

Issue
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TURNING POINT

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Inside

- [Dump the Dumping](#)
- [Posters Galore](#)
- [Efficient Protocol for Oyster Mushroom Cultivation](#)
- [Modelling the solutions](#)
- [Word of Mouth](#)
- [Addressing Malnutrition](#)

Domain Updates

The Energy group hopes to monitor the atomization of a biogas plant in campus to help in process optimization and predicting its variation in gas generation. In another project, an experimental biogas plant with various feeds and a 200 litre-capacity is to be tested, to understand its kinetics. A visit to Pune's Sahyadri Shikshan Sanstha has brought up the idea of a hybrid water pumping system for efficient irrigation in drawdown agriculture.

Kalpana 2016, the nationwide innovation and fabrication competition, is an initiative of the Education group to generate market-viable ideas. In its second edition now, it offers two events – Nirmiti – prototype-making and Drishtikon – poster-making. Also on the group's agenda is conducting a 'Fun in Fabrication' Workshop at the Product Realisation Lab and working on some new solutions after a visit to Vigyan Ashram, Pabal.



Segregating at work



Dump the Dumping

The Deonar dumping ground, India's oldest and largest dumping ground has spelled havoc, over time. If pollution due to the recurrent fires has resulted in numerous health issues, does IIT Bombay have a solution - to reduce its wastes from continual dumping at these landfills?

Mumbai's population, economy and urbanization have greatly accelerated the municipal solid waste (MSW) generation rate. The municipality responsible for waste management faces the challenge of providing an effective and efficient system to citizens, with lack of financial resources, manpower and adequate technology. Tata Centre for Technology and Design's solution of waste management and technology development could be the key here.

After several discussions with the concerned stakeholders (Municipal Commissioner and Chief operating officers of Municipalities), Tata Centre initiated discussion with a few

professors and students from various departments and formed a thematic group to efficiently manage campus MSW. The objective has been to identify, implement and develop technologies for generating energy out of the waste collected from the IITB campus and thereby reduce the amount of waste that goes to landfill.

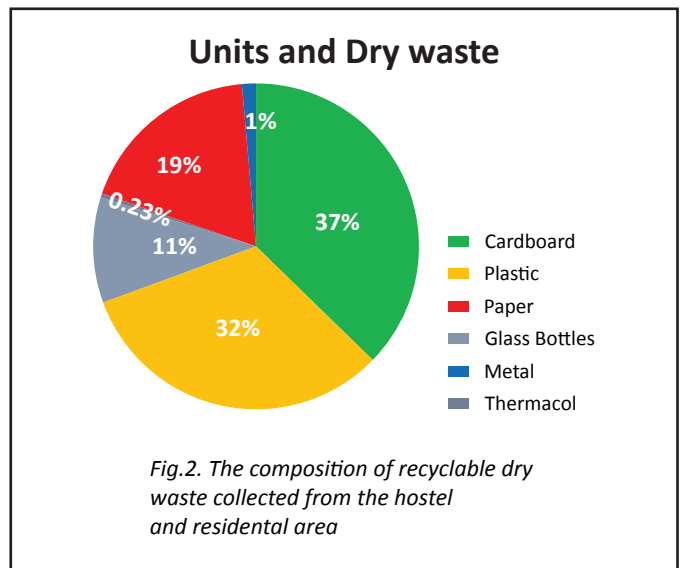
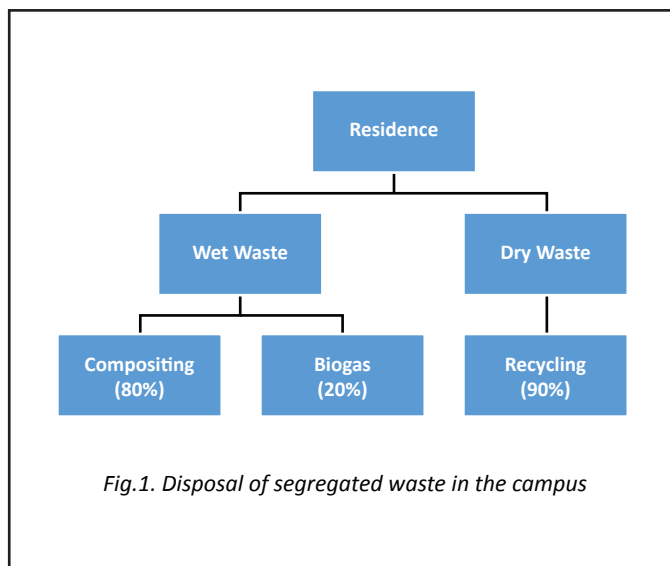
Call for segregation of waste :

