

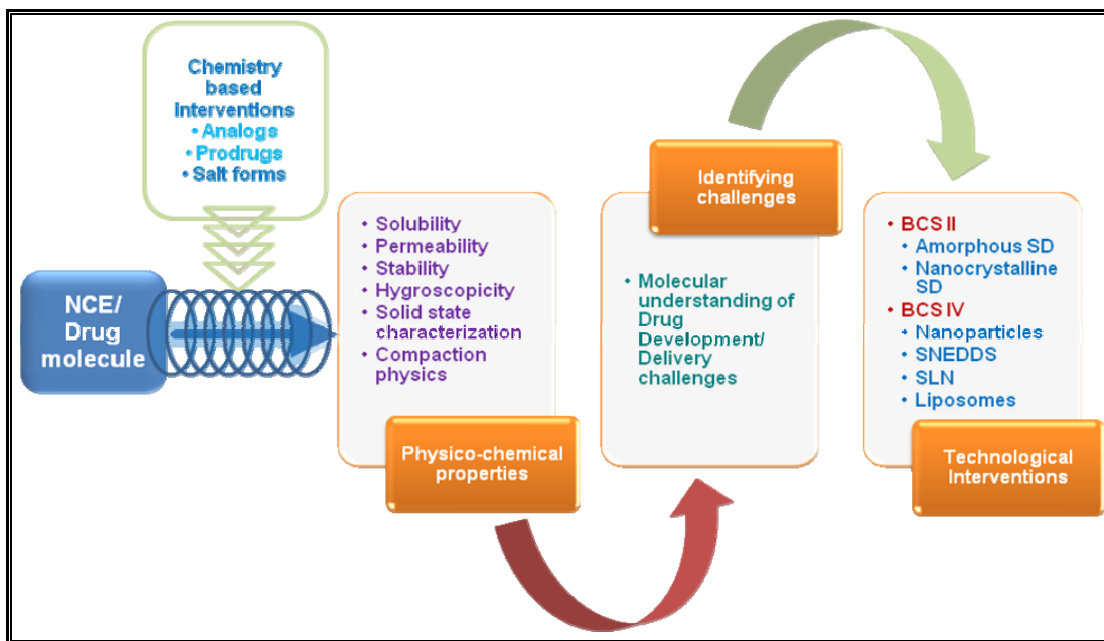


Arvind K Bansal, Ph.D. is currently Professor and Head, department of Pharmaceutics at the National Institute of Pharmaceutical Education and Research (NIPER), SAS Nagar, Punjab, India. Dr. Bansal is leading a group of about 15 post-graduate and doctorate students, in various areas of Pharmaceutics like pre-formulation profiling, solid state characterization, improvement of aqueous solubility, enhancement of oral bioavailability and compaction physics. Dr. Bansal holds a masters (1988) and doctorate degree (1993) in Pharmacy from the University of Delhi. Dr. Bansal served in the pharmaceutical industry as a research scientist in major Indian pharmaceutical companies – JK Pharmaceuticals (now called Regent Drugs after being acquired by Teva Pharmaceuticals, Israel) and Ranbaxy Laboratories Limited.

At JK Pharmaceuticals Dr. Bansal conceptualised, evolved formulation strategies, developed and transferred the technology to production shop floor of products belonging to dry powder injection, suspension for reconstitution, immediate release and delayed release tablets, oral liquid suspension and capsules.

At Ranbaxy Labs Limited, in addition to these activities Dr. Bansal was actively engaged in business, regulatory and legislative decision making process for timely launch of generics products in the domestic and international market. He also conceptualised and established a pharmaceutical research group focussing on pre-formulation and formulation development of New Chemical Entities (NCEs) leading to filing of two INDs. The activities of his group included characterization of physico-chemical (solid state pharmaceutics, aqueous solubility, pH solubility profiling, pH stability profiling, solid state stability, compatibility studies) and physico-technical (flow properties, hygroscopicity, and compaction studies) properties of the NCE, early formulation development, process development, fabrication of clinical trials batches and support to chemical and biology groups.

