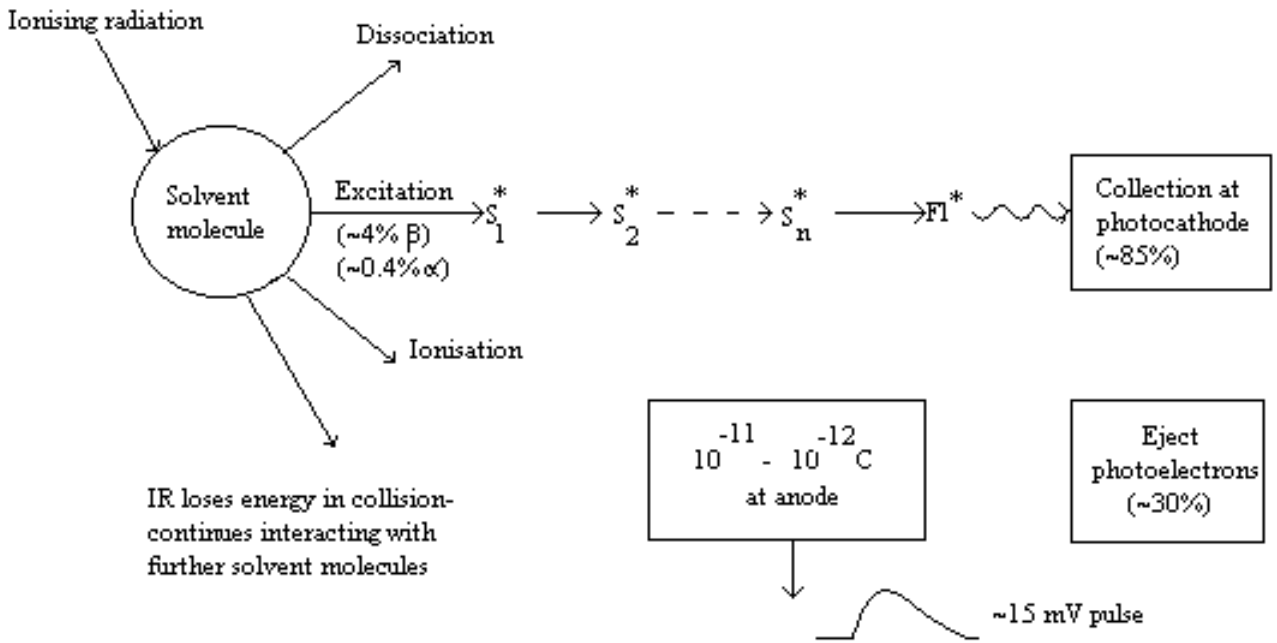
Liquid Scintillation Counting



Solvent Characteristics

- Minimum absorption of light emitted by fluor
- High absorption of energy from radiation and transfer of energy to fluor
- Maximum purity to reduce interference with energy transfer
- Low freezing points
- High solubility for material to be assayed
- Best solvent is toluene despite many attempts to produce aqueous-based materials.

Fluor Characteristics

Most aromatic solvents are not good fluors and so solutes which are, have to be added.

- High absorption of energy from solvent molecules and emission of light matching spectral sensitivity of photo cathode
- Solubility in solvent
- Adequate chemical stability
- Short fluorescence time

The energy transferred in the form of photons is a function of fluor concentration

Quenching

- Quenching refers to a reduction in the amount of light incident in the photocathodes
- This causes a decrease in the number of pulses produced, i.e. a reduction in counting efficiency, and a downward shift in the pulse height spectrum and a reduction in the value of the mean pulse height
- Three types of quench
  - Chemical
  - Colour
  - Optical

Chemical Quenching

Caused by the presence of materials in cocktail which interfere with transfer of energy from solvent to fluor molecules. Mechanisms include:

- Acid quenching resulting from interaction of H^+ with primary or secondary fluor
- Excessive concentration of one component
- Dilution quenching - dilution increases average distance between solvent molecules
- Dipole-dipole quenching resulting in non-radioactive loss of energy or increase in vibrational energy
- Electron capture preventing energy transfer from e^- to solvent molecules

Colour Quenching

- A coloured material in cocktail absorbs light photons emitted by fluor.
- In practice, all materials have an absorption spectrum.
- Can be reduced by bleaching or decolourizing, e.g. blood samples have been bleached with peroxide, but this increases the chemical quenching.

Optical Quenching

- Absorption of light by:
  - Condensation
  - Finger prints
  - Other residue

  on counting vial.

Quench Correction

- Quench correction is a method for the determination of the counting efficiency of a sample and hence, in conjunction with the count rate, the activity:

  Counting efficiency = count rate/activity

  when the disintegrations are 100% β -emission.

- All quench correction techniques use a set of standards, i.e. known activities (dpm) to which different quantities of quenching are introduced artificially to produce a range of quenching to cover that for the samples.