JSS UNIVERSITY, MYSORE

JSS COLLEGE OF PHARMACY, OOTACAMUND

QIP on Prospective Approach of Biotechnology in Modern Research & Future Direction of Drug Delivery-Systems

February 8th-14th 2016

Programme Summary Report

QIP on Prospective Approach of Future Direction of Drug Delivery-Systems was conducted during **February 8th-14th 2016** by the department of Pharmaceutics, JSS College of Pharmacy, Ootacamund. The Programme started on 08th morning 10 AM. The Speakers included Dr.Ram Kumar Senior manager Fourrts India Pvt Ltd, Chennai, spoke on the topic formulation, research and development-industrial prospective. Mr.BalajiKhadri Director-FR&D Formulations division from GVK BioSciences Private limited, Bangaluru interacted with fellow participant on opportunities and developments in industry in India and Abroad. Dr.K.Gowthamarajan, Dr. R.Sureshkumar,Dr.GNKGanesh,Dr.V.Senthil,Dr.N.Jawahar, Dr,NagasamyVenkatesh and Miss Asha Spandana and KVVS Sathyanarayana Reddy were the internal resource persons who delivered their valuable experience including practical demo during the programme. The programme also comprised of department visit and other laboratory facilities with interaction with subjects experts in the various departments. Participants from different colleges exposed themselves with sophisticated instruments and infrastructure. About 30participants all over India took part in the Programme. Participants actively involved in the programme with one to one interaction with the speakers. The programme helped in acquiring the knowledge on different techniques that could be employed to formulate different dosage forms of different drugs, their combination therapy and various case studies, to improve bioavailability. The following delivered Abstracts have been enclosed.

Title: Industrial Prospective-Taste Masking And Its Challenges

Speaker: Dr. Ramkumar, Senior manager, FR&D, Fourrts India Private Ltd, Chennai

Presented a talk regarding the problems associated with the pharmaceutical formulations and how to overcome.He shared few of his experience in the industry like how to mask the unpleasant odor to improve patient compliance by selecting suitable and compatible flavoring agents, preparation pellets for orally disintegrating dosage form.He also talked about adverse effects related to the use of medication

Title: Product Development Path-Industrial Point Of View

Speaker: Mr.Balaji Khadri, Director,GVK BIO Sciences Private Ltd. Bangalore

- The present scenario in Pharma. industries
- Upcoming opportunities for the budding pharmacist in the Pharma. Industry
- How a new product comes into the market
- Role of different department like R & D, QA, QC, Production/manufacturing unit, packaging unit to launch a new product into the market.
- SOPs and Pharma. Ethics

Title: Lipid Based Drug Delivery System For Enhanced Bioavailability And Solubility Of Poorly Soluble Drugs

Speaker: Dr. R. Sureshkumar, Asst. Professor, JSS college of Pharmacy, Ooty

In the present scenario, oral drug delivery is continuously looking into newer avenues due to the realization of the factors like poor drug solubility and/ or absorption, rapid metabolism, high fluctuation in the drug plasma level and variability due to food effect which are playing major role in disappointing *in vivo* results leading to the failure of the conventional delivery systems. Therefore, producing suitable formulations is very

important to improve the solubility and bioavailability of such drugs. Formulation and development of poorly water soluble drugs (PWSD) candidates continue to be a challenge to formulation scientists.. The lipid based formulation approach has attracted wide attention in order to enhance drug solubilization in the gastrointestinal tract (GIT) and to improve the oral bioavailability of BCS (Biopharmaceutical drug classification system) Class II and IV drugs. Highly lipophilic drug molecules, however, may associate with lymph lipoprotein in the enterocytes and gain access to the mesenteric (intestinal) lymphatics, effectively bypassing the liver and gaining access to the systemic circulation via the thoracic lymph duct. The lipid based formulations are exemplified by self nano or microemulsifying formulations, self-emulsifying pellets, liposomes, solid lipid nanoparticles (SLNs), nanoemulsions etc.

