

# CSIR in Media



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## Ratan Tata, Rajan Anandan back cannabis research firm

CSIR

21<sup>st</sup> December 2017



In 2016, cannabis-related startups raised \$66.3 million in venture capital funding, mostly in the United States. Globally, the cannabis market is expected to hit \$31.4 billion by 2021.

**BENGALURU:** Ratan Tata, the chairman emeritus of Tata Sons, and Google India's managing director Rajan Anandan are among a group of investors backing the Bombay Hemp Company (Boheco), the first startup in the country to study the medical use of cannabis in partnership with the Council of Scientific and Industrial Research (CSIR). The Mumbai-based company, which has raised a seed round of Rs 6.25 crore from the marquee investors, along with CSIR will grow cannabis and study its medicinal properties for use in the treatment of epilepsy and breast cancer, as well as for palliative care.

"We already have our first batch of cannabis plants cultivated in Jammu, within the CSIR framework," said Avnish Pandya, co-founder of Boheco, which started out as the country's first industrial hemp startup selling products from clothing to nutritional seeds. The seed funding is primarily being used to hire scientists in India as well as globally from countries such as the Netherlands and business development executives, as well as for further research.

### Active Interest from Some States

Tata declined to comment on the story and Anandan remained unavailable to respond to ET's queries. Boheco's Pandya said his company would have greater clarity on product development next year, and expects that based on the regulatory process, the first products to hit the market will be for palliative care. "It could take from one year up to four years or more before the product is approved and hits the



market," he told ET. Jahan Peston Jamas, cofounder of Boheco said the company reached another milestone this year with the creation of nano carbon, a form of renewable energy from the hemp fibre, making it one of the only Asian startups to be invited to join the Singularity University Accelerator in California. In 2016, cannabis-related startups raised \$66.3 million in venture capital funding, mostly in the United States. Globally, the cannabis market is expected to hit \$31.4 billion by 2021, with the US currently driving 90% of the sales, according to a recent report from cannabis market research firm, the Brightfield Group. In recent years, China has also increased its focus on hemp cultivation, with the China Hemp Research Centre being set up in Beijing. Boheco has seen active interest from the state governments of Uttarakhand, Uttar Pradesh and a few other states for cannabis cultivation permits. Most recently, the startup was invited by the governor of Himachal Pradesh to collaborate with the state government to foster commercial use for hemp, according to company executives. Founded in January 2013, Boheco first began exploring the market through varied hemp products, beginning with clothing and now has both business and retail consumers. The company works with textile businesses, fabric suppliers and designers who source hemp fabric. It also sells its own clothing products online and in niche boutiques across different parts of India, including Jaipur, Goa and Rishikesh.

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## New light on Kala-Azar

CSIR-IICB

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Biologists have discovered a virus-carrying microbe, a close relative of the leishmania parasite, along with the leishmania parasite in kala-azar victims – a finding that may provide new leads for understanding and devising better ways to treat this disease and its complications such as post kala-azar dermal leishmaniasis<sup>1</sup>.

In recent years, *Leishmania donovani*, the parasite that causes kala-azar, has developed resistance to antimonial drugs. The other co-infecting pathogens, such as human immunodeficiency virus, have been found to intensify the burden of this disease, particularly in developing countries like India.

Scientists from the CSIR-Indian Institute of Chemical Biology, Kolkata and Banaras Hindu University, Varanasi, led by Subhajit Biswas, identified *Leptomonas seymouri*, a virus-carrying microbe in most of the blood samples of kala-azar patients.

The studied samples contained both drug-sensitive and drug-resistant leishmania parasites. The researchers say that the virus can activate specific immune cells, triggering the host's innate immune responses. This, in turn, might aggravate kala-azar and post kala-azar complications.

This work will possibly encourage further research towards the development of virus vaccines and antivirals for the management of kala-azar and its complications, says Biswas.