At NIPER (2000 till date) Dr. Bansal has developed expertise in characterization and stabilization of the amorphous form, polymorphism, pseudo-polymorphism, particle engineering, screening of salt forms and improvement of oral bioavailability. His group works with the mission statement - '**developing science based industrially viable pharmaceutical technologies**' and works closely with pharmaceutical industry to create opportunities for commercial exploitation of the products. His group has successfully executed more than 350 sponsored projects from Indian and overseas pharmaceutical companies, in the area of pre-formulation and formulation development. Dr. Bansal's lab has developed platform technologies to improve delivery of 'difficult-to-deliver' drug molecules in the areas of amorphous solid dispersions, barrier coated amorphous particles, nano crystalline solid dispersions and SNEDDS.



Research Philosophy

He is engaged in teaching of post-graduate classes of Solid State Pharmaceutics, Product Development, Pharmaceutical Production Technology, Regulatory Consideration for Formulation Development, and a Ph.D. level course on Technological Aspects of Oral Modified Release Dosage Forms.

Current areas of research include-

Pre-formulation profiling

- Physico-chemical characterization
- Salt form selection
- Permeability studies using Caco-2, everted sac and *in situ* technique

Pharmaceutical material characterization

- Polymorphism, pseudo-polymorphism
- Molecular understanding of amorphous form
- Compaction physics
- Understanding material behavior using Dielectric relaxation spectroscopy
- Surface characterization of pharmaceuticals

Solubility enhancement technologies

- ‘Stabilization’ amorphous form using solid dispersions
- Co-crystals

Nanotechnology in drug delivery

- Small molecule assisted nano-crystallization
- Nano-crystalline solid dispersions
- Self nano-emulsifying drug delivery systems

Particle engineering

- Co-processing to improve physico-technical properties

Formulation development of novel and conventional drug delivery systems

- Development of lyophilization cycle

De-formulation studies to aid development of generic products

AWARDS AND HONORS

Appointed as Editorial Board Member of “Pharmaceutics”, a journal published by MDPI (Multidisciplinary Digital Publishing Institute), Basel, Switzerland.

Appointed as Editorial Board Member of “Journal of Excipients and Food Chemicals”, an open access journal published from USA, with affiliation to International Pharmaceutical Excipients Council (IPEC).

Appointed as Editorial Board Member of "Recent Patents on Drug Delivery & Formulation", a Journal published by Bentham Science Publishers Ltd.

AAiPS Distinguished Educator and Researcher Award for the Year 2008:

This award is given to a faculty member from a recognized Indian Pharmacy education and research center. This award offers a grant, funded by AAiPS, that covers participation at the AAPS Annual Meeting, usually held in North America. The mission of American Association of Indian Pharmaceutical Scientists (AAiPS) is to provide a forum for discussion, continuing education, and exchange of ideas on advances in pharmaceutical sciences and technology. It has a membership of over 700 comprising of pharmaceutical scientists, engineers and suppliers.

Appointed as Editorial Board Member of International Journal of Biosciences and Technology

Innocentive Award, in the area of formulation development for 3 consecutive years (April 2005, May 2006, May 2007):

Innocentive (www.innocentive.com) is a web-based community, managed by a sister concern of Eli Lilly,USA and facilitates pharmaceutical scientists to address challenges faced by chemical and pharmaceutical companies, from around the globe.

OPPI (Organisation of Pharmaceutical Producers of India (OPPI) Scientist Award 2006:

This award was conferred in September 2006, for outstanding contribution in the area of Pharmaceutics. The OPPI, established in 1965, is a premier organisation of pharmaceutical manufacturers in India. Its membership consists of companies with international collaboration and large Indian companies. It represents primarily research based companies in India. OPPI is not only an industry association but also a scientific and professional body.

