XA0055281

METHODS IN THE TREATMENT OF SODIUM WASTES

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Abstract

In the domain of sodium waste processing, we have followed a logical route that has enabled us to propose a global method with respect to sodium wastes. This approach has led to :

- The choice of only those sodium processes using water.
- The development of sodium purification methods.
- The development of methods for cutting metallic wastes soiled by or filled with sodium.
- The transformation of the resulting sodium hydroxide into ultimate solid wastes for surface storage.

1. METHOD FOR THE TREATMENT OF SODIUM WASTES

Our goal was to establish global methods for the treatment of sodium wastes. This consists in :

- Synthesising the different types of sodium elimination processes used, envisioned or to be developed.

- Selecting a limited number of processes which nonetheless allow treatment of the totality of sodium wastes, whatever their diversity or activity.

- Including in the method for treatment of sodium wastes a method for the management of by-products generated by the treatment of sodium wastes.

- Selecting the processes while taking into account:
  - their safety,
  - their effectiveness,
  - their simplicity of use,
  - their flexibility of use.

Since the definition of all these conditions could lead to contradictory selections and options, it can therefore be said that the global method for the treatment of sodium wastes is the result of a compromise.
The main points arising from this reflection are as described in the following chapters.

2. ONLY USE OF PROCESSES INVOLVING TREATMENT WITH WATER

Amongst all the possibilities of chemical reaction for sodium transformation, the use of water was chosen for various reasons:

- Water is one of the most easily available and least costly product.

- The other chemical products which react with sodium (i.e. alcohol type organic products) have the disadvantage of being inflammable, which entails supplementary risks in their use and also in their storage.

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- With the use of organic products there is the problem of treatment of liquid effluent products (organic saline solutions). In fact, these liquid effluents cannot be accepted by a conventional treatment system developed by a liquid effluent treatment station. It would therefore be necessary to combine the development of such processes with the development of a pyrolysis process for liquid and radioactive organic effluents.

- The use of water has the advantage of generating known by-products : hydrogen and sodium hydroxide for which the elimination systems have been established :

  - dehumidification of hydrogen and evacuation by atmospheric release via a stack, after radioactive control;

  - transformation of the sodium hydroxide produced into ultimate solid waste, either by a conventional process of immobilisation in cement (known as "cementation process") or by a more innovative process of immobilisation in ceramic (known as "ceramisation process").

The choice of one single technique for the transformation of sodium (the use of water) also provides homogeneity in the kind of by-products (aqueous soda and hydrogen only) and in the general safety rule to be observed in order to put these processes into practice.

3. DEVELOPMENT OF METHODS FOR THE TRANSFORMATION OF SODIUM WASTE

In order to minimise the number of processes employed, it is necessary that each process used allows treatment of as wide a range of waste as possible. In order to do this, and in order to maintain coherence in respect of the process and associated facilities, the wastes must fit to the criteria imposed by the processes and the associated facilities, and not the contrary.
These adaptations may concern the size or quantity of sodium, volume, geometry and activity. For this reason, it is imperative that a whole series of techniques and means of waste transformation is developed in parallel.

These methods can be split in two parts: mechanical methods and physico-chemical methods.

Amongst the mechanical methods one finds :

- sodium oven melting techniques, which can be compared to the process for complementary draining of components or capacities containing sodium,

- techniques for the cutting of sodium waste comprised of capacities full of sodium (for example, undrainable cold traps),

- sodium ingoting techniques, which transform the sodium waste into a standard form acceptable by the treatment facility.

Physico-chemical methods consist mainly of sodium purification methods. These methods can be used :

- to improve the sodium's pourability: filtration through PORAL filters, purification in relation to oxygen and hydrogen impurities by means of cold traps,

- to separate the tritium from the sodium :

  - by permeation in the case of the removal of impurities in a secondary cold trap [1],

  - by isotopic exchange or swamping in other cases.

- to diminish the sodium activity in ^{137}Cs and ^{134}Cs by adsorption on carbonaceous traps.

Description of these physico-chemical techniques is the subject of a separate presentation [2].

4. TRANSFORM THE AQUEOUS SODA PRODUCED INTO ULTIMATE SOLID WASTE FOR SURFACE STORAGE

The limits on the authorisation of release in saline solutions becoming ever more drastic, it was decided to envisage the transformation of aqueous soda produced by the facilities, into ultimate solid waste, either by cementation or ceramisation.
The presentation and comparison of these two processes is the subject of a specific paper [3].

5. CONCLUSION

These general ideas about sodium waste treatment have specified some axis of R&D on sodium removal in some ways such as :

- techniques for the cutting of sodium waste (i.e. metallic pieces full of sodium),
- new processes to treat sodium waste by using water in several particular conditions function of the type of waste to eliminate.

REFRERENCES

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