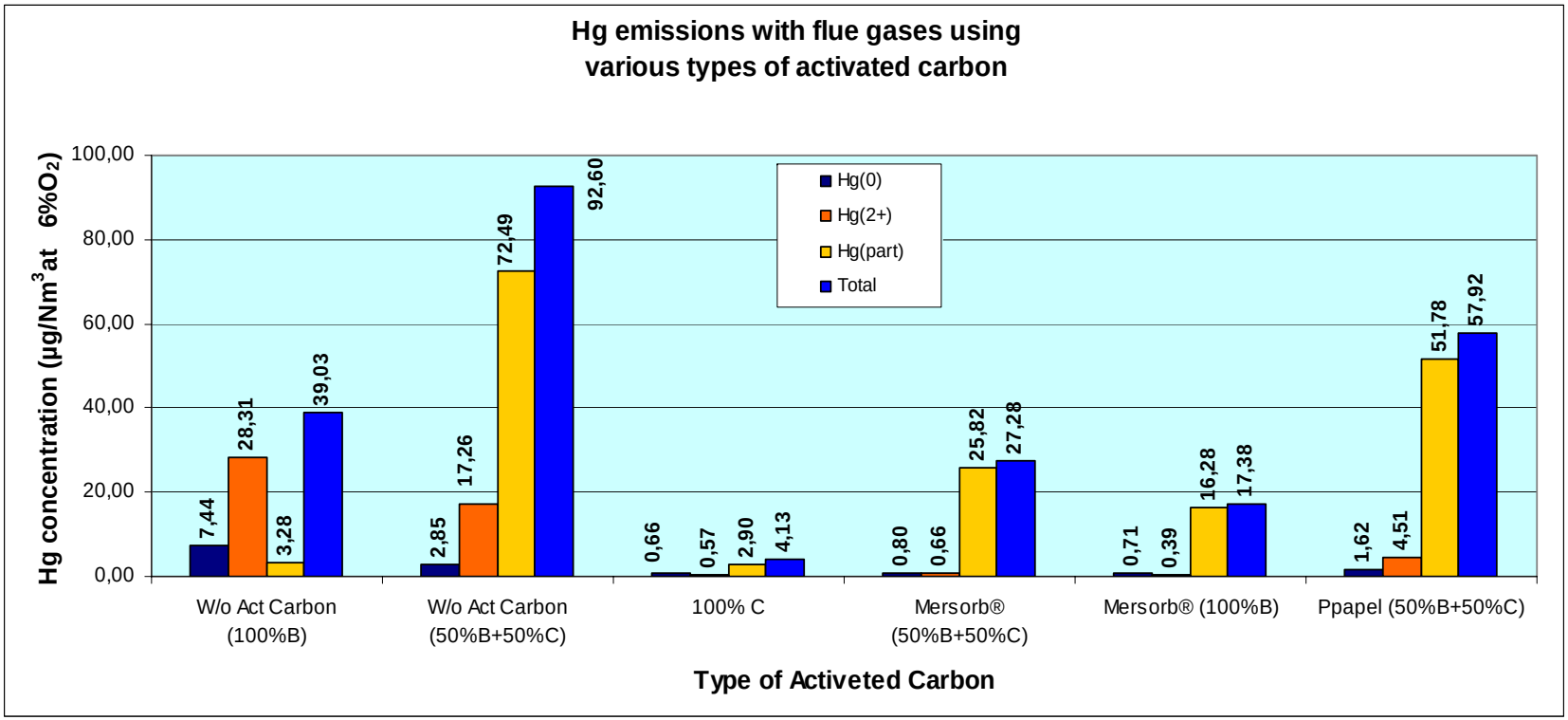
- In case of the combustion of the coal alone and the a mixture of with sewage sludge, the main Hg specie is particle-bound Hg
- In case of the combustion of the sewage sludge alone, Hg(0) and Hg(2+) are predominant species.