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## DNA-Based nanotherapy for cancer

CSIR-IMMT, IGIB

20<sup>th</sup> December 2017

Researchers have synthesised a novel type of DNA nanostructure that can inhibit the activities of specific cancer-causing tiny RNA molecules, making it potentially useful for treating cancers<sup>1</sup>.

MicroRNAs (miRNAs) are non-coding tiny RNA molecules that regulate the expression of many genes involved in various cellular processes, including diseases such as cancer. Recent studies have designed inhibitor molecules that can silence one type of cancer-triggering miRNA. However, such molecules cannot suppress cancers caused by multiple miRNAs.

To find an inhibitor molecule that can arrest cancer by blocking the activities of multiple miRNAs, scientists from the CSIR-Institute of Minerals and Materials Technology, Bhubaneswar, and the CSIR-Institute of Genomics and Integrative Biology, Delhi, led by Umakanta Subudhi and Souvik Maiti, prepared branched DNA nanostructures through a self-assembly process.

They modified the nanostructures in such a way that they can selectively bind to specific miRNAs that trigger breast cancer by silencing FOXO1a, a tumour-suppressor gene that encodes FOXO1a protein. This protein regulates glucose metabolism and other vital biological processes, but its levels are reduced in cancer cells.

In cell culture, the nanostructures retained their stability even after 36 hours and restored the levels of FOXO1a protein, inhibiting the activities of specific miRNAs that are known to initiate the unbridled growth of the cancer cells. Being biocompatible and easily modifiable, the nanostructures are potential candidates for developing safe cancer therapies, says Subudhi.

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## Highlights the importance of Tress for mankind

CSIR-IIIM

19<sup>th</sup> December 2017

Indian Institute of Integrative Medicine (IIIM), today organized 7th Tree Talk Anniversary on the theme “Aromatic Tree Diversity, Cultivation and Value Addition” under CSIR’s Aroma Mission” at IIIM Farm Chatha. Tree talk is an awareness activity which is based on voluntary participation hosted in the outdoors for nature education and conservation. The theme ‘Tree Diversity, Cultivation and Value Addition’ under CSIR’s Aroma Mission is aimed at boosting cultivation and value-addition of medicinal and aromatic plants for supply to industries related to aroma business and to the traditional system of Indian medicine.

Under the Mission, various economically important aromatic cops are being identified and promoted. On the occasion, the speakers highlighted the importance of organizing the event in raising awareness among the people to get familiar with neighbourhood trees, shrubs, creepers, herbs and other associated Entomo Avian which are helping in regeneration of forests. They said plants are valuable components of the global biodiversity. Among a large group of the plants many plants are significantly performing their applicability in multifold utility for human beings. They said that various plant parts like root, stem, and leaf are useful for specific purposes such as for medicinal value or for propagation. Modified plant parts like Bulb, Tuber, Rhizome, Corm etc. are also registered as useful plant parts for certain species. These structures are found to be useful for propagation as alternative source of the seeds and used for medicinal values.

The speakers said that in current scenario there is an urgent need for assessment, regeneration and conservation of these plants, trees for the posterity. The IIIM is a national Institute of the Council of Scientific & Industrial Research (CSIR) of India, with primary



focus of research on drug discovery from natural products (medicinal plants and microbial species). The programme was attended by Chief Conservative forests, Dr O.P. Sharma, Chief Scientist Dr Suresh Chandra, former Scientist Y.S. Badi, dignitaries from state administration and students.

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## Transforming agriculture in Kupwara through cultivation of high value aroma cash crops

CSIR-IIIM



19<sup>th</sup> December 2017  
Farms of Aroma Cash Crops in district Kupwara of Kashmir Valley” known as “**Project K-5000**” to utilize 250 ha of hilly marginal uncultivated land where agricultural activities are itself a big challenge for the economic benefits and welfare of farmers. The initiative has been taken by CSIR-IIIM jointly in collaboration with J&K State Science Technology and Innovation Council as a case study. Dr. Ram Vishwakarma, Director CSIR-IIIM Jammu throws light on the project “**K-5000**”, its objectives and the targets to be achieved for the benefit of farmers.

