SETH 200

A NEW MOBILE UNIT FOR SPENT ION-EXCHANGE RESINS EMBEDDING IN POLYMERS

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ABSTRACT

The CEA embedding process for low-and medium-activity waste in thermosetting resins (polyester or epoxy) has been used industrially. Recent developments (elimination of chemical pretreatment thanks to a new epoxy formulation and technological breakthroughs in the operating techniques) have greatly increased the potential of the process and have allowed with Technicatome's industrial experience, the elaboration of a new mobile unit easily operated and very competitive particularly in spent resin processing.

INTRODUCTION

Low and medium level activity radioactive waste must be stored in a matrix which provides a product that is acceptable for long-term disposal.

Among the most widely-used techniques, is the embedding process, which involves thermosetting resins (polyester, epoxy) developed by the CEA and TECHNICATOME.

This process, which is already in use in several fixed waste treatment facilities (nuclear power plants, dismantling workshops and research centers) has given interesting results, particularly in regard to the size reduction and containment of radioelements (especially cesium). The resins selected for embedding are capable of producing solid and homogeneous blocks which comply with the safety, transport and storage conditions comply with French nuclear safety organizations.

Due to its versatile character, this process is suitable for the treatment of many types of waste including:

- used ion-exchange resins,
- evaporator concentrates,
- solid wastes.

The recent development of a new epoxy matrix was a decisive step in developing a simple and powerful mobile unit initially capable of embedding ion-exchange resins.

AN EASY TO USE EMBEDDING MATRIX WITH A WIDE APPLICATION FIELD

This new matrix keeps the qualities of the previous thermosetting resins by:

- the use of reagents at ordinary temperature,
- excellent containment of radioelements: in the case of ion-exchange resin embedding, the leaching speed at 100 days is around 10^{-6}cm/d for cesium 137 and 10^{-8} cm/d for cobalt 60,
- good resistance to ageing mainly due to the matrix's excellent resistance to radiation and microorganisms,
- excellent physical characteristics,
- low weight and volume (4 to 6 times less than that of the concrete embedding method,
- high compatibility with numerous types of wastes.

In addition, this new epoxy formulation provides:

- simplification of the process since it is no longer necessary to carry out any chemical pretreatment of the spent ion-exchange resins,
- a guarantee of greater operating safety due to the significant tolerance of the embedding composition and the fact that no volatile solvent is used,
- the facility of processing waste containing up to 90% free water.

EMBEDDING PROCESS IN TECHNICATOME MOBILE UNIT-SETH 200

The amount of spent ion-exchange resin required to make a drum is transferred hydraulically to a metering pot, then to an embedding drum in its transport container (Fig. 1).

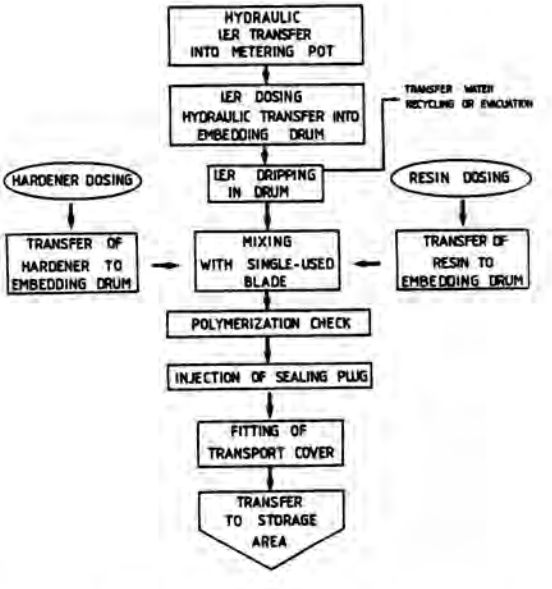

Fig. 1. Embedding Process in Mobile Unit - Seth 200

The water from the dripping process is then carried out using a strainer placed at the lower part of the mixer. The amount of water gathered is checked, then transferred to either the spent resin storage tank or to the liquid effluent treatment station. The reagents forming the embedded matrix are transferred from their respective dosing pots to the embedding drum. The constituents are then mixed with an appropriate sequence. After workstation switching, the package is moved to a temporary storage area. When the polymerization kinetics have been checked, a sealing plug is injected to complete the drum. After full polymerization, the package may be sent to the storage center.

MAIN TECHNICAL CHARACTERISTICS OF THE NEW MOBILE UNIT

The SETH 200 unit has a simple and safe operating process. It consists of modules which may be transferred by truck and are easily assembled (Fig. 2).

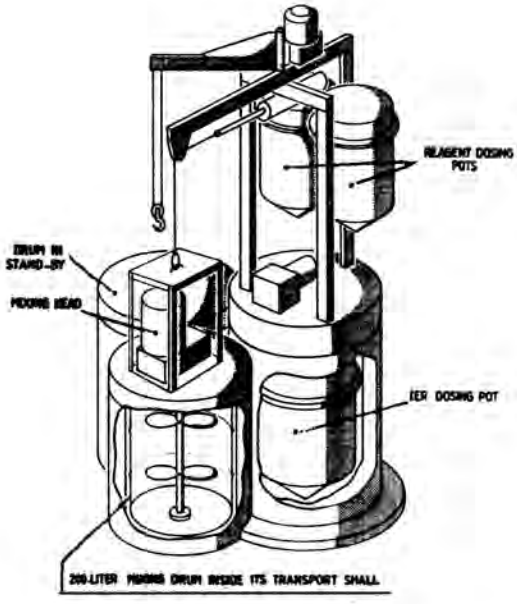

Fig. 2. Technicatome Mobile Unit for Spent Resins Embedding.

The unit, which has an original and compact design, naturally has independent effluent retention devices and biological protection screens which means it can be used in an unlimited stay controlled area. The production capacity optimized by the presence of two workstations enabling switching of empty and full drums in masked time. The fitting of the sealing cover and polymerization take place away from the station.

Production Capacity

The unit can process 1 to 2 m^3 of ion-exchange resins per day depending on the degree of automation, i.e., a production level of ten to twenty 55 gallon drums.

Operation Safety

The biological protection of the unit ensures protection of the operating staff. The polymerization temperature is less than 100°C and the products used are neither dangerous nor volatile. Except for the limited amount of rinsing water at the end of the operating period, the process does not produce any effluent.

Investment Cost

This high performance mobile unit is very attractive due to its low price which amounts to $400 000 (in 1984) for a standard unit.

Operation

Operation of this unit is very easy and requires only two people.