Title: Future Direction Of Pharmaceutical Technology

Speaker: Dr K Gowthamarajan, Professor, JSS College of Pharmacy, Ooty

The pharmaceutical sciences represent an evolving and highly dynamic field, and two overreaching trends show an increased effort to develop biologic-based drugs and creating more specific or targeted drug delivery techniques. Some recent developments are the development of spatial aggregation propensity for detecting protein aggregation, advances in drug-delivery technologies involving microencapsulation and nano coatings, and tools to understand the risk of nanomaterials in drug-delivery systems. Evolution of an existing drug molecule from a conventional form to a novel delivery system can significantly improve its performance in terms of patient compliance, safety, and efficacy. These days, drug delivery companies are engaged in the development of multiple platform technologies to get competitive advantage, extend patent life, and increase market share of their products the number of products based on new drug delivery systems has significantly increased in the past few years, and this growth is expected to continue in the near future. Recent advances in the field of genomics have accelerated research of biopharmaceuticals, and today a large number of companies are busy developing protein- and peptide-based drugs. These

biopharmaceuticals present challenges to drug delivery scientists because of their unique nature and difficulty in delivery through conventional routes. Therefore, future research will focus on the delivery of these complex molecules through different routes, including oral, nasal, pulmonary, vaginal, rectal, etc. This presentation will be overviewed about the existing drug delivery technologies and the special concern about the recent research happened in JSS University.

Title: Nanoparticulated Mucoadhesive Ocular Drug Delivery System

Speker: Dr. V. Senthil, Professor, JSS College of Pharmacy, Ooty

It consists of the incorporation of adhesive molecules into some kind of pharmaceutical formulation intended to stay in close contact with the absorption tissue, releasing the drug near to the action site,The potential use for mucoadhesive systems as drug carriers lies in its prolongation of the residence time at the absorption site.Mucousl membranes of human organism are relatively permeable and allow fast drug absorption.The mucus contains glycoproteins, lipids, inorganic salts and 95% water by mass, making it a highly hydrated system. Mucin is the most important glycoprotein of mucus and is responsible for its structure. The main functions of mucus are protecting and lubricating the epithelium and other additional functions depending on the epithelium covered.Delivery of drugs to the posterior eye is challenging, and there is an increasing need for managing rapidly progressing for posterior eye diseases, such as diabetic retinopathy, age-related macular degeneration, and optic neuropathy.Currently, the intravitreal route is widely used to deliver therapeutic molecules to the retina. However, frequent administration of drugs *via* this route can lead to retinal detachment, endophthalmitis and increased intraocular pressure. For this reason ophthalmic drug delivery, particularly targeted to posterior segment, is one of the most challenging endeavors facing the ocular pharmacologists.The success of nanoparticle systems for ocular drug delivery may depend on optimizing lipophilic-hydrophilic properties of the

polymer-drug system, optimizing rates of biodegradation, and safety. Polymers used for the preparation of nanoparticles should be mucoadhesive and biocompatible. The choice of polymer plays an important role in the release kinetics of the drug from a nanoparticle system. Ocular bioavailability from a mucoadhesive dosage form will depend on the polymer's bioadhesion characteristics, which are affected by its swelling properties, hydration time, molecular weight, and degree of crosslinking. The binding of drug depends on the physicochemical properties of the molecule as well as of the nanoparticle polymer, and also on the manufacturing process for these nanoparticle systems

Title: Laboratory Animal Techniques To Conduct Oral Bioavailability Studies

Speaker: Dr. R.Vadivelan, Asst. Professor, JSS College of Pharmacy, Ooty.

