

TECHNICAL BULLETIN

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ZEOLITE-BASED BINDER FOR SOLIDIFICATION/STABILIZATION OF INDUSTRIAL HAZARDOUS WASTE

DESCRIPTION	A zeolite-based binding material for solidification/stabalization of industrial hazardous waste has been developed. This binding material will quickly solidify the hazardous waste, physically and chemically adsorb the hazardous ions, and stabilize them by substitution in hydration products.
ADVANTAGES	<p>A zeolite-based binding material has the following desirable characteristics:</p> <ul style="list-style-type: none">• Stabilizing heavy metal ions, e.g. cadmium, zinc, mercury, etc., and radioactive ions, e.g. strontium, cesium, etc. in hazardous waste;• Quick setting solidification (setting time in the range of 10-30 minutes);• Sufficient strength for solidified forms (compressive strength in the range of 7-15 Mpa);• Cost effective
UTILIZATION	The zeolite-based binding material can be manufactured with commercially available raw materials, existing cement mixing equipment and low energy cost processes.

Concrete Encapsulation

The use of zeolite as a binding material in the formulation of hazardous waste encapsulating concrete capitalizes on the unique properties of high porosity, surface area, and exchange capacity as well as its pozzolanic activity. Zeolites are aluminosilicate minerals with a three dimensional porous molecular framework. The excess net negative charge imbalance gives them a high cation exchange capacity. The regular void spaces in the lattice allow molecular sieving and capturing based on size and charge. The porosity creates a large effective surface area for adsorption. The combined large surface area and charge character impart pozzolanic activity to the mineral grains by improving hydraulic cementing properties while increasing buffering capability and corrosion resistance to resulting concrete.

Stabilization Process

- Heavy metals such as Pb, Cd, Zn, Cu, Ag, and Hg are trapped by ion exchange
- Radioactive cations, Cs and Sr, are trapped by ion exchange
- Other mobile metal wastes, including As, U, Cr, and Mo may be immobilized by hydrogen bonding of oxyanions and physically encapsulated
- Volatile organic compounds may be captured by molecular sieving into the pore structure
- Non-volatile organics are adsorbed onto the large surface area of the zeolite grains

Solidification and Encapsulation

Encapsulating zeolite concrete is made with zeolite as a portion of the aggregate. It is manufactured with a situation-specific formulation, but using common, commercially available raw materials, cement and admixtures and normal low cost, energy efficient concrete manufacturing processes.

The pozzolanic and buffering zeolite component not only traps, adsorbs and immobilizes contaminants, but also adds strength and corrosion resistance to the encapsulating zeolite concrete. The bound material is quickly solidified in the process to physically envelop the hazardous waste into a concrete block or aggregate. Sufficient compression strength (7-15 Mpa) is achieved after curing for some load bearing situations. In many cases, a useful product will result.

The encapsulated, stabilized product passes CGSB or TCLP leachate tests and can be safely stored without fear of contaminants being remobilized; a permanent remediation.

Applications

- Oil and fuel contaminated soils
- Inert drilling cuttings (with or without brines)
- Flare pit remediation
- Heavy metals, lead paint residue
- Paint sludge
- Contaminated wood waste