Hg emissions with flue gases when an Activated Carbon is used

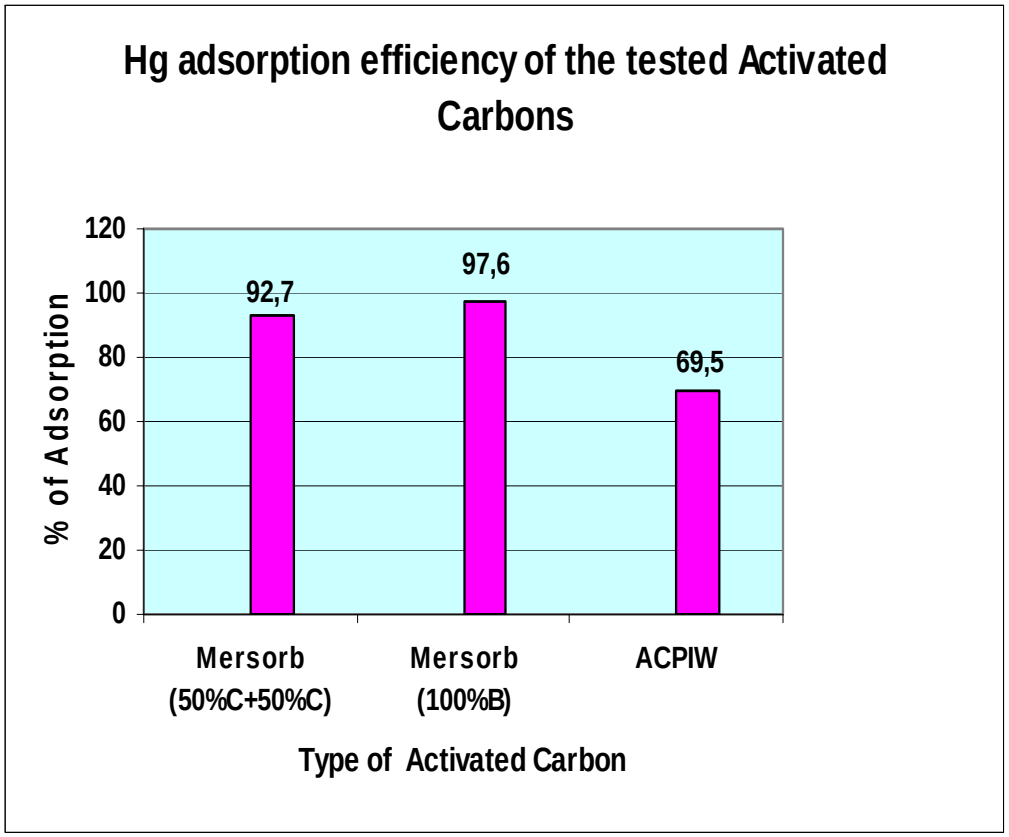


- In case of the combustion of the mixture 50%C+50%B, the level of mercury emissions is reduced from 92,7% to 97,6%, when Mersorb® is used.
- With the same mixture, using activated carbon prepared from paper industry waste, the level of Hg emissions is reduced only by 69,5%.

