

# ESTIMATION OF DRY SOLIDS IN RADWASTE SLURRIES AND SOLUTIONS

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## ABSTRACT

Disposal of low level radioactive waste requires a knowledge of the dry solids content of the slurry or solution being processed. The classical methods for solids determination involve weighing, drying and weighing again. Solid radwaste materials consisting of ion exchange resins and regenerants are hygroscopic, and therefore, require extended drying periods. The methods set forth in this paper contribute the convenience of short analysis time as well as reduced contamination hazard.

One method developed here for slurries of ion exchange resin, both powder and bead form, as well as for solutions of inorganic salts, features the use of closed containers. By determining the specific gravity of the solution or slurry and through a knowledge of the settled volume percent vs. the dry weight percent, the required information can be obtained. In the other method, a knowledge of the moisture holding characteristics of various resin mixtures permits the use of moist resin percent of a slurry to calculate the dry resin percent. Both methods give verifiable results for individual wastes.

### BEAD FORM ION EXCHANGE RESINS

The portion of an ion exchange resin slurry which settles, in other words the settled volume percent, can be related to the dry weight percent in the slurry, as shown in Fig. 1 where regenerated cation and anion exchange resins are compared. Mixed beds of three different combinations, each having chemically equivalent cation exchange resin to anion exchange resin, have relationships illustrated in Fig. 2. These relationships change as the mixed beds are exhausted, as seen in Fig. 3. Another change in relationship is obtained by pulverizing the resins; see Fig. 4. Evidently, it is necessary to understand the processing program for a given resin mixture in order to work out an applicable relationship. A curve like those shown in Figs. 1 through 4 can be developed for any radioactive material by preparing a similar mixture that is not contaminated. The surrogate mixture is used to establish the relationship. In such a study graduated centrifuge tubes are used for the volume percent values and classical gravimetric weighing procedures are used to establish the dry solids content.

This first method then, involves obtaining a sample in a preweighed, graduated centrifuge tube. The volume of the solids settled either by gravity in the case of pure bead resin, or by centrifugation if the resin has been pulverized, is expressed as a percent of the total slurry volume. By reference to the preestablished relationship graph, the percent dry solids in the slurry is obtained. By preweighing the centrifuge tube and its cap, the analyst is able to obtain the specific gravity of the sample. These data can all be derived from a closed tube which then can be discarded.

Additionally, each lot and type of ion exchange can be characterized by a moisture holding capacity. This involves

the moisture still remaining in the resin after all of the external water has been drained off. Pulverized resin can be vacuum filtered to remove the exterior moisture. When the external moisture is removed, the sample can be weighed to give a moist weight. This weight can then be multiplied by a predetermined fractional factor to obtain the dry weight. This means that the moist weight percent of a slurry sample can be used to obtain the dry weight percent. The factors for converting moist weight percent to dry resin weight percent for some selected resins are seen in Table I.

### POWDERED ION EXCHANGE RESINS

The relationships between the volume percent and weight percent for powdered ion exchange resins differ from those of pulverized bead resin, primarily due to various amounts of incorporated fiber in the powdered resin blends. These relationships can be seen in Fig. 5 where the data for somewhat exhausted powdered resins are plotted. The degree of exhaustion will change the location of these curves, so some estimate of the expected plant operating conditions should be taken into account in preparing curves of this kind.

Since powdered resins remain suspended for long periods of time, it is necessary to centrifuge the samples in order to obtain reproducible volume percent values. Here again, the preweighed, graduated centrifuge tube which is capped immediately after taking the sample, permits the determination of the desired information without opening the vessel.

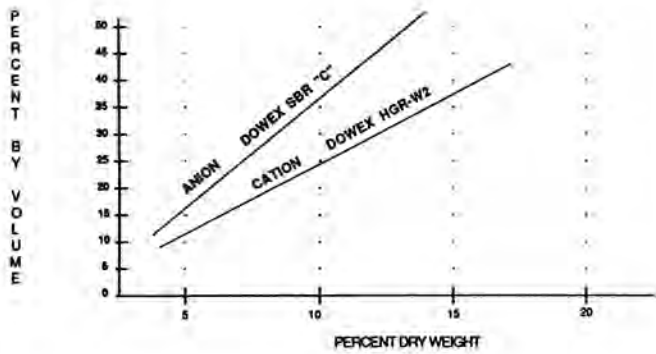


Fig. 1. Unused Ion Exchange Resin.

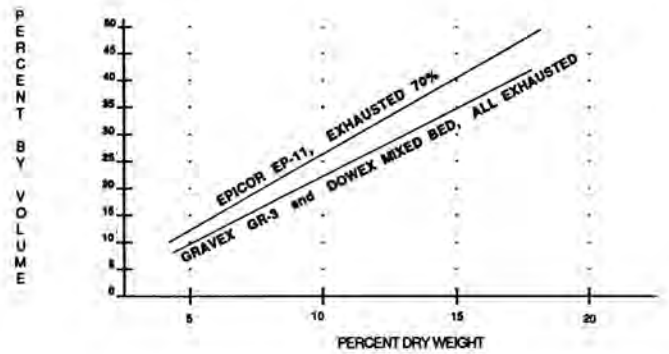


Fig. 3. Used Bead Resin.