Experimentation on animals in course of medical research and education is covered by provisions of the Prevention of Cruelty to Animals Act, 1960 and *Breeding of and Experiments on Animals (Control & Supervision) Rules of 1998, 2001 and 2006*framed under the Act. These are enforced by the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), a statutory body under the Prevention of Cruelty to Animals Act, 1960. Pharmacokinetic studies with veterinary medicinal products can be carried out in relation to clinical efficacy, tolerance in the treated animal and safety for the consumer. The principal objectives are to estimate the factors involved in the absorption, distribution and elimination (metabolism and excretion) (basic pharmacokinetic studies) and/or to compare the bioavailability of the active ingredient from two or more product formulations and/or routes of administration (bioequivalence studies).One of the important aspects of pharmacokinetic studies include the determination of withdrawal periods and provide guidance and assistance to applicants in the design execution and interpretation of pharmacokinetic investigations of a given active ingredient ,in the target species in relation to efficacy, irrespective of the route of administration of the veterinary medicinal product, the pharmacological class of the active ingredient or the animal

species in which use of the product is intended. Millions of animal experiments are carried out every year in preclinical research and toxicity testing. In drug development today, oral bioavailability studies in animals are used as a guidance to decide if a compound would have sufficient oral bioavailability in humans.

Title: Extrusion And Spheronization

Speaker: Dr. G.N.K. Ganesh, Asst. Professor, JSS College of Pharmacy, Ooty

In present times, the pelletization technologies are giving much attention as they represent an efficient pathway for manufacture of new drug delivery system .It has good advantage over the conventional dosage form. Pelletization technique help in the formation of spherical beads or pellets having a diameter 0.5 -1.5 mm which can be eventually coated for preparation of modified release dosage form .It leads to an improvement in flow ability, appearance and mixing properties thus avoiding for generation of excessive dust and reduces segregation and remove the undesirable properties and improve the physical and chemical properties of fine powder. The pellets can be prepared different techniques such as powder layering, suspension /solution layering, extrusion and spheronization, cryopelletization, etc. Today pelletization represents an efficient pathway for novel drug delivery in the scope for different oral immediate or controlled delivery systems. Because of its simple design, high efficiency of producing spherical pellets and fast processing, pelletization has found a special position in pharmaceutical industry and especially in case of production of multiparticulate oral controlled release dosage forms as compared to granulation. Pelletization technique produces more spherical pellets and offers more advantages than granulation process. In addition, hot-melt extrusion method has provided a new,

wider platform to produce spherical pellets of drugs which are not stable or have compatibility problems in presence of solvents.

Title: Preparation And Characterization Of Elastic Vesicular Systems

Speaker: Dr. D. Nagasamy Venkatesh, JSS College of Pharmacy, Ooty

Elastic vesicles (EVs) are deformable in nature consisting of a lipid bilayer and aqueous inner core with an ability to carry both hydrophilic and lipophilic drugs. They are generally composed of phospholipids or surfactant and an edge activator. The surfactant molecules provide the flexibility to the lipid bilayer membrane of EVs. These surfactant molecules destabilize the lipid bilayer and thereby turn increase the deformability of the vesicles.

Advantages Of Evs As Delivery Systems

- EVs possess an architecture consisting of hydrophobic and hydrophilic moieties held together and as a result it can accommodate drug molecules with a wide range of solubility.
- They can deform and pass through narrow constriction. This high deformability gives EVs better penetration of vesicles across the biological membranes.
- They can act as a carrier for wide variety of drugs with different pharmacological nature such as analgesics, anesthetics, corticosteroids, anticancer agents etc.,
- They are composed of natural phospholipids, similar to liposomes, EVs are biocompatible and biodegradable.
- EVs can protect the encapsulated drug from undesirable conditions such as metabolic degradation.
- They can act as drug-depots, releasing their contents slowly and gradually.
- EVs can be employed for both systemic as well as localized delivery of drug molecules.
- They are easy to scale up as the preparatory technique is simple, does not involve lengthy procedure and unnecessary use of pharmaceutically unacceptable additives.
- They are more stable as compared to conventional liposomes and do not rupture while penetrating through the biological membrane.
- Engineered EVs can be targeted into or through specific tissues or biological membranes.