Comparison of the Hg emissions without and with Activated Carbon

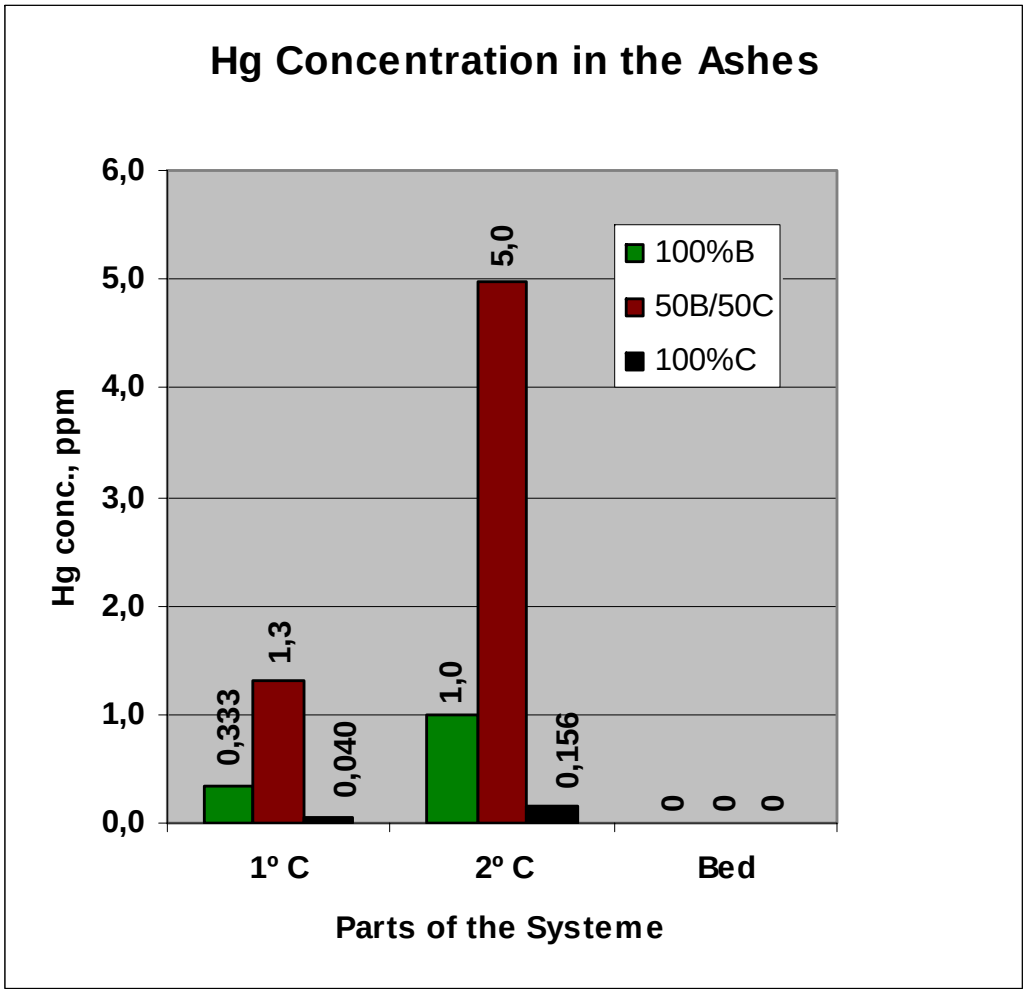


Hg adsorption efficiency

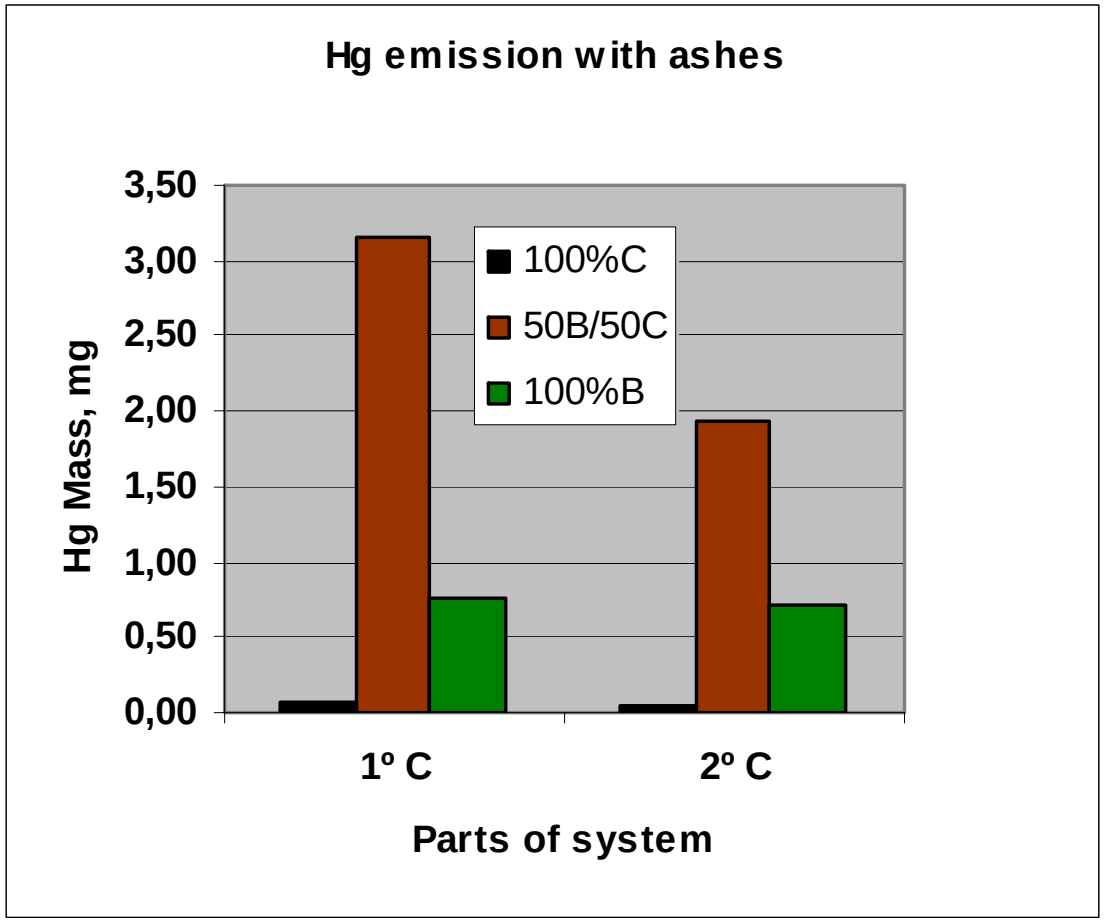


- **Test conditions:**
  - **Temp Hot Box = 110 ºC**
  - **Residence Time = 0,03 sec**
