Experiment 7
Liquid Scintillation Counter

The liquid scintillation detector is used to measure beta decay in a number of biological applications. In this experiment you will gain some experience in its operation.

I. Examining the ^3H Spectrum

We will take data using one of the standard ^3H samples in the liquid scintillation detector. We will find the number of counts in each of the first 35 channels.

Data Analysis:

1. Graph your data using excel.
2. The endpoint energy for ^3H is 18.6 KeV. From your graph determine the energy/(channel number).
3. Add up the total number of counts in all the channels. From this value and the activity of the sample, determine the efficiency of the detector for ^3H. Note: the half-life of ^3H is 12.35 years.

II. Examining the ^{14}C Spectrum

Repeat parts 1 through 3 above for the ^{14}C data. The endpoint energy for ^{14}C is 156 KeV. We will take data using bin sizes of 5 channels.

III. Examining the ^{40}K Spectrum

We will take data on three different ^{40}K spectra. We will use one of the data sets to graph the data, determine the efficiency of the detector, and determine the windows for the channels ratio method. Does the quenching for the ^{40}K spectrum appear to be the same as for the ^3H and ^{12}C spectra?

1. Graph the first data set using excel. From your graph determine appropriate windows for the channels-ratio analysis.

2. Use the two windows from part 1 and the channels-ratio method to determine if the quenching is the same for each of the three data sets.

Laboratory Write-up

1. (2 points) Your data and graph of the H^3 spectrum.

2. (1 point) Your calculation for the energy/(channel No.) for the H^3 spectrum.

3. (1 point) Your calculation for the counting efficiency for H^3.

4. (2 points)Your data and graph of the C^{14} spectrum.

5. (1 point) Your calculation for the energy/(channel No.) for the C^{14} spectrum.

6. (1 point) Your calculation for the counting efficiency for C^{14}.

7. (1 point) Your data and graph of the first K^{40} spectrum.

8. (1 point) Your calculation for the counting efficiency for the first K^{40} spectrum.

9. (2 points) Your calculation to determine if the quenching is the same for all the K^{40} samples. Is the quenching the same for all the K^{40} samples? Comment.