### Tell us about Project K-5000?

K-5000 is an umbrella project of **CSIR-IIIM** and **JK ST&IC** in district **Kupwara** in which 250 hectares (5000 kanals) of hilly, undulated and uncultivated land is being brought under cultivation of different aromatic cash crops and the main target is particularly rainfed or degraded area prone to soil erosion.

With the increasing number of farmers deserting their farm lands owing to low returns, deceptive fluctuations in market prices, inadequate irrigation facilities, accessibility problems to various technological interventions and improper channelization of farm produce to distant and demanding markets, the Council of Scientific & Industrial Research- Indian Institute of Integrative Medicine (CSIR-IIIM) Jammu has devised a plan to improve the farmers socio-economic conditions through the introduction of some promising aromatic cash crops suitable to the different agro-climatic conditions of the valley. In this regard, the Institute has embarked on a project “Establishment of Demonstration



### **Why have you chosen district Kupwara for this project?**

The district has a reported area of 67000 hectares (ha) as per revenue records out of which 49581 hectares is under the use of agricultural activities and 8504 hectares constitute barren and uncultivated land which is quite huge. If only this barren/unused land is brought under cultivation of different aromatic cash crops it will have a huge impact in reshaping the agro-economics, besides creating potential sites for eco/adventure tourism in the district.

### **Which crops are to be cultivated under Project K-5000?**

Considering the topography, agro-climatic and physical conditions of the areas identified at Kupwara, the aromatic crops which are suitable for such climatic and topographic conditions are Tagetus, Lavender, Rose scented geranium, Rose, Rosemary, Clarysage and Mentha species. These crops are hardy and have the capacity to grow well in degraded, waste-lands and rainfed soils which is the basic feature of hilly areas.

### **What are the production activities carried out in Project K-5000?**

The production activities which CSIR-IIIM is carrying under K-5000 involve developing quality planting material, developing demonstration farms at identified locations, standardization of cultural practices in GAP (good agricultural practice mode), harvesting and post-harvest processing, distillation technology, quality assessment: biochemical/molecular profiling.

### **What prompted CSIR-IIIM and JKSTIC to have Project K-5000?**

To improve livelihood and socio-economic status of small and marginal farmers as more and more farmers are leaving farming because of low farm income and to put wasteland and rainfed areas under cultivation of aromatic cash crops which not only boost the income but also diversify the agriculture sector by adopting aromatic crops like Lavender, Rosemary, Rose and Tagetus.



## What are the objectives and targets of Project K-5000?

The basic objective of the project is to demonstrate the potential of these crops by cultivation and post harvest management of these crops. We have successfully grown these crops and a model has been established for further adoption by farmers. Besides this our objectives include

- Extension of aromatic crops in District Kupwara and elsewhere in the State.
- Ensuring high profitability and improved economic status of farmers.
- Skill development and awareness of farmers, students, and rural unemployed youth through orientation and training programmes.
- Diversification of agriculture sector by providing alternate crops over the traditional crops for better returns.
- Utilization of degraded wasteland, rainfed and unproductive land.
- Entrepreneurship development
- Our target is to cover an area of 5000 kanals of degraded wasteland, rainfed and unproductive land in three phases over the period of three years 2017 to 2020 wherein the cultivation, processing, and utilization of different aromatic crops will be done.

## How much land was utilized in the Project K-5000 in the first phase (2017-2018)?

The target area of around 75 hac of land in phase one would be brought under intensive cultivation of Tagetus and Lavender. Tagetus was grown at different remote location at Machipora, Natnusa, Waisa Kaonar, Hafrada, Dard e Harri, Rengpath, Nagri, Kukroosa, Gonipora on the areas which are highly marginal undulating and steep. Lavender is being extended across different parts of Kupwara at Machipora, Natnusa, Dard e Harri, Kukroosa, Bahadurpora, Nagri and Gonipora and target area of 200 kanals has been earmarked to be brought under the crop in the current cropping calendar before the area experiences snowfall.



