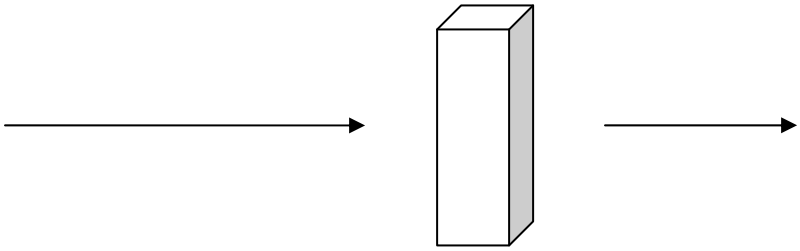
SHORT VERSION

"Beer's Law Of Mass Spectrometry, Again."

Analogy Explained.

Photons, electromagnetic radiation, (i.e. energy) pass through a medium being reduced by a process, liquid phase.

Photon creation. Transmission Detection



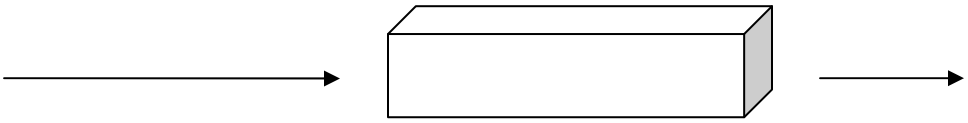
P_o P

$\% T = P / P_0$

$\text{Log}\ (P_0/P) = A = \varepsilon bc$

Ions, charged matter (i.e. energy) , pass through an analyzer and are reduced by a filtering process, gas phase.

Ionization (EI) Transmission Detection



$M + e^- = M^+_{in} + 2e$ %T M^+_{out}

$M^+_{in} \alpha\ N\ Q$

$\%T = M^+_{out} / M^+_{in}$

$\%T = M^+_{out} / kNQ$

$M^+_{out} = k\ \%TNQ$

$\%T = k_r(1/R)^n = k_r\ (1/\text{NumRF})^n = k_r/(f\ l\ 1/v)^n$

ε is an energy term as is Q the ionization cross section in the case of 70 eV/EI QMS.
b is the path length and % T in QMS depends on the path length of ion traveling, l, in an analyzer of freq f, at velocity, v.
c is the solution concentration and N is the amount of moles in the source in a dynamic process that hopefully mirrors, c.

Proposed mass spectrometry "Beer's Law" generalization.

We propose that when ion creation is first ordered or pseudo first ordered, that the analogy shown here can apply across ionization techniques (EI,CI, CID, ESI, MALDI, DART, etc.) and MS transmission (and other) analyzers.

This explains why we can observe linear calibration curves across diverse sample intro, ionization & detection MS devices.

The analogy can serve as a tool to assess, verify multivariate MS data quality across diverse applications spaces, we assert, as qualitative and quantitative analysis are simply different parts of the same equation.

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