Overview of Publications and Industry Interaction

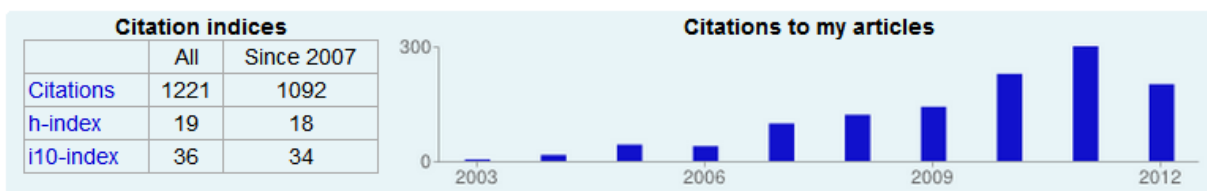


Arvind Bansal

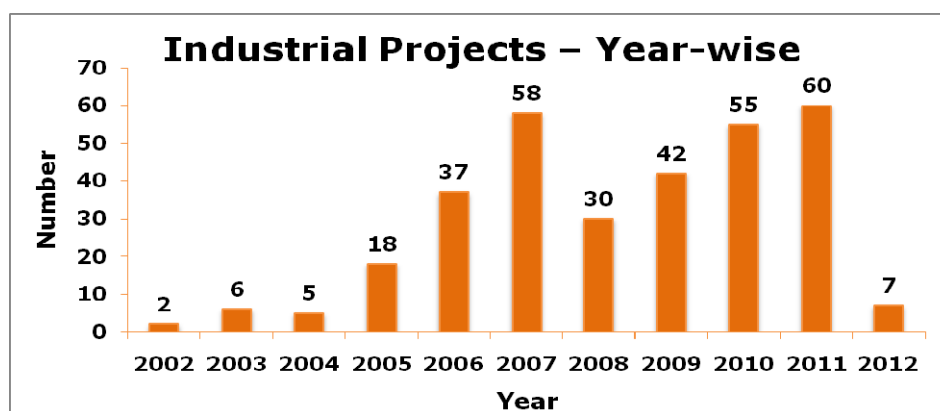
Professor of Pharmaceutics, NIPER

Pre-formulation studies - formulation development - material characterization

Verified email at niper.ac.in



Types	Patents		Publications		
	Granted	Applied	Research articles	Review articles	General articles
Numbers	4	27	92	23	18



SCIENTIFIC PUBLICATIONS

Patents

Granted

1. Bansal AK, Gupta P, Kakumanu V. ***A synergistic pharmaceutical composition of celecoxib with improved aqueous solubility.*** No. 248660. Granted on 02/08/2011.
2. Bansal AK, Verma S. ***A process for coating highly water-soluble drugs,*** Indian Patent No.: **243918**; Patent filing date: **03.12.2002**; Patent grant date: **11.11.2010**

3. Bansal AK, Gupta P, Kakumanu V. **A process for the preparation of celecoxib composition with improved aqueous solubility.** Indian Patent No.: 243294; Patent filing date: 18.11.2002; Patent grant date: 04/10/2010
4. Bansal AK, Puri V, Chawla HPS, Kaul CL. **Prolonged release injectable preparation of ketorolac.** Indian Patent Application granted on 04.06.2009, No. 234519.

Applied

1. Bansal AK, Amin A. **Method and Composition to retard sorption of preservatives to Plastics,** Indian patent Application No. 406/DEL/2011
2. Bansal AK and Puri V. **Fast dispersing multi layered stabilized amorphous particle and process thereof,** provisional Indian Patent Application No. 1735/DEL/2010, filed on July 23, 2010
3. Bansal AK, Puri V and Kohli G. **Quick disintegrating taste masked composition.** International PCT Application No. PCT/IB2009/007032
4. Bansal AK, Munjal B, Patel S. **Self-Nano-Emulsifying curcuminoids composition with Enhanced Bioavailability.** International PCT Application No. PCT/IB2009/005154. Filed on: 2nd April, 2009
5. Bansal AK, Munjal B, Patel S. **Novel self nano emulsifying curcumin (curcuminoids) composition with enhanced bioavailability.** Indian Patent Application filed 24th July 2008, No. 1776/DEL/2008.
6. Bansal AK, Goyal M, Roy I, Banerjee U C. **A stabilized protein composition.** Indian Patent Application filed 23rd May 2008, No. 1268/DEL/2008.
7. Bansal AK, Puri V, Kohli G, Rao PR. **Quick disintegrating taste masked composition.** Indian Patent Application filed on 16th July 2007, No. 1488/DEL/2007.
8. Bansal AK, Puri V. **Novel formulation of celecoxib.** Indian Patent Application filed on 18th June 2007, No. 1300/DEL/2007.
9. Bansal AK, Mohammad GA, Puri V. **An improved process for producing stavudine polymorph III.** Indian Patent Application filed on 12th June 2007, No. 1256/DEL/2007.
10. Bansal AK, Mohammad GA, Puri V. **A pharmaceutical composition.** Indian Patent Application filed on 24th May 2007, No. 1118/DEL/2007.
11. Bansal AK, Kumar L, Amin A, Jain R. **Novel acid addition salts of enalapril.** Indian Patent Application filed 16th May 2007, No. 1064/DEL/2007.
12. Bansal AK, Kumar S, Chawla G. **A process for producing spherical crystals of mebendazole.** Indian Patent Application filed 3rd May 2007, No. 951/DEL/2007.
13. Bansal, AK, Bansal P, Patel S, Munjal B, Jachak S, Kohli G. **Novel curcumin formulation.** Provisional Indian patent, Application no. 367/DEL/2007, filed on 22nd February, 2007.
14. Bansal AK, Kakumanu V. **Method of improvement of bioavailability of prodrug, using self emulsifying drug delivery system.** Indian Patent Application filed 23rd Nov 2005, No. 3136/DEL/2005.
15. Bansal AK, Kakumanu V, Arora VK. **Gastroretentive dosage form of cephalosporin, and process of preparation thereof.** Indian Patent Application filed 23rd Nov 2005, No. 3137/DEL/2005.
16. Bansal AK, Kakumanu V. **Method of improvement of bioavailability of prodrug using solid lipid nanoparticles.** Indian Patent Application filed 23rd Nov 2005, No. 3139/DEL/2005.

