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# Comparison of Freeze and Spray Drying to Obtain Primaquine-Loaded Solid Lipid Nanoparticles

James Jorum Owuor, Technical University of Kenya, Nairobi, Kenya
Florence Oloo, Technical University of Kenya, Nairobi, Kenya
Japheth Kibet Ngetich, Kenya Medical Research Institute, Nairobi, Kenya
Mwaiwa Kivunzya, Technical University of Kenya, Nairobi, Kenya
Wesley Nyaigoti Omwoyo, Maasai Mara University, Nairobi, Kenya
Jeremiah Waweru Gathirwa, Kenya Medical Research Institute, Nairobi, Kenya

## ABSTRACT

This article describes how the spray drying and freeze drying of various nanosized Solid Lipid Nanoparticle (SLN) and the physicochemical attributes of the acquired particles were examined. Primaquine loaded Solid Lipid Nanoparticles dried by the two strategies is examined. Particles were characterised by determination of size, drug loading, encapsulation efficiency and surface morphology. In vitro and kinetic drug discharge models were also considered. Preparation parameters have no impact on the molecule morphology and properties, and the main parameter deciding the molecule attributes in the drug substance of the nanoparticle, either in the spraying or in the freezing technique of drying. The drug release profile of spray dried SLN is superior to that of the freeze dried SLN.

### KEYWORDS

Double Emulsion, Freeze Drying, Solid Lipid Nanoparticle, Spay Drying

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A well-known technique of synthesis of nanoparticles is spray drying (Sánchez et al., 2010). One favoured design in spray drying comprises on the preparation of a suspension that is delivered into the drying chamber, and atomized by pumping it at high pressure through a pressure multi-spout cluster, after that the upward spiraling beads meet hot air which is channeled through a diffuser into the chamber (counter-current to the droplets) (Negre et al., 1996). There are additionally co-current and blended systems, together with various atomization modes (rotating atomiser, pressure spouts, two-liquid spouts) (Master et al., 1991). Despite the configuration and atomisation method of the spray dryer, it is important to prepare and optimise the nanoparticles suspensions keeping in mind the end goal to acquire homogeneous spray dried particles with high apparent density.

Another strategy for the synthesis of nanoparticles is freeze drying. This strategy is getting extraordinary consideration these days for the synthesis of nanosized particles from inorganic salts and for the produce of porous bodies by a freeze casting process. The preparation of particles by this method was created with the target of maintaining a strategic distance of pressing aids to the particle surface (Lyckfedt *et al.*, 2003). However, it is extremely restricted when contrasted with spray drying. A principle highlight of freeze drying as a nanoformulation strategy is that the acquired nanoparticles have high porosity thus light granules can be produced (Uchida et al., 2002; Yokota et al., 2001). The porosity and subsequently, the thickness of particles are controlled by the strong stacking of the suspensions, though the size distribution of the particles is a component of the viscosity and the solid substance of the suspension, the streaming rate utilized for spraying and the pressure of the connected gas (Moritz and Nagy, 2002; Rundgren et al., 2003).

The present research envisaged reformulating PQ to enhance its efficacy and half-life, which may impact on its dosing regimen by enabling lower dosage and longer frequency. These will lead to reduced toxicity and better patient compliance. The strategy employed toward this was through the synthesis of PQ-loaded Solid Lipid Nanoparticles (PQ-SLNs). The PQ-SLN that was spray dried(SD) and PQ-SLN that was freeze dried(FD) were use in order to compare the two selected methods, spray drying and freeze drying, and the physicochemical characteristics of the obtained nanoparticles such as their morphology, surface area, and size distribution as a function of the suspension preparation conditions. The influence of processing parameters such as nozzle diameter, solids content, temperature and air pressure on the nanoparticle characteristics were also studied.

## MATERIALS AND METHODS

### Materials

All materials, reagents, chemicals, and PQ base utilized as a part of the study were provided by our partners at the Novartis, Basel, Switzerland. The stearic acid (SA), chitosan low-viscous, polyvinyl alcohol (PVA) of molecular weight 13,000–23,000 and partially hydrolyzed (87%– 89%), D-lactose monohydrate, sulfanoyl and ethyl

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