

Optimization of *Nigella sativa* oil-based ferulate ester synthesis using response surface methodology

ABSTRACT

Nigella sativa L. seed, also recognized as black cumin is a medicinal plant that possesses miraculous power of healing due to the abilities to cure various ailments. Owing to the oily properties of plant oil, the oil ester is more preferable exhibiting special features such as non-toxic, outstanding moisturizing action and most importantly the absence of oily texture. In this study, *Nigella sativa* oil-based ferulate ester was synthesized via transesterification of *Nigella sativa* oil (NSO) and ethyl ferulate (EF) in the presence of immobilized lipase, Lipozyme RM IM from *Rhizomucor miehei*. A five-level-four-factor central composite rotatable design (CCRD) from response surface methodology (RSM) was applied to study the influence of synthesis parameters: lipase dosage (50-80 mg), temperature (40-60°C), substrate ratio of NSO:EF (2.5:1-5.5:1 w/w) and time (3-7 hr) aiming for the maximum percentage yield of ester. The optimized synthesis conditions were lipase dosage of 67 mg, temperature of 56°C, substrate ratio (NSO:EF) of 4.4:1 w/w and time of 4 hr. The maximum production of ester obtained was 49.87% which is acceptable with the predicted value of 48.82%.

Keyword: *Nigella sativa* oil; Enzymatic transesterification; Plant oil-based ferulate ester; Optimization; Response surface methodology (RSM)