A waste segregation system has already been in place in the hostels and academics within the campus. Through a collaboration with Dr Bhagwan Patil and his team at the health office, a full-fledged systematic segregation effort was undertaken to segregate the wastes

in residential buildings, with some residents practising it already. Dr. Patil and his team also tied up with Stree Mukti Sanghatana, a Mumbai-based NGO into waste segregation, to segregate the dry wastes into different sectors – cardboard, glass bottles, metal, plastic, paper, thermocol – which are recycled outside campus.

Methodology:

A residential building of 60 families or a group of two or three buildings with similar strength was considered. An information leaflet on ‘wet and dry waste’ was given to the residents two to three days ahead of the start date. The performance for each building was monitored for about two weeks, and people who failed to segregate wastes were repeatedly requested by the garbage collector and the Tata Centre representatives. The public health office took care of the dry waste.



Impact:

By February 2016, the residential area of campus remained segregated into wet and dry wastes. 80 per cent of the wet waste goes to the composting unit while the remaining 20 per cent is used in the biogas plant. Result: the green-gas emission has been reduced significantly – and the residents are better aware of what is happening to their wastes. A mobile app is also being worked upon to record the quality and quantity of wastes segregated in the campus. This model, if successful, can be replicated out of campus to reduce the burden on dump yards.

The broad objective of this group is to demonstrate an integrated approach towards efficient waste management with IITB campus as a test bed. This involves combination of various technological options such as rapid composting, bio gas production, bio-reactor landfill, garden waste pelletization and plastic pyrolysis. All these projects are underway and expected to demonstrate the concerned prototypes in the coming future.

- Jibi Jacob

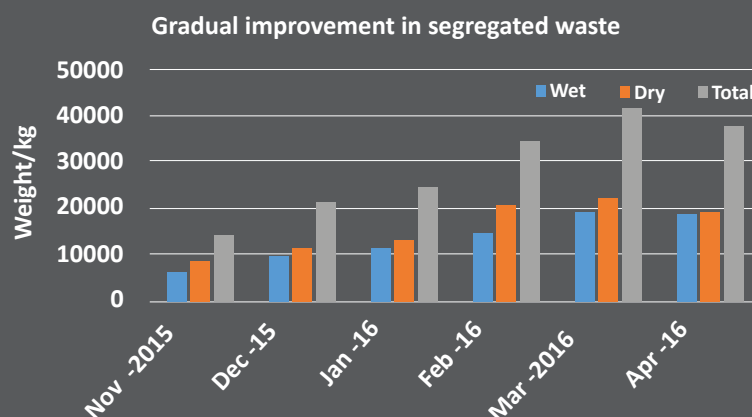


Fig.3. Segregation of waste in campus over the last six months

Addressing Malnutrition

The Tata Centre for Technology and Design at IIT Bombay has collaborated with Sion Hospital, SNEHA (a Mumbai-based NGO), and the ICDS (Integrated Child Development Scheme) for the Nutrition Project at the Dharavi slum, to address the problem of malnutrition.

The MoU signing event was held on the 12th of April, 2016 at IIT Bombay, where Prof. Narendra Shah from CTARA (Centre for Technology Alternatives for Rural Areas), Neena Shah More, Programme Director at SNEHA, Alka Jadhav, Professor, Paediatrics from Sion Hospital, Mr. Bhavane, CDPO ICDS-Dharavi, Prof. Sanjay Mahajani, Professor-in-charge of the Tata Centre and Prof. Ravi Sinha, Dean ACR, IITB, were present.

Prof. Narendra Shah announced that children from 300 anganwadis in ten beats of Dharavi will be selected for this project. A basic screening methodology will be used applying WHO's growth charts to detect children falling under the severely malnourished bracket.

As part of its activities in child malnutrition, CTARA had earlier partnered with the Sion Hospital to clinically evaluate the efficacy of locally produced therapeutic food called Medical Nutrition Therapy (MNT), designed to treat Severe Acute Malnutrition (SAM). Results of the clinical trial indicated that MNT was more effective than the standard protocols used in India.



