Title

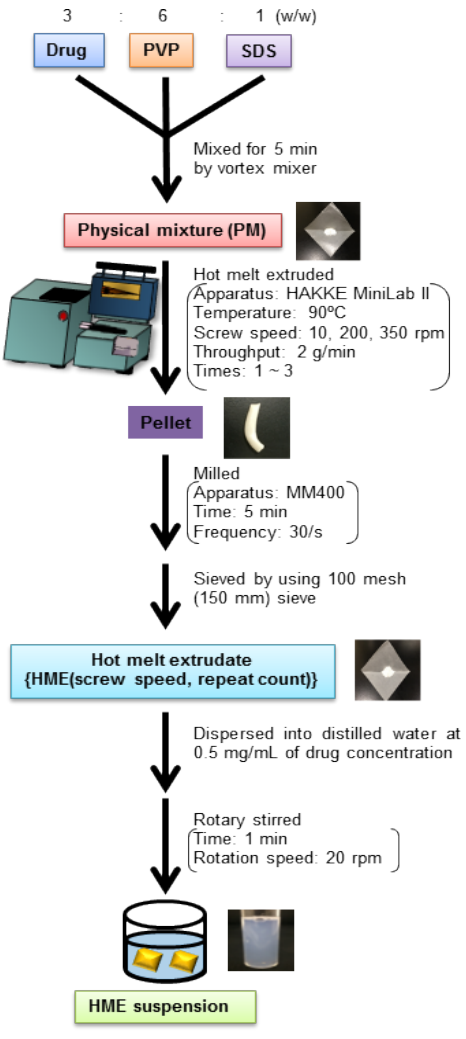
Nanoparticle formulation of drug crystals

Background and Purpose of Research

Nanonization of drugs increases the surface area, thus improves the dissolution rate of drugs. As such, nanonization of drugs is one of the methods of improving poorly water-soluble drugs' solubility as well as bioavailability which represents the rate of drug absorption into human body.
Current methods of nanonization of drugs include dry milling which uses ball mill or rod mill, wet milling which uses bead mill, high pressure homogenization, coprecipitation, crystallization, and the like. However, each of these current methods has its shortcomings. Dry milling lacks continuous processing thus is difficult to achieve volume production. Wet milling and high pressure homogenization enable to obtain nanoparticles but are not capable of handling drugs which are susceptible to hydrolyzation with water. Because nanoparticles are in the state of suspension under wet milling and high pressure homogenization, drying process is required in order to obtain solid formulation. Coprecipitation and crystallization yield nanoparticles contaminated by organic solvent. Because coprecipitation and crystallization involve precipitation of nanosized drug in aqueous media from organic solvent, residual organic solvent must be removed in order to retrieve nanoparticles. The purpose of this research is to provide nanoparticle formulation which does not require drying process or organic solvent, thus can readily and continuously produce nanoparticle drugs.

Summary of Research Results

Researchers achieved nanoparticle formulation of drug crystals through hot melt extruder which is not utilized under current methods of production of nanoparticles of drug crystals. Specifically, mixture of drug, water-soluble polymers, surfactants and the like is heated and kneaded with hot melt extruder. Proper setting of composition ratio of the mixture and the heating temperature obtain pellets (kneaded product extruded with the extruder) of dispersed nanocrystal drugs. This pellet is fabricated into oral formulation. After administering oral formulation, the polymers are dissolved and the drug nanocrystals are dispersed in human body and absorbed.



Advantages

It is superior to conventional drug nanocrystals preparation method in that organic solvent is unnecessary and volume production in simplified processes is achievable, both of which are not existent in current formulation of nanocrystals.

Applications

Improving solubility of poorly water-soluble drugs, at pharmaceutical companies, food companies, cosmetic companies, daily commodity companies, etc.

Inventors Kenjirou Higashi, Kunikazu Moribe

Licensing Contact

Future Medicine Education and Research Organization
at Chiba University
E-mail: mirai-shien@chiba-u.jp