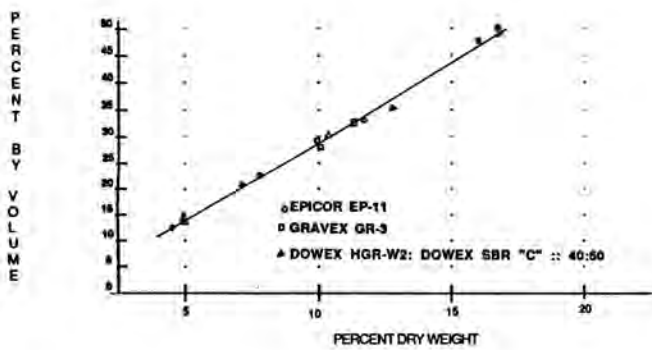


Fig. 2. Unused Bead Resin.

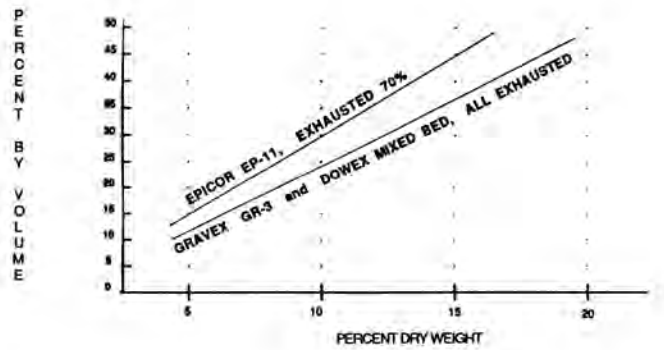


Fig. 4. Used Bead Resin Pulverized.

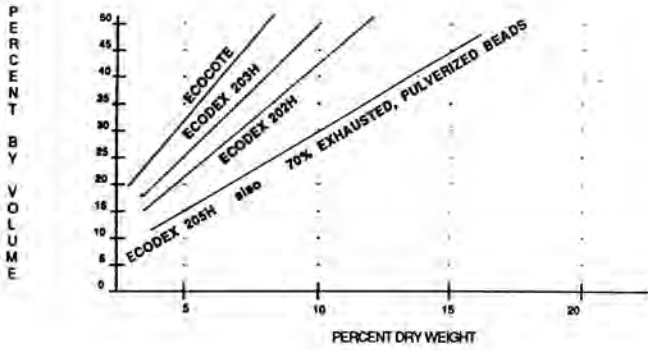


Fig. 5. Exhausted Powdered Resin.

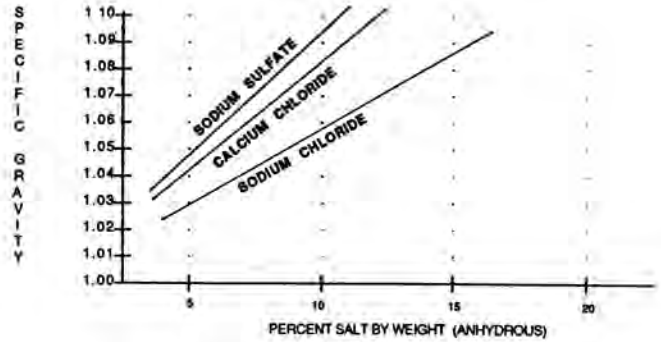


Fig. 6. Specific Gravity vs. Salt Solids.

TABLE I

Factors For Converting Moist Weight Percent To Dry Weight Percent

BEAD RESIN	REGENERATED FORM	EXHAUSTED FORM
Cation Exchange Dowex HGR-W2	0.54	0.59
Anion Exchange Dowex SBR "C"	0.41	0.56
Mixed Bed Epicor EP-11	0.44	0.50*
Mixed Bed Gravex GR-3	0.44	0.57

\* Epicor EP-11 was exhausted only about 70%.

POWDERED RESIN

Ecodex 202H	0.37	0.44
Ecodex 203H	0.45	0.41
Ecodex	0.45	0.48

To obtain the moist weight percent, using the second method, it is necessary to filter the powdered resin slurry in a standardized manner, and then to weigh the moist sample. The factors which were included in Table I for various pow-

dered resins can be applied to derive the dry weight percent from the moist resin value.

DISSOLVED SOLIDS

If the chemical nature of the dissolved minerals is known the amount of dissolved solids can be estimated from the specific gravity of the solution. The preweighed, graduated centrifuge makes determination of the specific gravity of a solution, a slurry or a mixture an easy matter, without requiring that the tube opened. In Fig. 6 the relationships between specific gravity and dry weight percent are plotted for three common salts which might be found in radwaste solutions. A knowledge of the inorganic materials used in the plant will assist in choosing the specific gravity curve to employ in estimating the solids content of a solution.