TCTD in collaboration with SNEHA and ICDS, to address the problem of malnutrition

In this project, 200 children would be fed these special foods designed for MAM (Moderately Acute Malnourished) during three months using the CMAM approach through Anganwadi workers to fulfil fifty percent of their daily calorie requirement. Another 200 would be kept under control to evaluate the efficacy. Additionally, a follow-up period of six months would commence after the initial three months, to ensure that the children did not fall back into the malnutrition trap. Dr. Alka Jadhav mentioned that augmented home-type food-formulations used for children affected by MAM (Moderate Acute Malnutrition) would also reduce the probability of these children falling in the SAM category. Since these children were not at an immediate risk of dying, there would be enough time to administer these foods. Ms. Neena Shah

More of SNEHA now wished to bring sustainability of solutions by working closely with the ICDS and the communities.

As a part of this endeavour, Mr. Bhavane (ICDS-Dharavi) proposed that children in Dharavi must be grouped under the categories of 'migration', 'malnutrition' and 'sick children' before taking further steps. Along with this, a target should be set for a sustainable solution.

Mentioning Tata Centre's involvement in 38 seed projects from various thematic areas such as healthcare, energy, waste management, water and education, Prof. Sanjay Mahajani, PIC, TCTD said that this project is one of the first two translation projects of the Centre. In conclusion, Prof. Ravi Sinha, Dean ACR at IIT Bombay, highlighted the fact that technology could help fill the gaps in various situations and the rigorous scientific approach being brought by IIT Bombay could prove extremely fruitful in this project.

- Devika Gupta



Efficient Protocol for Oyster Mushroom Cultivation

Mushroom as an efficient means for conversion of agricultural wastes into valuable protein presents a huge potential for generating additional income and employment. In India, the full scope of mushroom cultivation is yet to be unleashed.

The cultivation practice has centred on white button mushrooms, accounting for 85 percent of the total production. Oyster mushrooms is not popular as it is comparatively a new crop in India and farmers lack enough awareness and training in its cultivation practices. If a simplified and low-cost technology in oyster mushroom cultivation were to be introduced, it would ensure an efficient protocol that could serve as a model solution to millions of marginal and small farmers.

Background:

Oyster mushrooms are the third largest cultivated mushrooms in the world. China, the world leader in oyster mushroom production, contributes to nearly 85% of the total world production of about a million tonnes. The present production of this crop in India is only around 1500 tonnes due to low domestic demand and improper cultivation techniques followed by the farmers. To receive training about better cultivation practices, there is just one resource at Mushroom Research Centre in Solan, Himachal Pradesh, where training is conducted to this effect, twice a year.



Getting started with the oyster mushroom

Potential:

Mushroom being an indoor crop, utilizes vertical space and requires only 25-30 litres water to produce 1 kg mushroom, thus offering a solution to shrinking agricultural land and water. Our country can emerge as a major player in mushroom production utilizing abundant agricultural residues. Mushroom cultivation recycles agro-residues, much of which is otherwise burnt in the field. In the changing agricultural scenario, oyster mushroom also fits well in secondary agriculture which will play a pivotal role. Mushroom cultivation being a low-cost technology has wider scope for spread and adoption in rural India where millions of small and marginal farmers often face seasonal poverty and unemployment.

The Problem:

Farmers have been cultivating only a few varieties of mushroom using mainly wheat and paddy straw as substrates. In fact, other bio wastes and agro residues are found to be more yield-efficient than traditional substrate. According to a literature survey and experiments done in the past, the minimum yield of oyster mushrooms is expected to be 200 - 250 gm/ kg of fresh substrates. Current cultivation practices followed by farmers have yielded low quality & quantity of oyster mushroom. This has specially been seen over a field visit to Diveagar, in Shrivardhan Taluka, Raigad district, Maharashtra. The farmers here have also been facing problems in the straw pasteurization techniques.