17. Bansal AK, Kakumanu V, Arora VK. **Pharmaceutical composition of cefpodoxime proxetil and cyclodextrin; and process of preparation thereof.** Indian Patent Application filed 23rd Nov 2005, No. 3140DEL/2005.
18. Bansal AK, Arora S, Kaushal AM. **Improved modified release ropinirole.** Indian Patent Application filed 13th Oct 2005, No. 2755/DEL/2005.
19. Bansal AK, Banga S, Chawla G. **A process of producing improved celecoxib crystals.** Indian Patent Application filed 10th Oct 2005, No. 2709/DEL/2005.
20. Bansal AK, Trasi N, Kaushal AM, Banerjee UC, Roy N. **A stable phytase preparation.** Indian Patent Application filed 24th Dec 2004, No. 2557/DEL/2004.
21. Bansal AK, Verma S. **A process for coating highly water-soluble drugs,** Indian Patent Application filed 3rd Dec 2002, No. 1210/DEL/2002.
22. Bansal AK, Gupta P, Kakumanu V. **A process for the preparation of celecoxib composition with improved aqueous solubility.** Indian Patent Application filed 18th Nov 2002, No. 1165/DEL/2002.
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24. Bansal AK, Nachaegari SK. **A pharmaceutical excipient having improved compressibility for application in direct compression tableting.** Indian Patent Application filed 16th Jun 2003, No. 807/DEL/2003.
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26. Madan S, Bansal AK, Arora VK. **Process for the preparation of acyclovir infusion formulation.** Indian Patent Application filed 3rd Nov 2000, Granted 13th Aug 2003, No. 982/DEL/2000.
27. Gogia A, Bansal AK, Arora VK. **Process for the preparation of aqueous pharmaceutical compositions of fluoroquinolones.** Indian Patent Application filed 7th Mar 2000, No. 197/DEL/2000.

Research Papers

1. Pawar, Y.B., Purohit, H., Valicherla, G.R., Munjal, B., Lale, S.V., Patel, S.B., Bansal, A.K., Novel lipid based oral formulation of curcumin: Development and optimization by design of experiments approach. International journal of pharmaceutics 2012 436, 617-623.
2. Khomane KS, Nandekar P, Bagul P, Wahlang B, Pawar YB, Meena CL, Sangamwar A, Jain R, Tikoo K, Bansal AK., *Mechanistic Insights into PEPT1-Mediated Transport of a Novel Antiepileptic, NP-647.* **Molecular Pharmaceutics** 2012 DOI: 10.1021/mp200672d
3. Aitipamula, S., Banerjee, R., Bansal, A.K., Biradha, K., Cheney, M.L., Choudhury, A.R., Desiraju, G.R., Dikundwar, A.G., Dubey, R., Duggirala, N., 2012. Polymorphs, Salts, and Cocrystals: What is in a Name? Crystal Growth & Design 2012, 12, 2147-2152.
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5. Khomane KS, More PK, Bansal AK. *Counterintuitive Compaction Behaviour of Clopidogrel Bisulphate Polymorphs.* **Journal of Pharmaceutical Sciences** 101(7):2408-2416
6. Upadhyay, P., Dantuluri, A.K., Kumar, L., Bansal, A.K., Estimating relative stability of polymorphs by generation of configurational free energy phase diagram. Journal of pharmaceutical sciences. 2012

