



Confederation of Indian Industry



सत्यमेव जयते
Government of Gujarat

CòE-NT

CENTRE OF EXCELLENCE IN NANOTECHNOLOGY

A CII Centre of Excellence supported by Government of Gujarat

Theme: "Clean and Green Nanotechnology"



Centre of Excellence in Nanotechnology (CoE-NT)

Confederation of Indian Industry (CII) takes forward its nanotechnology initiative through CII Centre of Excellence in Nanotechnology (CoE-NT) to promote clean and green nanotechnology processes for different industrial applications.

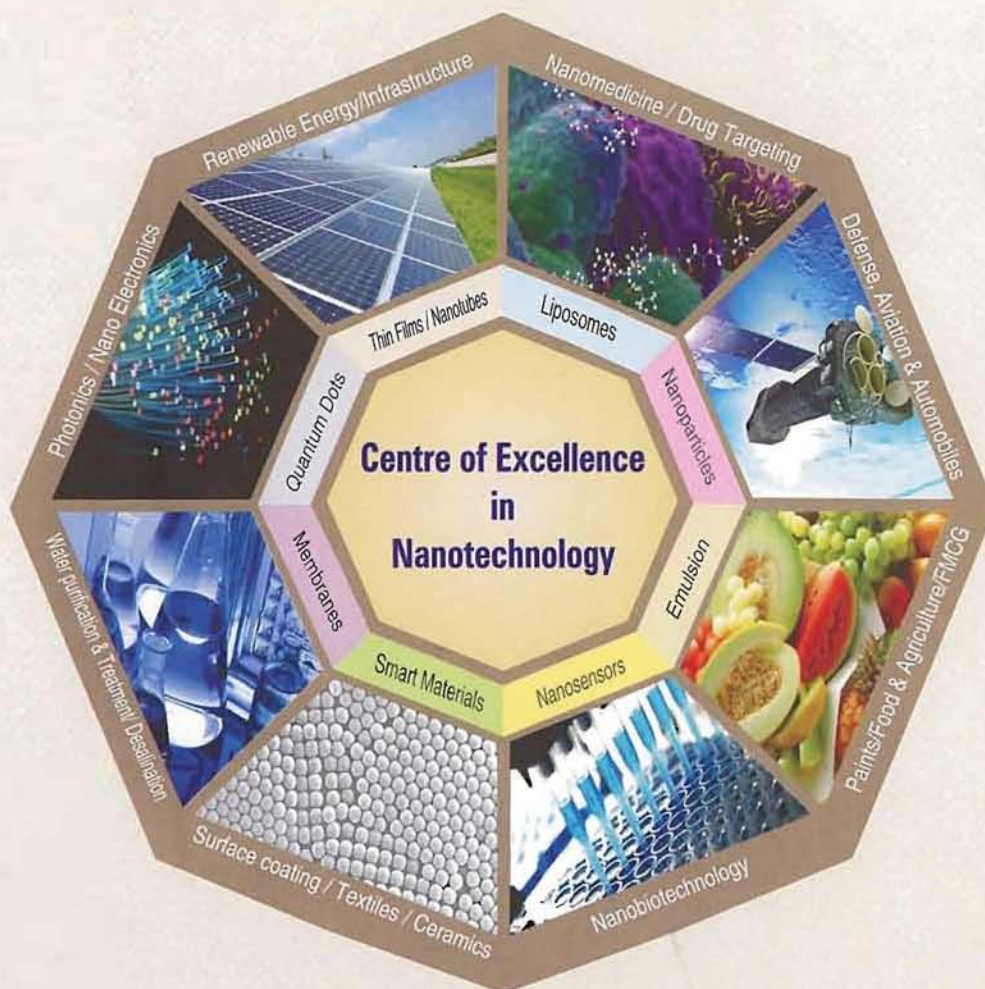
Objective :

Enabling Indian Industry to adapt green chemistry / nanotechnology in developing green processes / products to reduce the environmental pollutions and make the resource more sustainable.

