Patent

**Background**

Due to the ever-increasing applications of liposomes in biophysics, physiology and medicine, many techniques have been developed over recent years to manufacture them. All existing methods for the production of these Liposomes have serious drawbacks, namely rate of production, high production costs, low efficiency, low quality, pollution with metal particles during production, short operating life of used ultrasonic processors and difficult scale-up procedures. Specifically, for human drug delivery, liposomes (in the order of nano/micro size) are of growing interest as carriers of drugs. These liposome carriers can be targeted in various ways to deliver the encapsulated drug to specific sites within the human body.

Today chemotherapy is still the most common form of medication for the treatment of cancer patients. Through the application of liposomal drug delivery, high overall body dosages (which tend to cause severe side effects) are lowered and significantly higher cancer cell drug concentration can be achieved so as to enhance the therapeutic effects.

Through a new and innovative system (high efficiency, selective sizing, batch/continuous methods for commercial production) for the production of the required liposomes, highly effective liposomal drug delivery can be achieved through the coupling with various known targeting methods such as liposome surface coupling with specific proteins.

**Claims**

1. The creation of micro / nano sized particles through the accumulation of numerous smaller particles or molecules, thanks to specific spatial structure of acoustic field and wideband effects of cavitation.
2. Through the action of turbulence, particles described in claim 1. form through the sticking together (accumulation) of numerous single smaller particles or molecules which are present in a fluid carrier.
3. Dependant on the specifics of the fluid mixture (of which particles may be biomolecule, ferromagnetic, ions or other particles) various physical methods are employed so as to create a turbulence (such as acoustic, mechanical, optical, electromagnetic or electric field).
4. Specifically, for a biomolecule in liquid suspension, an acoustic method for creating the turbulence in the form of numerous small vortex’s coupled with axial and radial oscillations, pumping and streaming effects is applied.
5. For acoustic processing a uniquely designed resonating bar is able to produce and propagate the required liquid vortex’s via a combination of low frequency oscillations, ultrasonic frequency oscillations, including forced and frequency-sweeping oscillating regimes with different signal modulations.
6. The resonating bar has a mechanical design (incorporating specific geometries) which enables it to produce shear, vortex and turbulent waves coupled with axial and radial oscillations, pumping and streaming effects.

The resonating bar operates with best results when combined and driven with an ultrasonic generator namely MMM (Multifrequency, Multimode, Modulated Sonic & Ultrasonic Vibrations) produced by the companies MP-Interconsulting and Ultrasonic World Limited (as described in “EP 1 238 715 A1, Multifrequency ultrasonic structural actuator”).

1. The resonating bar has axial and perpendicular holes and channels, designed on a way that all of them are synchronously resonating, producing different wave motions, vortices and shear waves in axial and radial directions, when submersed in a fluid.