Integrated manufacture of liposomal dry powder formulations for pulmonary enzyme delivery: When pharmaceutical technology meets green chemistry

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Chronic obstructive pulmonary diseases, like COPD, asthma and cystic fibrosis, represent the third leading cause of death globally [1]. The treatment of these diseases requires long-term systemic therapy with high doses of anti-inflammatory drugs resulting in serious side effects, leading to cardiovascular diseases [2]. These disadvantages can be overcome resorting to suitable and biocompatible drug delivery systems, as liposomal dry powder formulations. These formulations can be obtained by the integration of a microfluidic system, where liposomes are produced and then dried using supercritical CO_2 - assisted spray-drying (SASD). In this work, through the nanoprecipitation method, using a one-step glass-capillary microfluidic device, Cu, Zn- Superoxide dismutase (SOD) – an enzyme with anti-inflammatory properties - was encapsulated in PEGylated liposomes (SOD@Lip), with an efficiency of 59 ± 6 %. *In vivo* experiments showed, through an ear edema model, that SOD@Lip administered by the intravenous route enable an improvement on edema inhibition over 45 % comparting to SOD in its free form [3]. To improve the storage stability of SOD@Lip without resorting to the cold chain, the SASD was used to convert SOD@Lip in suspension form into SOD-loaded liposomal dry powder formulations (SOD_Lip@DPFs). Preliminary studies have shown promising results on the production of SOD-liposomal dry powder formulations using $scCO_2$ and their suitability to be administered through the pulmonary route.

References

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