### **Is target area of 250 ha in Kupwara a State or farmers' land?**

Well initially the project aims at targeting the State land only. We will be extending these to the farmers' fields also gradually depending upon the farmers showing interest in the adoption of these crops.

### **How would you convince farmers to let their land be utilized in the project?**

Since the people of the adjacent area have seen the successful cultivation of Tagetus in the area, farmers are encouraged to see the results. They are willing to extend these crops to their own fields.

### **Who is executing, implementing and funding this project?**

The project is executed and implemented by CSIR-IIIM. However, the project is funded on 50-50 sharing basis between CSIR-IIIM and JK ST&IC.

### **What is the role of JK ST&IC in this project besides funding?**

JK ST&IC is providing the State land to be brought under cultivation of high value aroma cash crop which are Undulated, Marginal and steep.

### **Was there any resentment at grass root level to your activities under the project?**

Initially the farmers created some difficulty in implementation of project.

At one of the project site at Panditpora in Handwara, the farmers were reluctant to allow the operation under the project. However after the intervention of Honourable Minister for Science and Technology, Jenab Sajad Gani

Lone the work on sites restored. The support of the Honourable Minister has been pivotal on the ground for effective implementation of the project.



### **What was the approach of the local farmers at the start of the project?**

On the introduction of project farmers were skeptical about crops since the crops grow are new and they didn't have any idea about these crops. However we have harvested one flush of crops, results were encouraging, crop stand and its harvest was good.

The farmers were also oriented and sensitized about economic benefit of the crops as a result they are now pressing for the introduction of these crops to their field.

### **What extension strategy Project K-5000 is adopting to demonstrate the cultivation of these crops to the farmers?**

We are reaching out to the farmers via training programmes, workshops, on-farm demonstration, knowledge dissemination, and farmers-scientist interaction. Besides, we are also acting as a linkage between farmers and traders/marketing agencies.

### **How much cost effective is the cultivation of these aromatic crops?**

The cultivation of these aromatic cash crops is very cost effective as it yields revenue immediately. The traditional farming fetches only 10%-20% of the consumer price. Here the farmers will expect better returns in comparison to their traditional crops. In comparison to traditional cropping, where there is an increased incidence of diseases and pests, the occurrence in these crops is comparatively low because of their hardy nature thereby increasing returns with less input cost.

Plus they also require very less intensive agri-inputs and grow well under natural stress conditions, be it stress related to water, light, nutrients or salts besides that they are not damaged/grazed upon by wild and domestic animals thus requires less watch and ward. Certainly per hectare returns are far higher than the crops being grown in such areas.



## **How many folds will the income of farmers increase after cultivation of these crops?**

These crops are industrial crops and have their utilization in the aroma, food, flavouring and cosmetic industry. The target crops in the project are cash crops and are more remunerative as compared to other crops grown in the area.

## **What is its market size at State, the National and International level for these crops?**

There is an increasing demand for aromatic oils of lavender, Rose and other aromatic crops in current market scenario due to its flavoured eminence and fragrance. The recent trend is that the consumers are inclined towards the products that are produced naturally and have health benefits which have given it an increasing demand from the big economies of the world like USA, Europe, China and Australia etc. So the demand is more and the supply is less both in domestic and international markets.

