

Vitrification

FEEDSTOCK CLASSIFICATION

Any sludge-like process effluent rich in both organics and minerals

FEEDSTOCK EXAMPLES

Paper mill residue is a prime example because it contains lignocellulose and minerals. Municipal wastewater is commonly used. Manures have not apparently been used but seem to be viable.

FEEDSTOCK RESTRICTIONS

The process can be self-sustaining, but only with feedstocks with lower ash content – the ash itself also has to be melted, requiring more energy. For instance, vitrification of municipal wastewater is self-sustaining, but vitrification of paper mill residue is not.

PROCESS DESCRIPTION

Vitrification is the melting of minerals into glass. Effluent streams are dried to roughly 10 percent moisture content before being heated in a furnace to very high temperatures. This heating destroys harmful organic compounds while also trapping trace metals within the resulting liquid glass – two steps that turn hazardous waste streams into inert final products. The liquid glass leaves the furnace and is water quenched. The solid glass is then crushed into aggregate, with the size dependent on the intended application.

In addition, the organic components of the feedstock become a significant part of the fuel needed for vitrification. This can make the process exothermic, sometimes to the point of being self-sustaining. In the case of paper mill residue, the ash content of the residue requires supplemental heat to vitrify the ash, but the heat of combustion of the residue nevertheless results in net energy production. A heat recovery steam generator is used both to dry the effluent and generate steam.

PRIMARY BIOBASED PRODUCTS

Glass aggregate for use in products like flooring, concrete, asphalt, shingles and abrasives

PROCESS BYPRODUCTS

Electricity

MAJOR EQUIPMENT

Dryer, furnace, heat recovery steam generator, steam turbine¹

ENERGY REQUIRED

Vitrification occurs at 2700-2900° F,^{1, 2} but the process becomes exothermic depending on the organic content of the effluent

CAPITAL AND OPERATING COST

A plant can cost \$2-\$10 million,³ with operating costs of \$650/ton²

COMMERCIALIZATION STATUS

Commercially available. Vitrification plants have been in operation in the US for more than 10 years. Minergy even offers modular vitrification units, but without the power generation capability.

COMMERCIAL SUPPLIERS

Minergy Corporation (<http://www.minergy.com>) based in Neenah, WI USA (920.727.1411)

Vortec Corporation (<http://www.vortec.org>) based in Collegeville, PA USA (610.489.2255)

REFERENCES

¹ Minergy Corporation. <http://www.minergy.com> (12 April 2004).

² Mauro, Scott. 1996. "Vitrification of hazardous waste streams using natural gas as an energy source." http://p2library.nfesc.navy.mil/P2_Opportunity_Handbook/11_5.html (12 April 2004).

³ Carroll, Terry. Regional manager, Minergy. Interviewed by Sean Weitner. Telephone, 12 April 2004.

Vortec Corporation Oxidation and Vitrification Process. <http://clu-in.org/products/site/ongoing/demoong/vortec.htm> (12 April 2004).