Title: Approaches For Gastrotentive Drug Delivery Systems

Speaker: Miss Asha Spandana, Lecture, JSS College of Pharmacy, Ooty

Over the past four decades, gastro retentive dosage forms have recently become a leading methodology in the field of site-specific orally administered controlled release drug delivery system. Gastroretentive dosage forms have the potential to improve local therapy with an increase of short gastric residence time and unpredictable gastric emptying time and decrease the variation in bioavailability which is unobserved, in other commercially available preparations. A gastro retentive dosage form will release the drug over an extended period in the stomach and upper GIT thus enhancing the opportunity for absorption. Various approaches have been proposed to control the gastric residence of drug delivery systems in the upper part of the GIT including floating drug delivery systems, high density DDS, mucoadhesive systems, swelling and expanding DDS, modified shape systems and other delayed gastric devices. They enable oral therapy by drugs with a narrow absorption window in the upper part of the gastrointestinal tract or drugs with a poor stability in the colon. Furthermore, the drug can act locally within the stomach and prolonged intimate contact with the absorbing membrane increases efficacy.

Title: Approaches For Gastrotentive Drug Delivery Systems

Speaker: Dr. N. Jawahar, Asst. Professor, JSS College of Pharmacy, Ooty

Drug delivery to the brain is a challenge, because this tissue benefits from a very efficient protective barrier. The BBB is a major barrier to the passage of active molecules from the blood compartment to the brain due to presence of tight junctions between the brain cells. Solid Lipid nanoparticles (SLN) are novel drug delivery systems prepared to pass through such efficient barriers and target the desired site. Solid lipid nanoparticle are tiny colloidal carriers composed of biocompatible/biodegradable lipid matrix that is solid at body temperature and exhibit size range in between 100-400nm. SLN combines advantages and avoids disadvantages of other colloidal carriers like liposomes, polymeric nanoparticles and emulsions. Among the different drugs only 5% of the

drugs treat the depression, schizophrenia, and insomnia (Ghose et al.,1999) The successful incorporation of Olanzapine, a poorly soluble drug, into SLNs by an emulsification and low temperature solidification method. The preparation of solid lipid nanoparticles containing Olanzapine and its Pharmacokinetic with tissue distribution studies were carried out in rats, following i.v. administration of the OZ-Sol.Solid lipid nanoparticles prepared with different lipids and surfactants were found to be stable over period of two years. The interaction of solid lipid nanoparticles with human granulocytes has been reported that surfactant influences the velocity of phagocytosis of SLN by human granulocyt.

Title: Pharmaceutical Nanotechnology In Tissue Engineering

Speaker: Mr. Karri V V S Narayana Reddy, Lecture, JSS College of Pharmacy, Ooty

Nanotechnology refers to the fabrication, characterization, and application of substances in nanometer scale dimensions for various ends. The influence of nanotechnology on the healthcare industry is substantial, particularly in the areas of disease diagnosis and treatment. Recent investigations in nanotechnology for drug delivery and tissue engineering have delivered high-impact contributions in translational research, with associated pharmaceutical products and applications. Tissue engineering is very fast growing scientific area in this era which is used to create, repair, and/or replace cells, tissues and organs by using cell and/or combinations of cells with biomaterials and/or biologically active molecules and it helps to produce materials which very much resembles to body's native tissue/tissues. From tissue engineering current therapies got revolutionised and life quality of several millions patient got improved. Tissue engineering is the connecting discipline between engineering materials science, medicine and biology. In typical tissue engineering cells are seeded on biomimicked scaffold providing adhesive surfaces, then cells deposit their own protein to make them more biocompatible, but unable to vascularise properly, lack of functional cells, low mechanical strength of engineered cells, not immunologically compatible with host and Nutrient limitation are a classical issue in

the field of tissue and tissue engineering. Through this seminar we will understand the technology involved, need and application of nanotechnology based tissue engineering.