Novel in *situ* self-assembly nanoparticles for Pediatric drug formulations

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Over 65% of current medications don't have commercially available pediatric formulations. Lack of pediatric formulations has led to the necessity to interrupt tablets or open capsules for administration, risking reduced efficacy and adverse effects due to inaccurate dosing. Mostly the challenges faced by limitations on doses of liquid, flexible oral solid dosage forms are preferred for pediatric formulations. The recent discoveries which got a unique platform through nanotechnology to manufacture solid granules that produce in place self-assembly nanoparticles (ISNPs) when introduced to water or other fluids (e.g. gastrointestinal fluid). The current ISNPs are lipid-based nanoparticles. We successfully applied the ISNP nanotechnology for ritonavir, lopinavir, a fixed-dose combination of lopinavir/ritonavir and a fixed-dose combination of 4 drugs. Drug-loaded ISNP granules achieved over 15% of drug loading, acceptable stability at temperature and over 90% of drug entrapment efficiency. As per the dissolution and electronic-tongue, drug-loaded ISNP granules had familiar taste to the placebo granules. As the pharmacokinetic studies moreover showed that ISNP granules has improvised the drug bioavailability and bio distribution. The overall results demonstrated that the novel ISNP nanotechnology may be a very promising platform to manufacture palatable, heat stable and versatile pediatric granules.

As the pediatric formulations development and presentations is significant to make sure that children of all ages and their guardians have can safely access exact dosage of medicines. In line with Article 15 of the Paediatric Regulation, marketing-authorization applicants are required to incorporate in their paediatric investigation plan (PIP) any measures to adapt formulation of medicinal product. The pharmacotherapy aspects of children differ from adults, including capabilities for drug administration, medical toxicity, and taste preferences. Pediatric medicines are essentially formulated at their best to suit a child's age, size, physiologic condition, and basic treatment. To ensure adequate treatment of all children, different routes of administration, dosage forms, and strengths could also be required. Advanced regulations, opportunities of funding, research initiatives and innovative collaborative medicines have resulted in some recent progress within the formulations for advanced pediatric drugs. Many such advances include shift toward oral solid formulations and attention on novel liquid preparations, including flexible and multi particulate dosage of solid forms. As the greater development of the flexibility dosage, is easily administered, and better accepted for drug formulations in children. However, new pediatric formulations address only a little a part of all therapeutic needs in children; moreover, they're not always available. The main five highlights that are required for the development of medicines for children: (1) the continued prioritization of unmet formulation needs, particularly drug delivery in gaps gaps in treatment of pediatric cancers and disease that acquire during childhood in developing countries; (2) a far better use of existing data to facilitate pediatric formulation development; (3)As most of the advanced technologies that can improve new pediatric formulations; (4)clinical input and practice-put together proof with respect to the effect of novel definitions; (5) improved access to new pediatric formulations.

A wide variety of therapeutic agents require additional preparation such as nanoparticle formulations to provide adequate therapeutic activity of the therapeutic agent. Many drugs are hydrophobic in nature and thus require additives to increase the ability of the agents to be dissolved in vivo. While useful for increasing the therapeutic activity, nanoparticles often have difficulty in formulation as the nanoparticles typically are not stable for long term storage, can lead to increased degradation of the therapeutic agent over time, and tend to aggregate reducing the effectiveness of the nanoparticles. These issues with nanoparticle formulations hamper their use in a wide range of therapeutic applications. Furthermore, traditional nanoparticle compositions are not amenable to formulation as solid forms which can be administered as a capsule or tablet. Therefore, nanoparticle and pro-nanoparticle formulations which address aggregation, storage issues, and can be formulated in solid, parenteral, and topical formulations are of commercial interest. In some embodiments, the pharmaceutical compositions further comprise a pharmaceutically acceptable car rier. In some embodiments, the pharmaceutical compositions are formulated for oral, Subcutaneous, intravenous, intraperitoneal, intratumoral, intra-arterial, transdermal, topical, rectal, intranasal, transdermal, or buccal administration. In Some embodiments, the pharmaceutical compositions further comprise formulating the composition for oral administration. In some embodiments, the formulations for oral administration are a fixed-dose formulation, a Solid granule, an oral disintegrating tablet, an oral Sustained release tablet, or an oral Sustained release disintegrating tablet. In other embodiments, the pharmaceutical compositions further comprise formulating the composition for administration via an injection. In some embodiments, the formulations for administration via injection are formulated as a solid which may be reconstituted with saline or other pharmaceutically acceptable solutions. The oral route of administration is usually used for dosing medicinal products to paediatric patients and consequently many medicinal products should be available in both liquid and solid oral dosage forms. The variety of various oral dosage forms available, such as: solutions, syrups, suspensions, powders, granules, effervescent tablets, or dispersible tablets, chewable tablets and gums, mini tablets, innovative granules, conventional immediate release and modified release tablets and capsules, make this route extremely useful for the administration

of medicinal products to paediatric patients of a good age range. Oral effervescent dosage forms include tablets, granules and powders that are dissolved in water before administration. Effervescent products are alternatives to liquid dosage forms for substances with insufficient stability in aqueous media. They are also more portable than conventional liquid formulations.

For substances that aren't stable or can't be taste masked in liquid preparations, powders or multi particulate formulations (beads, granules, mini tablets) are encouraged. These are often dosed directly into the mouth of the paediatric patient, or by mixing the prescribed dose with a little amount of sentimental food or with a drink prior to administration. Formulations are often provided during a bottle with dosing scoop, or in single-dose sachets. They may also be supplied in the form of capsules the contents of which can be sprinkled onto food. The product information should specify which commonly available foods are suitable for mixing with the preparation, and also list foods that ought to be avoided thanks to stability, compatibility etc.