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### (54) HYDROPHOBIC ION PAIRING AND FLASH NANOPRECIPITATION FOR FORMATION OF CONTROLLED-RELEASE NANOCARRIER FORMULATIONS

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#### (57)ABSTRACT

Methods for encapsulating water-soluble biologic and small molecule active pharmaceutical ingredients (APIs) into nanoparticles by applying nanoprecipitation techniques and ion-pairing the nanoparticles with hydrophobic counterions to produce new API salts that exhibit altered solubilities are presented.

# Pre-formed ion paired API

Organic stream Water stream

ion-paired API complex



amphiphilic PCL-b-PEG stabilizer /



In situ API ion pairing

Organic stream Water stream



api

ion-pairing reagent amphiphilic PCL-b-PEG stabilizer

Rapid mixing

PEG-coated FNP based nanoparticle