*(The interview has been compiled by Roheela Kirmani – Project Assistant / Media Coordinator – K5000*

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## Former turmeric to clean biofuel: IIT, ICT, CSIR-CFTRI students win entrepreneurship challenge

CSIR-CFTRI



Members of the team that won the 24H Chrono Entrepreneurship Challenge. (Sourced)

**Roorkee** A team of young students from the Indian Institutes of Technology Delhi (IITD), Roorkee (IITR), Indore (IITI); Institute of Chemical Technology Bombay (ICT) and CSIR-Central Food Technological Research Institute (CSIR-CFTRI) have won an innovative business idea contest. The 24H Chrono Challenge was held this month at the Indian Institute of Science Education and Research Pune. The winners will be visiting France to participate in the final edition of the competition and explore an innovation hub in that country. About 56 students from all over India participated from institutes such as IITs, CSIRs etc. They were selected from applications that were invited in

19<sup>th</sup> December

October and were divided for the contest into eight teams with seven members, each with a different area of expertise.

Repaul Kanji, a PhD student from IITR worked in the winning team with two others from his institute (Vasundhara Jain, MTech scholar and Pritam Singh, PhD scholar, both from the biotechnology department). Others in the team were Anirban Kundu from IITD (MTech), Naresh Hanchate from ICT (PhD), Ankit Tiwari from IITI (PhD) and Vedashree M from CSIR-CFTRI Mysore. Each team was given 24 hours to figure out an idea and establish it as a business plan with all necessary strategies like financial planning, exit strategies, marketing and sales strategy etc. Their coach was Allan Rodriques, CEO of Maker's Asylum. Kanji's team focused on food processing, specifically on production of turmeric powder. It takes about a month for the rhizome (underground stem) of turmeric to harden for powdering, but one of the team members had a patent which cuts this



time from one month to eight hours. The residue from the powdering process is then used to make clean biofuel. “We build our plan around that” Kanji told HT. The contesting teams were guided by mentors and experts who helped them fine tune their business models. Experts selected from the public and private sector trained them on legal, commercial, and financial aspects related to the project.

The 24H Entrepreneurship Challenge, or ‘24H Chrono de ’Entreprenariat’, is a concept created by the French National Agency for Research and Technology (ANRT) and Novancia Business School to encourage the spirit of entrepreneurship among PhD students, and to equip researchers with the necessary skill sets to take their most innovative ideas from laboratory to market. Organised in France every year since France since 2011, it has now been brought to India as part of ‘Bonjour India’, a platform to push for innovation and creativity between France and India from November 2017 to February 2018.

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[Hindustan Times](#)



## The role of biorefineries in converting food waste into soaring economies

CSIR-IICT

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Researchers at the Council of Scientific & Industrial Research - Indian Institute of Chemical Technology (CSIR-IICT), Hyderabad are working on a set of integrated technologies that could solve two of the major challenges the world is facing today -- food wastage and energy deficit. The researchers discuss how biorefinery -- a facility that integrates biogenic waste conversion processes and technologies to produce fuels, power, heat and value-added chemicals -- can be a sustainable strategy for bioeconomy. Food waste refers to the decrease of food in subsequent stages of food supply chain that may be caused accidentally or intentionally, ultimately

leading to the generation of unwanted organic waste material. A report states that one third of the food produced for our needs, amounting to around 1.3 billion tons a year is wasted globally. Food waste is just not food wasted, but a lot more; land, water, energy and inputs -- all go to the bin along with the food. When the United Nations declared food waste as a global problem, it was reported that almost 8% of the greenhouse gas emissions comes from food waste. The other major source of greenhouse gas (GHG) emissions are fossil fuels, which are increasingly becoming unsustainable sources of energy with the world being 'energy hungry' more than ever. The current methods of energy production do not match the rate of consumption, and reducing GHG emissions with the advent of 'green' fuels are the need of the day. In the review study published in the journal Bioresource Technology, led by Dr. S. Venkata Mohan, Principal Scientist at CSIR - IICT, provides



an overview of present and futuristic technologies available to generate ‘green’ energy, and other chemicals from food and related biogenic waste products, in turn, escalating the bio-economy. Food waste predominantly constitutes organic compounds like carbohydrates, proteins and lipids (fats), which can be broken down to simpler compounds and then can be converted into a range of products by biological or bio-chemical reactions. Acidogenic fermentation or acidogenesis, for example, leads to the breakdown of organic compounds and conversion of these compounds into volatile fatty acids namely formic acid, acetic acid, propionic acid, butyric acid, iso-butyric acid and valeric acid in a cascade of biological reactions. Along with these acids, carbon dioxide and bio-hydrogen are also generated. Anaerobic digestion leads to conversion of these acids into bio-methane. Further optimizing the amount of bio-hydrogen and bio-methane produces bio-hythane. These acids are itself commodity chemicals and precursors for several other chemicals.

