

Chemical Treatment of Spent Resin

Stripping and Recovery of C-14, Resin liquefaction, Decomposition of Organic Matter and Waste Volume Reduction

Chemical treatment of spent resin reduces storage volume, disposal costs and facilitates long-term storage.

Challenge

Resins are an efficient and comfortable, but volume intensive approach to remove impurities from system media respectively to immobilize (active) impurities. Spent resin waste accumulates during NPP operation and during decontamination measures.

Usually the spent resins are intermediate stored in spent resin vessels due to absence of final disposal repositories or unclear waste acceptance criteria. Commonly these intermediate storage capacities become too little in regards to life time extension.

Disposal of radioactive waste is very expensive, especially when considered that most of the radioactive spent resin waste is actually inactive. This situation gets worse due to the fact that generally the spent resin waste are immobilized resulting in a volume increase.

Certain radionuclides and components complicates or even do not allow the disposal of spent resin waste or require a higher rad waste classification.

Solution

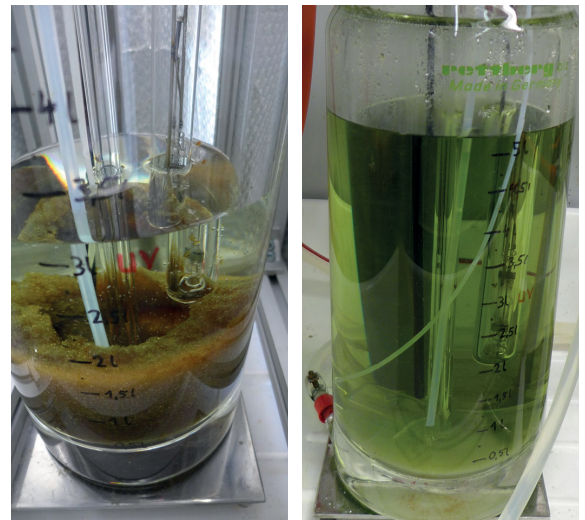
Our chemical treatment of spent resin removes and recovery inorganic C-14, liquefy spent resins, decomposes organic matter, and reduces the volume of spent resin waste by using a mild Fenton like oxidation process and an electrochemical advanced oxidation process.

The first step is a selective removal of inorganic carbonates and an optional recovery of $^{14}\text{CO}_2$ which can enable a lower level waste classification and facilitates final storage.

In the second step, the ion exchanger is liquefied which allows blending of resins with different activity inventory and immobilization by grouting with a volume reduction factor of 3–4 in comparison with direct grouting. Partially organic matter is decomposed to mainly CO_2 and H_2O .

The optional third step is to completely (> 99,9%) decompose organic matter (e.g. complexing agents) which facilitates long-term storage due to the higher stability of inorganic waste and minimizes risks to fail waste acceptance criteria.

In an optional fourth step the liquefied resin is transformed into a solid inorganic waste and the majority of radionuclides is separated from inactive ions resulting in a volume reduction factor for intermediate level waste (ILW) of up to 20 and of 3–4 for (very) low level waste (LLW).



Liquefaction of spent resin

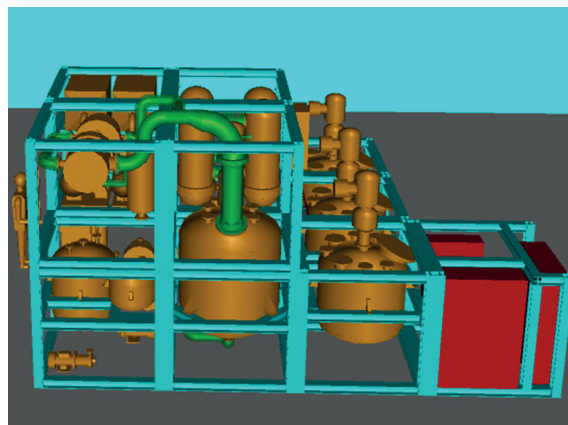
Customer benefits

- Reduce spent resin waste, storage volume and disposal costs.
- Grouting of liquefied spent resins generates 3–4 less waste than direct grouting
- Organic-free waste facilitates long-term storage and minimizes risks to fail waste acceptance criteria
- Targeted removal of activity loading enables lower rad waste classification or incineration
- Mobile treatment solution for fleet approach as well as for service with no invest and maintenance
- Customizable process and equipment

