Advanced Laboratory for Analysis Research and Nanotechnology

Asbestos

Turning a hazard into friendly materials

Via E. Mattei, 4 – 40050 Castello D'Argile (BO) – Tel + 39 051 795002 – Fax +39 051 795003 - www.chemicalcenter.it

Laboratory of Environmental and Biological Structural Chemistry
Via F. Selmi, 2 - 40126 Bologna – Tel. +39 051 2099485 – Fax +39 051 2099593 – www.lebsc.unibo.it

Introduction

In the last decades asbestos has been widely used in several technological applications, thanks to its high mechanical resistance and flexibiliy, its strong resistance to bad weather, non-flammabile and thermo-insulating properties.

Although in the first half of last century several studies had already revealed the fiber-sclerogenesis properties of this material, followed by a lot of data evidencing the link with the malign pleural mesothelioma, the public opinion strongly banished the use of asbestos in all the European countries only in the 80's.

In Italy Law N. 257/92 was issued for this purpose, forbidding extraction, import, export, marketing and production of asbestos, thus inducing all the regions to work out a decontamination plan from asbestos. This measure will therefore considerably reduce the related asbestos cancers incidence.

Chemical Center S.r.l. was founded in 2009 by the initiative of Professors, Researchers and Undertakers in Bologna. The Company's mission is to carry out researches for technological innovations, especially in nano-technologies, bio-technologies for designs, syntheses and chemical-physical characterizations of new technological advanced materials for bio-medical, environmental and agriculture-food applications.

Chemical Center S.r.l. aims to provide undertakers with its skilled experience acquired during decades devoted to research activities carried out in many Departments in the University of Bologna, especially concentrated on the study of the structure, morphology, stability, reactivity and surface chemical-physical properties of nano- and micro-structured materials.

The Company is therefore a reference point for public and private research activities in the design of new "smart materials" and the planning of innovative technologies for undertakers, in order to study their many problems and offer tailor made solutions, thanks to integrated synergies acquired during the university experiences, the scientific specialization and the complementarity of the many structures involved.

As a consequence of this approach Chemical Center S.r.l. is proud to have patented a process for materials containing asbestos transforming them from a danger to an earning source, using exhausted whey. The patent covers Italy, European and Eastern countries.

A PROCESS TO TRANSFORM CONCRETE-ASBESTOS HANDMADE MATERIALS USING EXHAUSTED WHEY

The process to “transform materials containing asbestos using exhausted whey” patented by Chemical Center S.r.l. ((MI2010A001 dated 30/07/2010) follows two main steps.

Large quantities of exhausted whey are used to decompose at room temperature the concrete phase (85%) thanks to the acid pH of whey. In this way the asbestos fibres (15%) included in the material are released.

The fibres will then undergo denaturation and decomposition in Magnesium an Silicate ions through a hydrothermal process at 180 °C.

Figure 1 –
Piece of concrete-asbestos handmade material containing asbestos

Important issues:

The fragmentation and disaggregating process of the cement-asbestos materials are carried out dipping the materials completely in whey, placing them in covered containers in order to easily avoid any fibre emission in the environment

The hydrothermal process at 180 °C completely destroys the crystal structure of asbestos producing a solution rich of Mg, Ni and Mn ions; the metals can easily be extracted though electrolysis making the process very convenient for marketing opportunities

Besides, no CO_2 produced during the process is dispersed in the environment, since this gas is used in the second part of the process, as an alkalinity reducer of the surnactant in the first step of the process

The process uses two polluting waste-materials, whose dumping is expensive, and produces metals, Calcium hydroxides, Calcium carbonates, soaps, phosphate-based fertilizers. So, once the process is over, these materials offer good commercial value

PILOT IMPLANT – RELATED VOLUMETRY (1 ton eternit)

REACTOR I (15.000 litres) is a tank made of reinforced concrete coated inside with fiberglass. The tank bears a fiberglass cover to hold gas in absence of pressure and contains a system made of milling cutters crushing the concrete asbestos handmade materials, while equipment and materials are completely dipped into the exhausted whey.

1 ton of eternit/10 tons of exhausted whey/1 quintal of diluted phosphoric acid

- once the reactor is filled up, the cover sealed and the cutters started, pH increases from acid to basic under the mechanical movings
- about 5 quintals of asbestos fibres, insoluble silicates and Calcium phosphates are deposited
- the CO_2 released in the meantime is leaded to REACTOR II through a proper canalization
- once the 5 quintals of precipitate are removed, the cloudy liquid remaining is treated with NaOH (10 kg); about 8 tons of dischargeable waste water are obtained, together with 4 tons of dense precipitate made of saponified acid fats (good to be transformed into soaps) mixed with surface-active agents
- the same cloudy liquid produces a plastic bio-polymer in one day if kept resting at 3 °C

Figure 2 – Pilot implant REACTOR I

REACTOR II (5.000 litres volume) is made of Inox, it is completely sealed and bears a heating tank at 180 °C resistant to 3 atm pressure.

5 quintals of asbestos fibers, insoluble silicates, phosphates and sulphates/5 tons water from REACTOR I/50 kg of phosphoric acid/CO_2

- CO_2 from REACTOR I is induced to gurgle; once the temperature of 180 °C is reached, a 2 atm pressure will be obtained inside

- the asbestos fibers undergo completed denaturation enriching the above aqueous solution with Mg, Ni, Mn, Fe ions, whose metals can easily be obtained by electrolytic reduction.

- Calcium phosphates and silicates will collect at the bottom. When treated in an aqueous solution and heated, these release Calcium ions which can be precipitated by NaOH obtaining Calcium hydroxide, in other words: water-paint

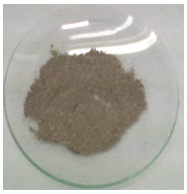

Figure 3 – Silicate residual at the end of the processing

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The remaining silicates are then suitable to be recycled without any danger.