7. Lale S V, Goyal M, Bansal AK. Development of lyophilization cycle and effect of excipients on the stability of catalase during lyophilisation, accepted for publication in ***Pharmaceutical Methods***, in January 2012.
8. Wahlang B, Pawar YB, Kabra D, Tikoo KB and Bansal AK. Accepted for publication in ***Arzneimittelforschung***, in 2011.
9. Amin A, Dantuluri AK and Bansal AK. Investigating the effect of humidity on the alpha-relaxations of low-density polyethylene using dielectric spectroscopy, accepted for publication in ***International Journal of Pharmaceutics*** in November 2011.
10. Patil SR, Kumar L, Kohli G and Bansal AK. Validated HPLC method for concurrent determination of antipyrine, carbamazepine, furosemide and phenytoin and its application in assessment of drug permeability through Caco-2 cell monolayer, ***Scientia Pharmaceutica*** accepted for publication in October 2011.
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13. Puri V, Dantuluri AK and Bansal AK. Barrier Coated Drug Layered Particles for Enhanced Performance of Amorphous Solid Dispersion Dosage Form accepted for publication in August 2011 in ***Journal of Pharmaceutical Sciences***
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15. Patel S, Kaushal AM and Bansal AK. The effect of starch paste and sodium starch glycolate on the compaction behavior of wet granulated acetaminophen formulations, ***Journal of Excipients and Food Chemicals*** 2 (3), (2011) 64-72.
16. Effect of counterion on the phase behaviour during lyophilization of indomethacin salt forms, accepted for publication in July 2011 in ***European Journal of Pharmaceutical Sciences***
17. Kumar L and Bansal AK. Effect of counterion on the phase behaviour during lyophilization of indomethacin salt forms, accepted for publication in June 2011 in ***European Journal of Pharmaceutical Sciences***
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Interaction with the pharmaceutical industry

Globalization of Indian pharmaceutical industry has introduced new scientific, regulatory and intellectual property challenges in the area of drug discovery and development. The industry expects academic institution to respond to their emerging needs in research and development. Realizing this, our laboratory has established strong ties with the Indian pharmaceutical industry. Our research activities are broadly divided into pre-formulation profiling and formulation development. Pre-formulation activities include solubility, permeability, stability, compaction physics and compatibility studies. Our laboratory has developed expertise in material characterization including salt form selection, polymorph studies, surface characterization and crystal engineering. Based on the pre-formulation profile suitable interventions for improvement of aqueous solubility and permeability are applied.

Indian pharmaceutical companies have made their strong presence globally in the generic market. We have significantly contributed to the development of generic formulations by proposing a decision tree for

reverse engineering of the innovator products. We have expanded the concept of 'sameness' of the generic formulations to the concept of 'sameness of formulation'. This leads to accelerated development of generic formulations and also improves probability of development of a generic formulation. [Bansal AK, Koradia V. *The role of reverse engineering in the development of generic formulations*. **Pharm Technol** 2005, 29(8), 50-55. (Aug)]. To this effect we have performed characterization of over 50 innovator formulations, for numerous leading generic exporters to advanced markets like USA and Europe.

Our laboratory has collaborated with numerous Indian and overseas pharmaceutical companies in the area of

- **Solid state material characterization**
- **Quantification of polymorphic forms**
- **Formulation development of conventional / modified release formulations**
- **Process optimization**
- **Development of value added generics**
- **Development of lyophilization cycle**
- **Technical support for patent litigation**

We have collaborated with numerous overseas and Indian pharmaceutical companies (a selected list is given below) on sponsored projects.

Medochemie Limited, Cyprus; Reckitt Benckiser, USA; JM Pharma, LLC, USA; DSM Anti-Infectives, Netherlands; United Laboratories, Philippines; Montajat Veterinary Pharmaceutical, Saudi Arabia; Sandoz Private Limited; Ranbaxy Research Labs; Dr. Reddy's Laboratories; Nicholas Piramal; Zydus Cadila Limited; Dabur India Limited; Panacea Biotech; Strides Arcolab; Jubilant Organosys; Natco Pharma; Alpha Drugs, Famy Care Limited; Alkem Labs; Promed Exports Private Limited; UCB Limited; Lupin Labs; Aurobindo Pharma; Macleods; Orchid Pharma; Ind-Swift Labs; Torrent Pharmaceuticals; Lupin Limited; Getz Pharma Research.