Production of PCL nanoparticles by flash nanoprecipitation for controlled release of caffeine

Proceedings of the Merck Young Chemists Symposium
Milano Marittima, Italy, 13–15 November 2017
SCI, ISBN: 978-88-86208-89-5, p. 80, 2017, Rome

OR-59

Production of PCL nanoparticles by Flash Nano Precipitation for controlled release of caffeine.

Daniele Massella,[a,b,c,d] Ada Ferri,[a] and Antonello Barresi.[a]

[a] *Department of Applied Science and Technology, Politecnico di Torino, Corso duca degli abbruzzi 24 10129 Italy*
[b] *University Lille Nord de France, F-5900 Lille, France*
[c] *ENSAIT, GMTEX, F-59100, Roubaix, France*
[d] *College of Textile and Clothing Engineering, Soochow University, Suzhou, Jiangsu, 215123, China*

E-mail: daniele.massellal@polito.it

Caffeine (CAF) is one of the most consumed drug worldwide due to its large application in food, pharmaceuticals, cosmetics and supplements; upon oral administration caffeine is cleared into the stomach in 20 minutes and absorbed into the blood within 1 hour [1]. Polycaprolactone (PCL) is biodegradable polymer extensively studied in drug delivery applications where long lasting releases are required [2]. Caffeine was encapsulated in PCL nanoparticles by exploiting the Flash nanoprecitation technique which is well known method to encapsulate hydrophobic drug [3], but not yet studied on hydrophilic active principles. The nanoparticles were produced in a confined impinging jet mixer by dissolving caffeine alternatively in the solvent (acetone) or in the antisolvent (water). The effect of the process parameters on the mean particle diameter and zeta potential of the nanoparticles was investigated by Dynamic Light Scattering. A novel procedure to accurately quantify drug Loading Capacity (LC) and Encapsulation Efficiency was developed and implemented. The in vitro release kinetic was assessed by dynamic dialysis method. Nanoparticles with average diameter ranging from 250 to 500 nm were successfully produced, the mean size was correlated to the flow rate. LC and EE were assessed in the range of 10-45% and 5-25% respectively. The release test showed a delay in the peak of caffeine in blood mimicking solution up to 6 hours.

[1] P. Nawrot, S. Jordan, J. Eastwood, J. Rotstein, A. Hugenholtz, and M. Feeley, *Food Addit. Contam*. **20** (2003) 1–30.
[2] V.R. Sinha, K. Bansal, R. Kaushik, R. Kumria, and A. Trehan, an overview, *Int. J. Pharm.* **278** (2004) 1–23.
[3] A. Ferri, N. Kumari, R. Peila, and A.A. Barresi, *Can. J. Chem. Eng.* **95** (2017) 1690-1706.