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is **our** everyday **commitment**

Technical information

- Volume waste reduction
 - ILW up to a factor of 20
 - (Very) LLW and ILW up to a factor of 4
- Organic free waste (TOC <100 g/m³ spent resin)
- Mild conditions: reaction temperature: 60 – 85°C, atmospheric pressure)
- Cheap and environment friendly reagent (H₂O₂) and catalysts (iron, copper)
- Advanced oxidation processes (Fenton-like wet oxidation/Boron doped diamond electrode)
- Batch size: 200 l/day
- Mobile equipment (units with 2 x 2 x 2 m dimension)
- Remote controlled (ALARA principles)

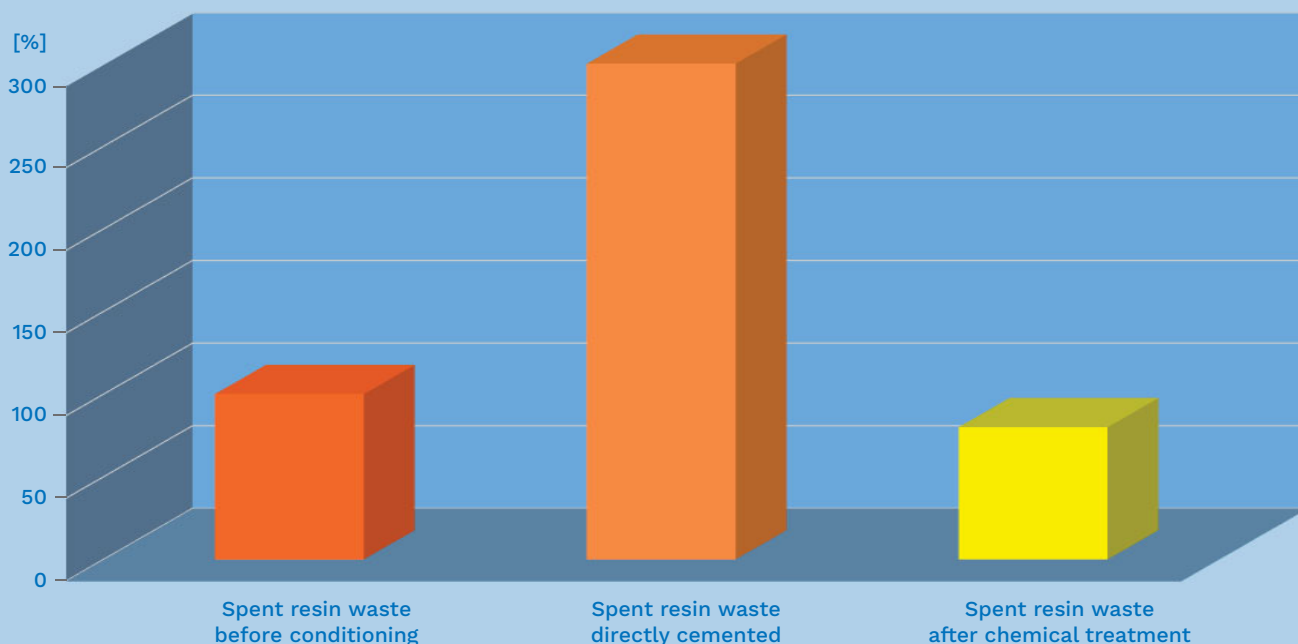


Mobile equipment for chemical treatment of spent resin

References

- Application of process principle during over 20 full system decontamination campaigns
- Laboratory trials for European customer
- Feasibility study for Japanese customer

Waste volume reduction



Contact: chemistry-services@framatome.com
www.framatome.com

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