Services & Activities:

- To encourage knowledge and experience sharing between Industry & Academics
- Conduct collaborative research to promote innovations
- Creating awareness through different events & programmes
- Facilitating the technology and training related needs of the industry / institution
- To establish policies and nanotechnology standards etc.
- To facilitate collaboration and technology transfer between academia and industry
- To identify the technologies, their evaluation, scale-up and commercialization
- Provide training to the industries / students on processes, instruments etc.
- Sector specific concept/white paper and policy watch
- Enabling best practices by promoting joint ventures, delegations and good practice projects
- Networking and stakeholder involvement

Applications of Nanotechnology



Platform Technologies under development:

1. Dyeing and Printing Sector:

Nanodyes impart better absorption & color intensity than traditional dyes, reduce the dye required and reduce costs, thereby eliminating the generation of toxic waste and protect the environment. We are working with local textile dyeing and printing industry for further penetration of this technology into their process (Patent Pending Technology).



2. Personal Care Sector:

Various Personal care products e.g. skin cream, tooth paste, face pack, shampoo, shaving gel etc. are under development using extracts from various natural materials. Developing nanoformulations of these ingredients can improve the permeability to provide better results by minimizing the side effects. Nanocurcumin formulations are under development (Patent Pending Technology).

3. Pharmaceuticals / Biotechnology Sector:

Various Nanotechnology based medicines are under development for drug delivering to target tissues in order to enhance the bioavailability and hence efficacy, reduce the drug side effects and improve the patient compliance. This would further help in reducing the costs and life-cycle management of the product.

At present, nanoformulation of Riboflavin is under development for treatment of ocular diseases and its use as nutraceutical (Patent Pending Technology).



4. Development of Novel Materials and Coatings:

Various nanomaterials are under development which can be used for coating applications in Automobiles, Defense, Ceramics, Energy, Paints etc. These coating are proposed to provide dust and moisture resistant surfaces for enhanced product efficiency. Use of these nanocoatings will reduce the quantity of material required and hence make the objects lighter and economical.

Technologies / Expertise Available

S. No.	Technology	Size	Applications
1	Nano-Curcumin formulations	< 100 nm	Anti-microbial Coatings, Cosmetics, Therapeutics, Dyeing & Printing Materials
2	Nano-Silver formulations	< 50 nm	Anti-bacterial Coatings, Cosmetics, Therapeutics
3	Nano-Iron formulations	< 50 nm	Diagnostics, MRI, iron deficiency anemia
4	Ocular Formulations	< 100 nm	Delivery of NSAIDs, Riboflavin etc.
5	Anti-cancer targeting	< 200 nm	Delivery of Cytotoxic drugs & Antibody Conjugated Nanoparticles
6	Product Stability Enhancement Technology	NA	Various proteins, Peptides, Antibodies, Chemicals, Polymeric conjugates & other liquid formulations

Provisional Patent Applications:




- Nanoformulations of Riboflavin for various industrial applications.
- Curcumin Nanoformulations.

Reports / Articles under publication:

- Technical report on "Recent Innovations in Solar Energy: Improving efficiency using Nanotechnology"
- Review article on "Historic Developments, Current Technologies and Potential of Nanotechnology Develop Next Generation Solar Cells with Improved Efficiency"
- Research article / abstract on "Development of Nanocurcumin Formulations for Wound Care Management"

R&D Partner: Nirma University, Ahmedabad

Posters:

Development of Curcumin Nanoparticles for Textile Applications^{*,5}
 Centre of Excellence in Nanotechnology (CoE-NT), Confederation of Indian Industry (CII), Ahmedabad.
 Institute of Pharmacy, Nirma University, S.G. Highway, Ahmedabad.

^{*} Technology available for out-licensing / collaboration
⁵ Patent pending

Contact: Dr. Ajay Gupta (ajay.gupta@cii.in)

1. Introduction

- Dye industry is facing many challenges including poor binding & absorption on-to fabric, effluent generation, toxicity and hence environment pollution.
- Nanotechnology may help in reducing the quantity of dye used, while providing better color efficiency and reduced effluent generation.
- Aim of this work is to develop curcumin nanoparticles to improve dyeing efficiency and color stability.

2. Methodology

- Curcumin nanoparticles were prepared by using solvent-anti-solvent technique.
- Exhaustive process was used for dyeing.

3. Results and Discussion

A. Particle size analysis

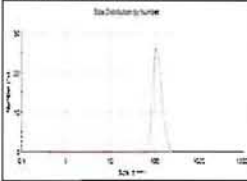



Fig 1: Typical size distribution of curcumin nanoparticles (~120 nm) by dynamic light scattering measurement.


B. Dyed cotton fabric

Cotton without treatment



Curcumin Nanocurcumin

Cotton with treatment



Curcumin Nanocurcumin

Fig 2: Dyed cotton fabric without treatment.