- **The ACPIW must be improved by the impregnation or other treatment.**

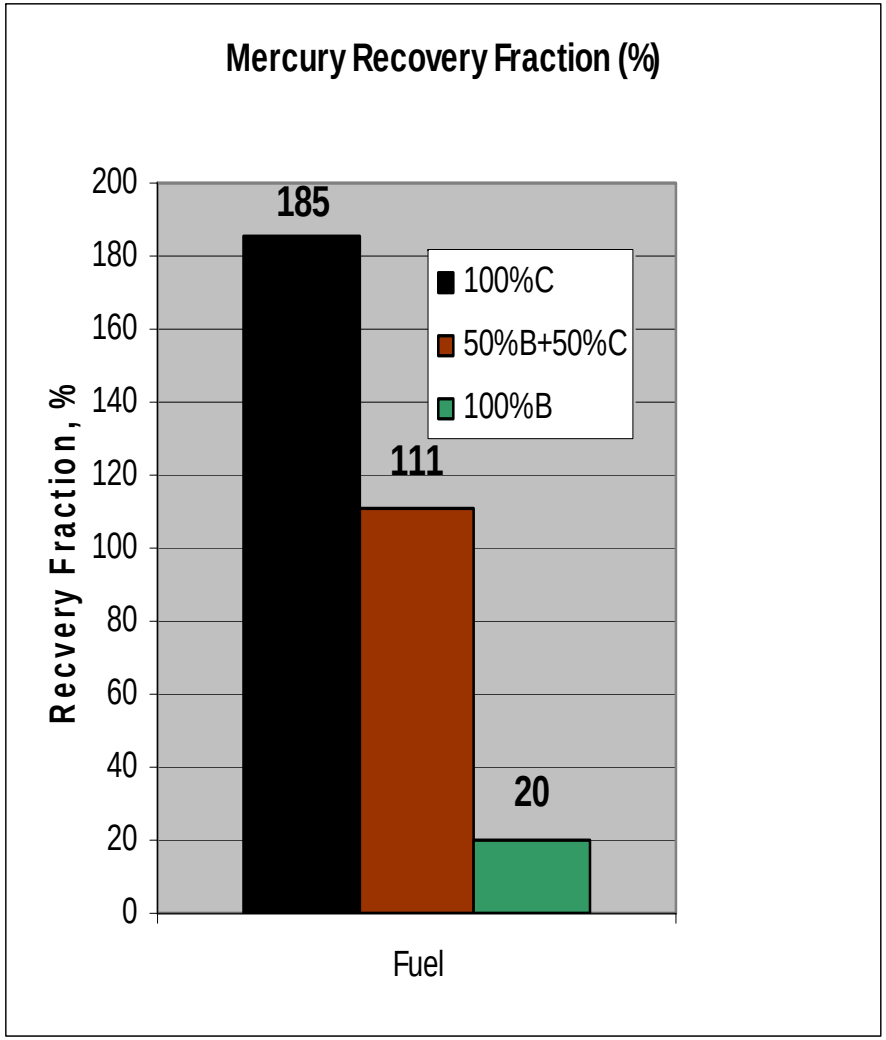
Concentration of Hg in the Ashes



Hg Emission with Ashes



Recovery Fraction of Hg



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