National Technological Center for Mercury Decontamination
M E R S A D E

(LIFE06 ENV/ES/PRE/03)
MERSADE STABILIZATION PROCESS:

As a form for the permanent storage of mercury

Patent: P200930672
1.- Transformation of liquid mercury in HgS (metacinnabar) by reaction between liquid mercury and elemental sulfur, using the mechanical energy supplied by a planetary ball mill.

2.- Incorporation of metacinnabar into a polymeric S-concrete matrix composed of gravel, sand, filler, elemental sulfur and modified sulfur to obtain a final material similar to a concrete.
**FINAL PRODUCT:** Monolithic sample (rectangular parallelepiped of 16x16x4cm).

**TOXICITY TESTS:**

- **Leachability test TCLP (EPA1311) (on crushed samples):**

  The content of Hg in the leachates is ~100 µg/l, lower than the maximum value accepted as limit for mercury in the Resource Conservation and Recovery Act Regulatory (200 µg/l)

- **Hg emissions:**

  Mercury emission of samples were lower than those of cinnabar (100-150 times) and metacinnabar (15-20 times)
• **Mechanical properties:** *(UNE 196-1:2005)*
  - Very high resistance to compression (> 55 Nmm²)
  - High flexural resistance (>8.5 Nmm²)

• **Physical Properties:**
  - Very Low porosity \( (P_r = 1.97\%)\)
  - Very low pore volume \( (V_p = 0.63 \times 10^{-2} \text{cm}^3/\text{g})\)
  - Very high density: 3.181 gr/cm³ for content of 30 % Hg w/w

• **Hydraulic properties:**
  - Water Absorption under low pressure *(RILEM N.4):* negative. Rain drops at high velocity will not modify the surface of the sample.
  - Water Absorption by Capillarity *(UNE-EN-480-5):* Extremely low capillarity coefficient \( (0,07 \text{ gr/cm}^2)\) very low permeability
**Durability**

*Water absorption and resistance to alkali for hydrophobic impregnations*
UNE-EN 13580:2003

The water absorption coefficient is very low → a high resistance to alkali.

*Resistance of ageing by salt mist* UNE-EN 14147:2003

The samples exhibited good aspect without cracks, scales or other kind of external damage or degradation

*Determinaton of freeze-thaw resistance* ISO 20394: 2007

The samples exhibited good aspect after test, without cracks, scales or other kind of external damage or degradation

•Resistance to direct fire EN-ISO-11925-2:2002: passed
CONCLUSIONS:

In respect to the process:

- It is conducted under dry conditions; there is no water consumption, nor effluents, nor any solid waste.

- 100 % metallic mercury is transformed into an inert solid material. The hazardousness of this metal disappears.

- No curing or aging times are required for the final product.

- Raw materials and reactives are cheap.

- It is conducted under normal atmosferic conditions. The biggest energy consumption is related to the heating of material to 140 º C.
CONCLUSIONS (II):

In respect to the final product:

- The polymeric matrix eliminates the leaching and emissions of mercury to the ground, to the water and to the atmosphere, **offering good environmental guaranties**.

- The final product displays excellent physical and mechanicals properties, along with excellent behaviour in different agressive environments guarteeing **its safe permanent storage**.

- It is flexible in terms od its dinal shaping: monolithic blocks/bricks, or any other shape depending on the final destination.
CURRENT ESTIMATED COST AT THE EUROPEAN UNION:

EUR 3500 to 4000 / t Hg.

(Including: collection, transport, estabilization process and final disposal.)
GRACIAS / THANKS