

# This Week's Citation Classic

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**Baillie L. A.** Determination of liquid scintillation counting efficiency by pulse height shift. *Int. J. Appl. Radiat. Isotopes* 8:1-7, 1960. [Sinclair Research Laboratories, Inc., Harvey, IL]

A two-channel liquid scintillation spectrometer can accumulate strong pulses and total pulses separately in the two channels. The ratio of counts in these counting efficiency, so that count rate and counting efficiency can be found simultaneously. [The *SC*<sup>®</sup> indicates that this paper has been cited over 250 times since 1961.]

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"The work described in this paper was inspired by the practical need to measure C14 concentrations in a large number of liquid chromatography cuts. These cuts varied in character, with some containing only clear hydrocarbons, while others contained alcohol and/or colored compounds. Counting efficiency differed for each sample, and the necessary measurement of counting efficiency by the internal standard method was tedious and time consuming.

"The same mechanisms which diminish counting efficiency also diminish the light output of the scintillator vial. These include dilution, chemical quenching, and adsorption of light by color. As a result, the ratio of strong pulses to total pulses changes in a way that is related to counting efficiency.

It occurred to me that a two channel spectrometer might furnish enough information so that count rate and counting efficiency might be determined simultaneously.

"In order to obtain data for the calibration curves, I made up a sizable number of quenched standard vials, using various amounts of diluents, chemical quenchers, and colored material. When the ratio of strong pulses to total pulses was plotted against efficiency, I was pleased to find that most of the samples fell on the same curve. Only the strongly quenched, colored samples fell on a curve of their own. By using these curves, I was able to improve both speed and accuracy in the radioassay of my chromatography cuts.

"When I decided to write a paper describing this method, it seemed appropriate to include a discussion of the effect of counting statistics on the calculated disintegration rate. This proved to be quite an interesting problem, because the same random counting errors which affect the ratio used to find the efficiency exist in the count rate itself. It develops that a random error in the group of strong pulses has some tendency to cancel out in the final answer, while a random error in the weaker group of pulses is amplified somewhat. Of course, statistical error in count rate divided by efficiency is always greater than statistical error in count rate alone. In the final analysis, the channel ratio method leads to smaller errors in routine counting than can be achieved by most alternative methods.

"This paper attracted a surprising amount of attention when published in the *International Journal of Applied Radiation and Isotopes*. Apparently, any method which offers a reduction in tedious labor at no expense in data quality will tend to be popular among scientists."