Fig 3: Dyed cotton fabric with treatment.

C. Comparative color strength

Para.	Ref. (w/o T)	NanoC. (w/o T)	Ref. (w. T)	NanoC. (w. T)	Chitosan	Alum	CuSO ₄
T ₅	100	935	100	270	263	180	150
X/S	3.80	35.57	9.12	24.65	24.05	16.50	13.73
X	61.07	70.64	57.88	64.32	65.13	63.45	56.88
Y	64.51	70.47	62.34	68.25	69.80	67.42	60.33
Z	47.75	42.96	27.54	27.13	27.12	27.01	27.80
L	84.23	87.22	83.09	86.13	86.90	85.71	82.01
a	-0.18	6.38	-2.80	-0.82	-2.29	1.04	0.73
b	20.15	3.59	43.78	49.63	50.98	49.12	41.51
c	20.15	31.72	43.87	49.64	51.03	49.13	41.51

4. Conclusion




- Curcumin nanoparticles were found to have size around 120 nm.
- Nanocurcumin dyed cotton fabric showed better colour strength than that with plain curcumin.
- Nanocurcumin penetrate deep inside the fabric and hence improved dyeing efficiency and colour stability.
- Since the quantity of dye required is reduced, effluents generation is minimized, thereby protecting the environment.

5. Future Developments

- Characterization of water and light fastness properties.
- Developments of new technology platforms (e.g. Indigo dye, Harad extract, Pomegranate extract etc.).

6. References

- [1] M Kakran et al, J Nanopart Res (2012) 14, 757.
- [2] M Hasan et al, International journal of scientific engineering and technology (2014) 3, 838.

Development of Curcumin Nanoformulation for Cosmetic Applications^{*,5}
 Centre of Excellence in Nanotechnology (CoE-NT), Confederation of Indian Industry (CII), Ahmedabad.
 Institute of Pharmacy, Nirma University, S.G. Highway, Ahmedabad.

^{*} Technology available for out-licensing / collaboration
⁵ Patent pending

Contact: Dr. Ajay Gupta (ajay.gupta@cii.in)

1. Introduction

- Curcumin is a chief chemical constituent of turmeric (*Curcuma longa*).
- Known for fairness, anti-microbial, anti-cancer properties etc.
- Using nanotechnology as a tool to enhance solubility & hence bioavailability.
- Aim of the work is to develop curcumin nanoformulation for cosmetic applications.

2. Methodology

- Curcumin nanoparticles were prepared by using solvent evaporation technique.
- Characterization of physico-chemical properties of nano curcumin
- Development of cosmetic formulations

3. Results and Discussion

A. Particle size analysis

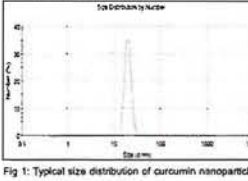




Fig 1: Typical size distribution of curcumin nanoparticles (~20nm) by dynamic light scattering measurement.

B. Curcumin Solubilization



(A)



(B)

Fig 2: (A) Nanocurcumin (20nm) showing enhanced solubility in water and (B) plain curcumin showing its water insolubility.

C. Nanocurcumin containing cream




Fig 3: Nanocurcumin skin cream.

D. Comparative evaluation of creams

Sr. No	Parameters	Nano-curcumin Cream	Marketed Product-1	Marketed Product-2
1	Colour	Bright Yellow	Light Yellow	Golden Yellow
2	Curcumin size (nm)	20 nm	-	-
3	Type of Emulsion	Oil in water (o/w)	Oil in water (o/w)	Oil in water (o/w)
4	pH	6.5	7.05	7.25
5	Consistency	V. Good	V. Good	V. Good
6	Homogeneous	V. Good	V. Good	V. Good
7	Spreadability	V. Good	V. Good	V. Good
8	Easy to remove	V. Good	V. Good	V. Good
9	Emollient effect	V. Good	V. Good	Good
10	Viscosity (0.6 RPM)	526 x 10 ³ C Ps	350 x 10 ³ C Ps	950 x 10 ³ C Ps

E. Permeation study

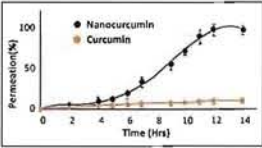


Fig 4: Permeation study of nanocurcumin

4. Conclusion

- Curcumin particle size was found to be around 20 nm.
- Consistent and comparable to marketed products.
- Better permeation and hence improved efficacy.

