Sonosensitizer

A sonosensitizer is a special substance that makes cells, especially cancer cells, more sensitive to ultrasound.

When a sonosensitizer is inside a tumor and you apply ultrasound, it reacts by producing toxic molecules (like reactive oxygen species) that damage and kill the cancer cells, without harming much of the surrounding healthy tissue.

It's similar to how a photosensitizer works with light in photodynamic therapy, but here the trigger is sound.

Classification

Sonosensitizers can be classified mainly into three groups:

Organic sonosensitizers – These are carbon-based molecules. – Examples: porphyrins, chlorins, dyes like indocyanine green (ICG). – They are usually biocompatible but sometimes less stable under ultrasound.

Inorganic sonosensitizers – These are based on metals or metal-like materials. – Examples: titanium dioxide (TiO_2), zinc oxide (ZnO), gold nanoparticles, ruthenium complexes. – They are very stable but can have issues like electron-hole recombination (as you mentioned earlier).

Hybrid/composite sonosensitizers – These combine organic and inorganic parts to get the best of both worlds. – Example: TiO_2 coated with porphyrin molecules or metal-organic frameworks (MOFs) with active centers. – They aim to improve ROS production, targeting, and stability.