

Comparison of Box–Behnken and central composite designs in optimization of fullerene loaded palm-based nano-emulsions for cosmeceutical application

ABSTRACT

Box-Behnken (BBD) and central composite rotatable designs (CCRD) were used as statistical multivariate methods in the formulation optimization of fullerene loaded nano-emulsions. Effect of palm kernel oil ester (10-20%, w/w), emulsifier (5-10%, w/w) and xanthan gum (0.6-1.0%, w/w) as formulation variables on the particle size, ζ -potential and viscosity of the nano-emulsions were investigated. Under the optimum conditions, CCRD model predicted the response values for particle size, ζ -potential and viscosity were 153.6. nm, -53.4. mV and 42.1. Pa. s, respectively. Nonetheless, BBD model suggested that the optimum conditions for a fullerene loaded nano-emulsion would gave particle size, ζ -potential and viscosity of 151.6. nm, -53.8. mV and 43.1. Pa. s, respectively. The actual response according to suggested compositions for both models showed excellent agreement with the predicted value with residual standard error (RSE) of less than 4%. Optimum nano-emulsions were stable during storage at 25 and 45. °C for 90 days and freeze-thaw cycle.

Keyword: Nano-emulsions; Fullerene; Response surface methodology (RSM); Central composite rotatable design (CCRD); Box–Behnken design (BBD)