5. Future Developments

- Cream for the treatment of various diseases like psoriasis, acne, allergic reaction, skin infection etc.
- Toothpaste / Shaving cream / Face pack.
- Developments of new technology platforms (e.g. Silver / Gold / Aluminum / Iron / Silica).

6. References

- 1) C Moorthi et al, Asian Pac J Trop Biomed (2012) 11, 841.
- 2) A Sahu et al, Indo-Global Journal of Pharmaceutical Sciences (2011) 1, 77.

Events

One day workshop on Green Nanotechnology and Modern Industries

25 October 2013, Ahmedabad

The objective of the workshop was to create the awareness about green nanotechnology in the Gujarat state and optimize the immense business potential of nanotechnology. This workshop was fruitfully conducted to provide details of recent trends in this new area of technology to enable industry to get more sustainable and clean processes and products.

About 35 participants from the industries and academics attended the workshop and benefited.



First Meeting of the Governing Council of Centre of Excellence in Nanotechnology

21 January 2014, Ahmedabad

L-R: Mr Maheshwar Sahu, IAS, Co-Chairman, CoE-NT Governing Council and Additional Chief Secretary, Industries & Mines Department, Government of Gujarat; Mr R Mukundan, Chairman, CoE-NT Governing Council and Chairman, CII Western Region & Managing Director, Tata Chemicals Ltd. And Mr Anjan Das, Executive Director – Technology, CII).

One day workshop on Enhancing Drug Solubility and Bioavailability Using Nanotechnology

10 October 2014, Ahmedabad

Nanotechnology being an emerging industry, game-changing strategies for making the poorly soluble drugs bioavailable and hence can be utilized to make the number of drugs commercially successful. The objective of the workshop was to provide effective learning environment for young researchers from industry and academia to understand various nano approaches which can be utilized to enhance the solubility and bioavailability of the poorly soluble drugs.

More than 90 delegates from Industry and Academics attended the workshop and benefited.



One day seminar on Moving Towards Skin Perfection: Latest Innovations in Cosmetic Research

12 December 2014, Ahmedabad

The objective of the seminar was to discuss various facial skin ailments, their causes, symptoms, therapy and treatment to cure such ailments. This seminar became successful to identify the unanswered questions about skin treatment from the perspectives of those with the disorder, their parents/guardians/partners and treatment providers. Latest technologies in cosmetic therapy and ongoing research in cosmetics formulation was demonstrated in this seminar.

About 35 participants from the Industries & Institutions attended the seminar.

Industry Interaction Meet on Development & Commercialization of Biotechnology based Antibodies: Collaboration Opportunity with CCAB, Canada

11 February 2015, Ahmedabad

The Canadian research community has developed several patented therapeutic antibodies based technologies for treatment of various diseases e.g. cancer, infectious diseases and AMD etc. and demonstrated the proof-of-concept. The objective of this high profile scientific and commercial meet was to disseminate the technology offers and explore the collaboration/partnership opportunities for providing cost effective treatment options in India and globally.

More than 55 participants from various Pharma & biotechnology based Industry, academic Institutes, CROs, ophthalmic clinics, and government organizations attended this meet.



One day Seminar on Recent Innovations in Solar Energy (RISE 2015)

26 February 2015, Anand

The objective of the seminar was to provide an effective learning environment for researchers from industry and academia to understand various latest innovations in solar energy sector which can be employed to enhance the efficiency of solar cell as well as innovative approaches to fuel the solar industry. It also aimed at understanding the different approaches for Energy Conversion, Storage and Efficiency improvement.

This seminar was well attended by more than 120 participants including Solar PV researchers & manufacturers, raw-materials suppliers, consultants, Government bodies and Academics.



Participation of CoE-NT at various Seminars / Conferences

MSME Linkages 2013:

CII's 4th National Conference on the "Technology and Supply Chain Development for MSMEs-Driving Global Competitiveness";
30-31 August 2013, Ahmedabad



Dr. Ajay Gupta was invited as a speaker at AICTE Sponsored Faculty Development Program on "Importance and Application of Solid state in Pharmaceutical Formulation" organized by Saurashtra University; 11-23 November 2013, Rajkot

Topic: "Latest Trends in Pharmaceutical Product Development"

Dr. Ajay Gupta was invited as a Guest Faculty to deliver seminar on the "Iron Based Nanofluids for Biomedical Applications" at Nirma University; 13 December 2013, Ahmedabad