*“The calorific value -- the amount of energy produced by the complete combustion of a fuel -- of diesel is 45.5 Mega joule (MJ) /Kg and that of the bio-hydrogen is 141.80 KJ/Kg. On the other hand, one kilogram of diesel burnt under ideal conditions will produce 2.65 Kg of CO<sub>2</sub> and 1 Kg of petrol burnt under ideal conditions will produce 2.3 kg of CO<sub>2</sub>. However, bio-hydrogen when burnt will not emit CO<sub>2</sub>, making it an ideal green fuel”, says Dr. Mohan, talking about the greener aspect of bio-hydrogen.*

Biodiesel is gaining rapid interest towards replacing petroleum diesel to some extent. Biodiesel faces a disadvantage of oxidative stability due to which when the bio-fuel is not processed and stored properly oxidation happens. Hence, researchers are now working around this challenge. “Biodiesel used in automobiles is generally employed in mixtures from B5 to B20 (diesel with 5 and 20% vol. of biodiesel, respectively) depending on the location. Further, to improve biodiesel oxidative stability, antioxidants are added. Additionally, utilizing microalgae as feedstock for biodiesel production can address several disadvantages of plant based biodiesel to some extent. Microalgae can generate as much as 40 times more oil per acre than bio-oil producing plants and the oxidation stability of



micro algal biodiesel is more than plant based biodiesel, which means that it can be stored for a longer period of time when compared to plant based biodiesel”, says Dr. Mohan. The researchers also list ‘electro fermentation’ -- a process where electrodes are used to electrochemically control microbial fermentation -- as another promising method to convert organic sources into valuable chemicals and biofuels. “Electrode placement in a microbial environment creates a potential, influencing the rate of reaction by regulating the electron flow, thereby enhancing resource recovery from the bioprocesses”, explains Dr. Mohan. Bio-ethanol and biobutanol, common products obtained from the biochemical synthesis of solvents, could serve as alternative source of fuel in the near future. Food waste also acts as an abundant source of electrons for Electroactive Bacteria (EAB) -- a class of bacteria that are capable of transferring electrons outside the cells to an electrode or metal ore -- thus acting as a source of ‘bioelectricity’.

Scientists have also developed similar technologies to generate bio-fertilizers and bio-polymers, that provide ‘greener’ alternatives to what we currently use. The future holds a lot of promise to bioeconomy. According to a report published by BCC Research, the global market for biorefinery technologies will grow from \$466.6 billion in 2016 to \$714.6 billion by 2021, with a compound annual growth rate of 8.9% for the period of 2016-2021. Of course, from citizens building basic biorefineries at home to the policy makers and the government playing a major role in making this happen, a lot needs to be done to realise these revenues.

*“Steps must be taken for realizing the potential opportunities that exist with waste mining and biorefineries. Government can support biorefineries through soft loans or land allotments. The government's support for producing a long-term plan for a bioeconomy with incentive structure, policy and ameliorating market distortions will support bioeconomy”, says Dr. Mohan.*



Biorefineries indeed promise a revolutionising clean and green future we all look forward to. Who knows, the food that you throw today may charge up your phone tomorrow or, run your car!

*This article is based on a research paper titled “Food Waste Biorefinery: Sustainable Strategy for Circular Bioeconomy” published in Bioresource Technology Journal. Financial support was given through funding from CSIR in the form of Network Project and Department of Biotechnology (DBT) as research grant.*

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