LIQUID SCINTILLATION COUNTING

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Liquid scintillation counting

- **Liquid scintillation counting** is the measurement of radioactive activity of a sample material which uses the technique of mixing the active material with a liquid scintillator (e.g. Zinc sulfide) , and counting the resultant photon emissions. The purpose is to allow more efficient counting due to the intimate contact of the activity with the scintillator. It is generally used for alpha and beta particle detection.
- Liquid scintillation counting (LSC) is the standard laboratory method to quantify the radioactivity of low energy radioisotopes, mostly beta-emitting and alpha-emitting isotopes.
- In order to efficiently transfer the emitted energy into light, LSC must consist of two basic components

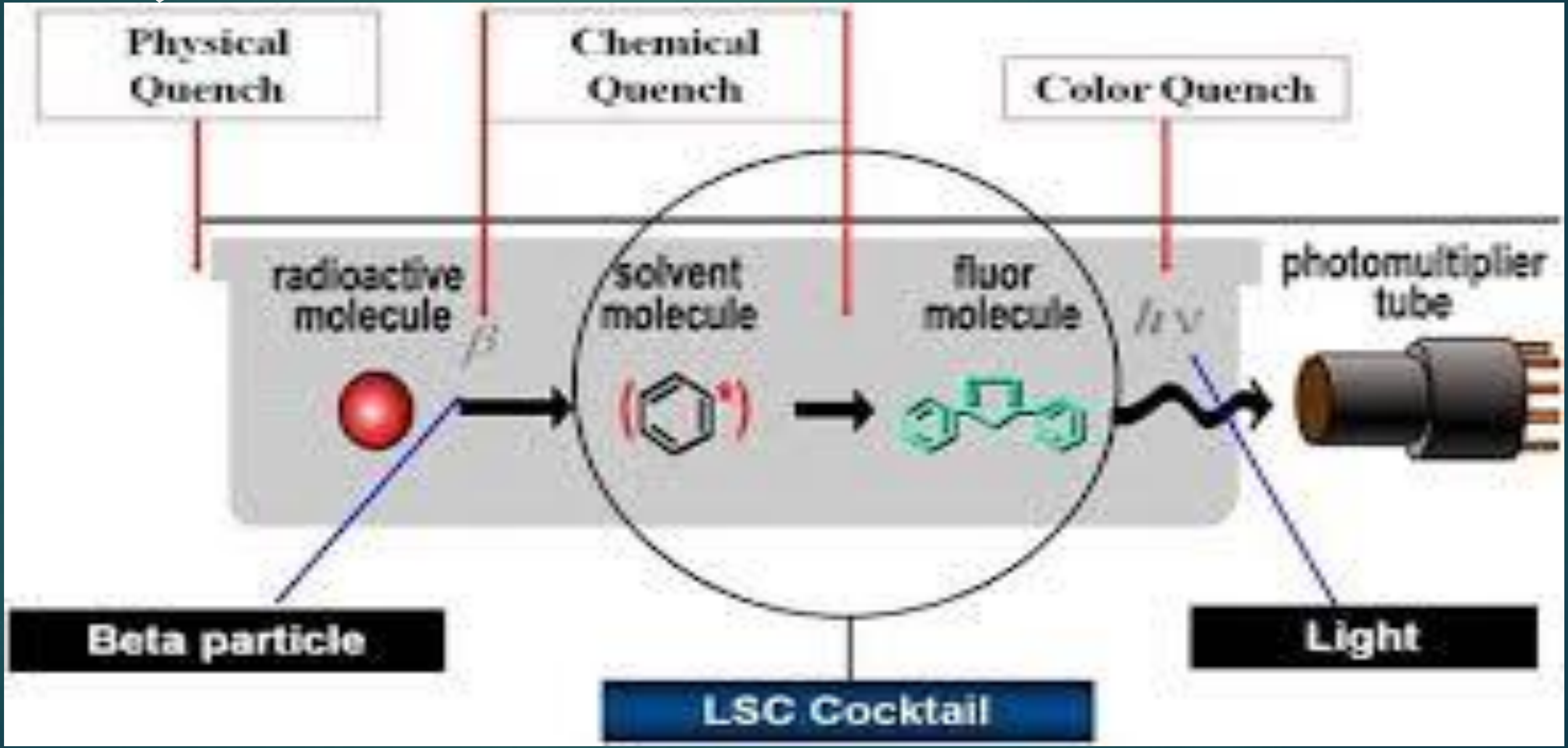
PRINCIPLE OF LSC

- After excitation of the aromatic solvent molecules through the energy released from a radioactive decay, the energy is next transferred to the scintillator (also sometimes referred to as the "phosphor" or "fluor"). The energy absorbed through the scintillators produces excited states of the electrons, which decay to the ground state and produce a light pulse characteristic for the scintillator. The light is detected by the photomultiplier tube (PMT) of the liquid scintillation counter.
- **LSC must consist of two basic components:**
- The aromatic, organic solvent –dissolve sample
- The scintillator(s) or fluors- emit light

Working .....

- Samples are dissolved or suspended in a "cocktail" containing a solvent (historically aromatic organics such as xylene or toluene, but more recently less hazardous solvents are used), typically some form of a surfactant, and small amounts of other additives known as "fluors" or scintilltors.
- Beta particles emitted from the isotopic sample transfer energy to the solvent molecules: the π cloud of the aromatic ring absorbs the energy of the emitted particle. The energized solvent molecules typically transfer the captured energy back and forth with other solvent molecules until the energy is finally transferred to a primary scintillator.
- The primary phosphor will emit photons following absorption of the transferred energy. Because that light emission may be at a wavelength that does not allow efficient detection, many cocktails contain secondary phosphors that absorb the fluorescence energy of the primary phosphor and re-emit at a longer wavelength

LIQUID SCINTILLATION COUNTER DIAGRAM



FLUORS......

There are two categories of fluors: Scintillators can be divided into primary and secondary phosphors, differing in their luminescence properties.

- Primary Fluor – most primary fluors emit light in the UV range with wavelengths shorter than 400 nm
- Secondary Fluor (wave shifter) – the presence of the secondary fluor increases the wavelength of the emitted light to one more efficiently absorbed by the photomultiplier tubes

ADVANTAGES OF SCINTILLATION COUNTING

3. The ability to accommodate samples of any type, including liquids, solids, suspensions and gels.

4. The general ease of sample preparation.

5. The ability to count separately different isotopes in the same sample, which means dual labelling experiments can be carried out.

6. Scintillation counters are highly automated, hundreds of samples can be counted automatically and built-in computer facilities carry out many forms of data analysis, such as efficiency correction, graph plotting, radioimmunoassay calculations,etc.

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DISADVANTAGES OF SCINTILLATION COUNTING

It would not be reasonable, having outlined some of the advantages of scintillation counting, to disregard the disadvantages of the method. Fortunately, however most of the inherent disadvantages have been overcome by improvement in instrument design. These disadvantages include the following.

1. The cost per sample of scintillation counting is not insignificant; however, other factors including versatility, sensitivity, ease and accuracy outweigh this factor for most applications.

2. At the high voltages applied to the photomultiplier, electronic events occur in the system that are independent of radioactivity but contribute to a high background count. This is referred to as photomultiplier noise and can be partially reduced by cooling the photomultipliers.

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