Results

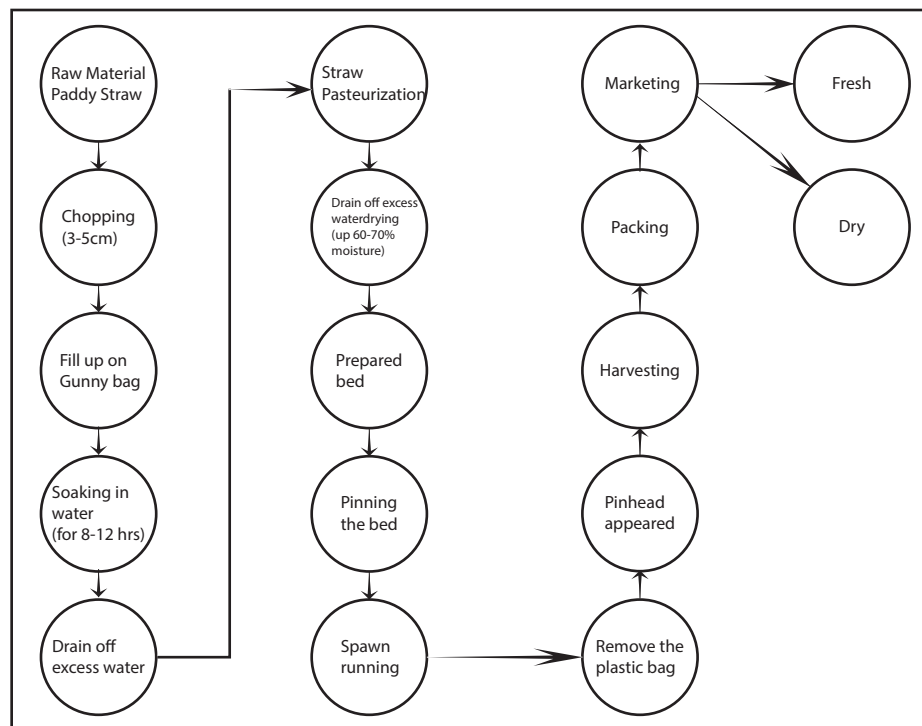


Vertical arrangements of mushroom bags

Plan of Action:

Further, after collaborating with the Gorus Organic Farming Centre at Nanegaon, Pune, it was decided to conduct field trials for oyster mushroom cultivation. A workshop that trained about 50 women and a small group of farmers in the latest oyster mushroom cultivation techniques followed, ensured skill development and employment generation. An initiative was then taken to standardize the protocol for Oyster Mushroom cultivation.

Flow Chart: Field Experiment



[Note: Throughout the field trials, temperature and humidity were monitored and controlled. Temperature was maintained at 25-30 degree Celsius. Humidity was maintained at an average of 60-70 % degree Celsius???.

Both temperature and humidity were maintained by covering the entire area with wet gunny bags.]

Data Recorded

• **Total Production:** 10 kg of straw used for production of oyster mushroom yielded 6.7 kg of oyster mushroom

Biological efficiency:

$$\frac{\text{Fresh Weight of mushroom} \times 100 \%}{\text{Dry weight of substrate}}$$

Biological efficiency is estimated to have reached a maximum of 67%.

Identified Problems

- Quality of spawn was variable.
- Temperature and humidity was poorly controlled
- Inefficient and high energy demanding

protocol (boiling at 75-80 degree celcius) for straw Pasteurization.

- Absence of a proper “protocol” for oyster mushroom production on a small to medium scale.
- Lack of proper training to operators.

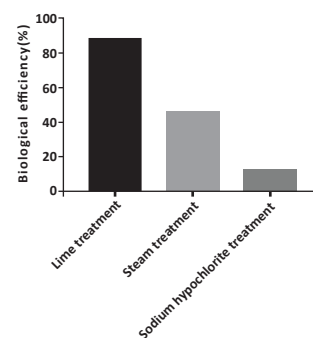
Modifying the Protocol

- Development of bio-efficient protocol for mushroom cultivation.
- Innovative alternatives for mushroom cultivation. (Forest residues, underutilized substrates, biomass pellets).
- Conducting workshops for training farmers.
- Reduction of total mushroom production cycle. (Which is currently 60-80 days).

Conclusions

- Different pasteurization treatments have significant effect on yield of mushroom.
- Lime treatment showed good results for yield among the 3 treatments for pasteurization.
- The variety of Oyster Mushroom selected for the study is well suited for the current agro climatic conditions.

Biological efficiency analysis of various treatments performed for pasteurization of Rice straw



- Chandrakala Sharma



Fruiting body developed on rice straw

Posters Galore

On the 5th of May, 2016, Lecture Hall 2 became the venue for Tata Fellows' first Poster presentation.

