Chemistry - PI 24

MODERATOR WATER - PURIFICATION

Objectives

1. In one or two sentences, describe how suspended solids and dissolved solids are removed from the moderator.

2. State the reason for "deuterizing" purification system ion exchange resins prior to use.

In Module 22-2, we discussed the sources and effects of impurities in the moderator water. This module addresses the philosophy behind the moderator purification system. (For details of the mechanics of the purification system, see 233.20-2.)

Purity of the moderator water is maintained by passing a side-stream from the outlet of the moderator coolers through filters and ion exchange (mixed bed) vessels. (Ion exchange theory is detailed in Module 21-3.)

The filters remove any particulate matter while the ion exchange beds remove ionized, dissolved species. A side benefit of using ion exchange vessels is that the neutral pH of the moderator water can be maintained by using the resin in the D-OD form. D-OD form means that the cation resin exchanges D^+ (deuterium) for cations and the anion resin exchanges OD^- (deuteroxide) for anions. The net result is that only D^+ and OD^- are present at the outlet of the ion exchange vessel. As the water entering the vessel has equal numbers of cations and anions, there will be no excess of either D^+ or OD^- and the product will therefore be neutral (ie, pH7).

Resins are usually purchased in the H-OH form and before use, they are "deuterized" to maintain high moderator isotopic.

Deuteration is accomplished by slowly passing heavy water (D_2O) upflow through the column. The resin is converted from the H-OH form to the D-OD form by simple ion exchange.

When resins are exhausted, they are **not** regenerated as they contain radio-nuclides and therefore must be removed to radioactive waste storage. Before the columns are sent away, they are de-deuterized to recover their deuterium content. This is done by passing light water from the top to the bottom of the column. The resin is converted to the H-OH form and the eluted D_2O is sent to an upgrading process.

Practice Exercises:

Why not just continue on to Module 22-4?

P.D. Dodgson