Tech Fact

Backwashing a Resin Bed

Introduction

Ion exchange resin beds must be occasionally backwashed to remove accumulated debris or fine resin particles. With co-flow regeneration, a backwash step can be carried out before each regeneration. With reverse flow regeneration, backwashing should be performed only when required by an increase in pressure drop.

A backwash is achieved by applying a uniform flow of water from the bottom of the bed to fluidize the resin and disengage any resin fines and suspended material from around the resin beads. Typically, the volume of backwash water required is approximately 2 displacements of the freeboard volume (see Figure 1).

The picture shows an ion exchange vessel with freeboard and reverse flow regeneration with water hold-down. The principle is however the same for all vessels with a freeboard, including mixed bed units.

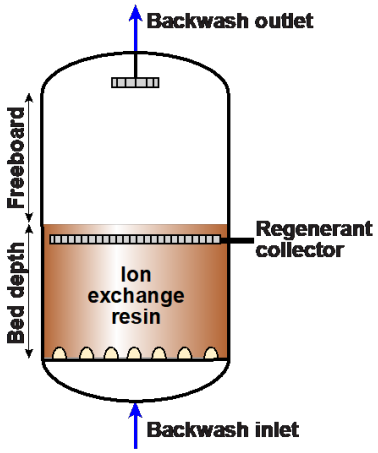

Figure 1: Vessel at start of backwash

For resin fines and particulate to be removed from a resin bed it is suggested that the resin be expanded to within 300 mm (12 inches) of the backwash collector at the top of the vessel (see Figure 2).

The percent expansion for an ion exchange vessel is defined using the formula below.

$$\% \, Expansion = \frac{Fluidized \; height}{Settled \; bed \; depth} \times 100$$

In general, the bed expansion is about 60 % of the settled bed depth for uniform resins, more for Gaussian resins and mixed beds.

Form No. 177-03590, Rev. 1
October 2019

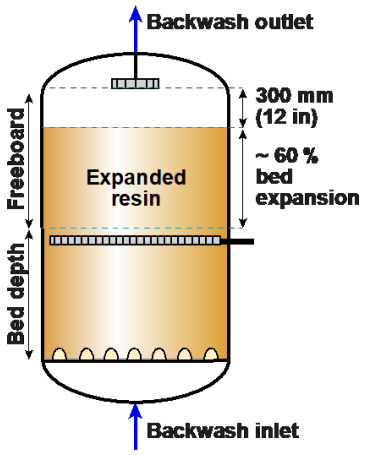

Figure 2: Vessel during backwash

Calculating backwash flow rate

The expansion characteristics of ion exchange resin are a function of water temperature, resin bead size and resin density which are unique for each particular resin. To determine the backwash flow rate for a resin, it is necessary to consult the technical product literature, which is specific to that particular resin. In the literature there will be a graph of backwash expansion vs. linear flow rate at a given water temperature.

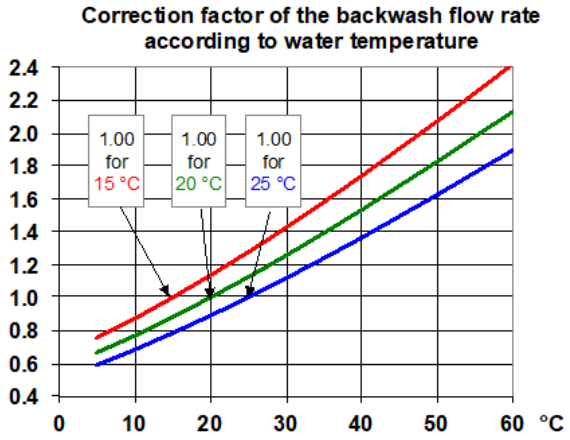

Figure 3: Temperature correction for three reference temperatures

As different resin producers use different reference temperatures for their backwash data, Figure 3 gives the multiplication factor to apply at the actual backwash temperature for three different standards: 15 °C, 20 °C, and 25 °C.

For instance, if the reference temperature is 25 °C, the recommended linear flow rate 15 m/h and the actual backwash temperature is 12 °C, the factor (blue line) is 0.7, and the final backwash linear flow rate will be 15 × 0.7 = 10.5 m/h.

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Calculation for mixed beds

The way to estimate the backwash flow rate for mixed beds is to take about 40 % expansion for the cation resin and 120 % for the anion resin (because it has a much lower density). For a typical MB having 40 % cation and 60 % anion resin, the resulting expansion will be:

$$(0.4 \times 0.4 + 1.2 \times 0.6) = 0.88$$

i.e. close to 90 % total expansion.

Packed bed systems

In AMBERPACK, UPCORE™, and other packed bed systems, the resin cannot be backwashed in situ. Instead, it must be transferred to an auxiliary backwash tower when a backwash is required.

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