Micro-particles by ultrasonic atomization: new strategy towards novel drug carrier
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Abstract & Introduction

Fine particles are required in many pharmaceutical preparations. To obtain these particles different techniques are used but the spray drying represents the most diffuse process. In this latter technique the fundamental step is the atomization, i.e. the break-up of a liquid jet in droplets caused by transformation or transfer of large amounts of energy (kinetic or pressure energy).

The ultrasonic atomization is proposed as a technique which requires much less energy; the droplets are produced by spreading the liquid onto a surface which is vibrated at ultrasonic frequencies. The principles of ultrasonic atomization are well known and applied since the ’60 of the last century however reliable correlations between operating parameters and droplet size still lacks.

Results and Discussion

Experimental parameter changes:
- alginate solution concentration, C, (1, 2 and 3% w/w),
- volumetric flow rate, V, (in the range 0.1-0.6 mm³·s⁻¹)
- power level, P, of the source of ultrasonic wave (in the range 4-11 W).

External trends:
- the particle diameter weakly decreases with the level of the power delivered;
- the particle diameter increases with the volumetric flow rate;
- the particle diameter increases with the alginate concentration.

Evaluation of the relationship between process parameters and size are pointed out.

Materials, apparatus and methods

Materials. Sigma Aldrich supplier: Sodium alginate (CAS number 9005-38-3) and copper sulfate-penta-hydrate (CAS number 7758-99-8).


Methods. Experimental runs are performed by spraying the alginate solution into a sulfate solution. The alginate reticulation (by formation of a rigid network “egg-box” structures) is a very fast reaction, which takes place immediately after the impact between the alginate drop and the copper solution.

Conclusions

Lab-scale ultrasonic atomization of alginate solutions has been carried out changing process parameters: (alginate concentration, volumetric flow rates, power delivered); pointing out a method to obtain and to characterize the small resulting alginate particles; correlating the process parameters to the particle diameters.

The ultrasonic atomization is a very promising technique in the intensification processes for pharmaceutical fine particles production.