5th Gujarat Manufacturing Show 2014: "Growth and Sustainability of Electrical and Electronic Equipment Industry for Indian Power Sector"; 19-20 September 2014, Ahmedabad



KnowledgeXpo and India-US Technology Summit: Infinite Possibilities; 18-21 November 2014, Greater Noida

Dr. Ajay Gupta was invited as a speaker at 2nd National Conference on Pharma and Allied Industry: **PHARMA CONFEX 2014** organized by SAKET Project Ltd., Ahmedabad.; 19-20 December 2014, Ahmedabad

Topic: "Essential Prerequisites and Latest Trends in Formulation Development"



Dr. Ajay Gupta was invited to be a Session Chair, Panelist and a Speaker at **International Conference on Development and Manufacture of ADC: "Current Trend in Antibody Drug Conjugates"** organized by Select Biosciences India Pvt. Ltd., Chandigarh; 2-3 March 2015, Bangalore

Topic: "Engineering of Antibody Conjugated Nanoparticles for Targeted Drug Delivery"

Media Coverage



BioTecNika, Issue 1,
Vol 3, JAN-2015, Page no. 20



Pharmatutor, Vol 3,
Issue 2, Page no. 86



Cosmetic & Herbal News,
DEC-2014, Page no. 62



Cosmoprotech,
NOV-DEC-2014, Page no. 48

Canadian body plans research collaboration with drug firms

Aims to undertake research and manufacturing of cancer drugs

dna correspondent
@dnaindia



The research projects may not just be limited to cancer drugs but also extend to research of metabolic diseases like diabetes and other infectious & age-related illnesses.

Ahmedabad: Canada-based federally funded institution, the Centre for Commercialization of Antibodies and Biologics (CCAB) on Wednesday announced its plans to collaborate with Indian pharmaceutical companies with a view to carry out research and eventually

manufacturing of cancer drugs. Antibodies are the fastest growing area of therapeutics for the past decade and the trend towards antibody-based treatments and drugs is likely to accelerate in the years to come.

DR SACHDEV SIDHU, CEO, CCAB foundation of this collaboration. Canada India Business Exchange (CIBX) and their partners Confederation of Indian Industries (CII) held a think tank meeting for CCAB with leading CROs, pharmaceutical companies and regulators in Ahmedabad on

Wednesday. Dr. Sachdev Sidhu, CEO of CCAB says, "CCAB would like to see a coupling of its world class research capabilities in the area of antibodies and biologics with the best of India's clinical research companies. This should enable us to accelerate the development of therapeutic products and reduce the costs associated with them. Lower manufacturing costs will eventually aid in making drugs affordable." Sidhu added that the research projects that would eventually be finalized by October this year.

Canada to introduce cheaper drugs in India

Times News Network

Ahmedabad: India will be the first country where Canada will send products to lower prices for Indian patients. The move is part of a broader effort to make medicines more affordable in emerging markets. The Canadian government has announced that it will send a list of 100 drugs to India, which will be sold at a 10% discount to the price in Canada. The list includes drugs for cancer, diabetes, and other chronic diseases. The move is expected to save Indian patients millions of rupees.

DeshGujarat

Significant news in the Gujarat state

Reporters of Desh Gujarat

Canada's CCAB to introduce breakthrough Cancer drugs in India; 'Think Tank' meet in Ahmedabad

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Confederation of Indian Industry

About CII

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, playing a proactive role in India's development process. Founded in 1895, India's premier business association has over 7200 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 100,000 enterprises from around 242 national and regional sectorial industry bodies.

CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programs. Partnerships with civil society organizations carry forward corporate initiatives for integrated and inclusive development across diverse domains including affirmative action, healthcare, education, livelihood, diversity management, skill development, empowerment of women, and water, to name a few.

The CII theme of 'Accelerating Growth, Creating Employment' for 2014-15 aims to strengthen a growth process that meets the aspirations of today's India. During the year, CII will specially focus on economic growth, education, skill development, manufacturing, investments, ease of doing business, export competitiveness, legal and regulatory architecture, labor law reforms and entrepreneurship as growth enablers.

With 64 offices, including 9 Centers of Excellence, in India, and 7 overseas offices in Australia, China, Egypt, France, Singapore, UK, and USA, as well as institutional partnerships with 312 counterpart organizations in 106 countries, CII serves as a reference point for Indian industry and the international business community.

Contact

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