Annalisa Dalmoro et al., J Nanomed Nanotechnol 2017, 8:4(Suppl)
DOI: 10.4172/2157-7439-C1-049

Ultrasonic energy as effective tool to improve the production methods of lipid and polymeric drug delivery systems

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Statement of the Problem: The large interest in the development of lipid and polymeric micro- and nano- drug delivery vectors lies in their properties of minimizing drug loss or degradation, reducing side effects, improving drug biodistribution and penetration in cellular compartment. Different advanced preparation techniques are currently used, however as all modern manufacturing processes also pharmaceutical industry must respond to the mandatory rules of sustainable productions. Therefore it is moving to the intensification of production processes, included those based on nanotechnologies, i.e. to process miniaturization, capital cost reduction, and improvement of energy use and final product quality. Among the tools to achieve this objective, ultrasonic energy has the potential for the improvement of production techniques of lipid and polymeric carriers on micro and nano scale.

Methodology & Theoretical Orientation: Ultrasonic atomization and sonication were the method used for the "intensified" production of drug delivery vectors, respectively. The fundamentals of both were analyzed in order to understand the mechanisms at the basis of micro- and nano- vectors formation and sizing.

Findings: The ultrasonic energy was a potent tool able to produce vectors encapsulating different active molecules, in particular to: 1) produce enteric shell-core microparticles by energy-saving ultrasonic atomization, 2) make stable double emulsions for the production of polymeric micro- and nanoparticles, 3) size the final dimension of liposomes, according to the application requirements.

Conclusion & Significance: Advantages and novelties introduced by the use of ultrasonic energy in preparative methods of lipid and polymeric vectors were put in evidence by proving that the ultrasonic-based techniques are versatile and promising for the successful preparation of stable, highly loaded formulations, avoiding any harsh preparative conditions or large amount of solvents.

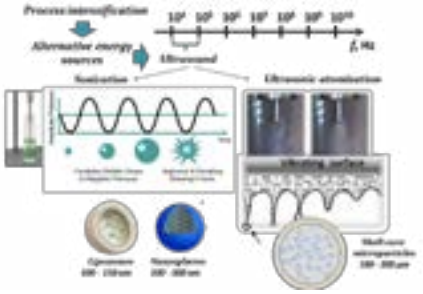

Figure: Ultrasound as alternative energy source for intensification of production methods of micro- and nano- carriers

Biography

Annalisa Dalmoro carries out her research work in TPP group at the University of Salerno on novel processes for the production of dosage forms and on the development of materials for biomedical applications. In particular, she focused her work on the design and building of a semi-continuous bench-scale apparatus for the production of shell-core microparticles combining two non-conventional technologies, such as ultrasonic atomization and microwave drying; on the production of micro and nano systems by exploiting ultrasonic energy; on the synthesis of enteric polymers for pharmaceutical applications; on the study about the crosslinking phenomena of biopolymers, thus about their applicability for *in situ* coating of coronary stents. Moreover, she was also involved in studies on granulation processes, stabilization of food by spray drying, and on fruits, grains and legumes processing by microwaves, through collaborative projects with companies.

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