Open from **11:30 am to 3:30 pm**, many innovative posters based on the projects worked on by the fellows, students and staff in collaboration with the faculty, were exhibited. The posters were complemented by prototypes to picture the functioning of the products. Many members from the faculty along with students visited this event.

The Healthcare domain saw a maximum number of projects. One could easily spot Shefali Mittal with her portable and inexpensive microfluidic device that could efficiently separate RBCs and platelets from the blood. Hina Shah's project 'Role of technology in Cervical Cancer Diagnosis' showcased a device that screened women for cervical cancer and assisting video tutorials to train healthcare workers at cervical cancer screening in their locality. Aswathy Nandakumar developed a Low Power Receiver Front End for Biomedical Applications, for the real time monitoring of health.

Sayan Samanta worked on the 'Folic Acid - an Anti-Cancer magic bullet' project while Deepak Gupta developed Low Cost 3d Scaffolds for Bone Reconstruction, and Aayush Gupta showed the mobile phone assisted-biliscopes to screen neonatal jaundice.

As Y Shweta Hymavathi enthusiastically explained about her Non-Invasive delivery of NSAIDs for arthritis pain management, Akshay Subramaniam elaborated on the use of paper microfluidic platforms for biomarker-based detection of osteoporosis and Ashish Kumar proposed the use of indigenous oilseeds to formulate a health drink for MAM infants.



The posters ably complemented the prototype solutions

There were posters on energy where using garden-waste in a gasifier-stove to reduce clinker formation was observed by Sandeep Sharma, and Tirtha Sarathi Lodh's monitoring project for rural applications included a low cost, rugged solar PV micro inverter. The dark coloured roof coatings from Vikram Singh claimed to reflect heat radiations from the sun and Umang Shah's poster spoke of through the earth communication for underground mines.

The design and fabrication of an arecanut harvester by Pratik Gadkar and team imbued a promising streak in the Agriculture and Food domain. Sangeeth Sankar's project on a seed storage system for community based seed banks of marginal farmers was equally intriguing. Another change was a video in the domain of housing that showed just two people doing the assembly of a

house in a mere three hours. Vishal Bhushan Jha illustrated his project - Affordable Housing for Urban Slums, through this detailed account.

Karan Vohra's presentation in the Education project aimed at creating solutions in resource-constrained areas to facilitate English language learning, through animated stories and rural narratives. Tapan Kumar's 'Participatory Design with Bhil Artists' had its approach as participating with Bhil artists along with the designers.

Finally to tap the potential demand for water and its purification, Ramprasad V chose to employ simple technology of ceramic filtration in the fabrication of a portable water purifier for rural areas. The interaction over those few hours presented a whole new riot of colours and myriad of ideas.

- Devika Gupta





Word of Mouth

(These students have just completed their tenure as Tata Fellows)



Tirtha Sarathi Lodh

M.Tech, Power Electronics and Power Systems branch of Electrical Engineering Department

Project: Low cost solar PV Micro Inverter

Motivation: Doing research in an interdisciplinary environment with exposure to end to end innovation

TCTD experience: During the last two years, attending workshops helped me to explore technologies beyond my own research field. The Gadchiroli visit helped to empathize with the BOP's needs. At MIT, taking in the research methodologies and work cultures was like a dream come true.



Sayan Samanta

Department of Metallurgical Engineering and Materials Science

Project: Functional nano-hybrids for cancer treatment

Motivation: Moving out of the comfort zone to explore other interdisciplinary areas

TCTD experience: Technical inputs helped us establish a product based start-up, from scratch to deployment. We Tata Fellows, evolved from being an eclectic group to a gang of friends over lectures, presentations, and the Gadchiroli and MIT trip. TCTD made work fun even while the chord of dissonance struck, a few times. All one happy memory!



Akshay Subramaniam

M.Tech, Chemical Engineering Department

Project: Point-of- care Diagnostic for Osteoporosis

Motivation: To broaden my engineering skills and obtain hands-on exposure to subjects outside chemical engineering

The TCTD experience: The project has been quite challenging, which involved challenges such as miniaturising a complicated multi-step reaction. It has been quite a rewarding experience, especially in terms of applying my undergraduate studies in an entirely new setting.



Aayush Gupta

M.Tech, Biomedical Engineering at BSBE Department

Project: Jaundice diagnostics in neonatal care

Motivation: The collaboration that the Tata Centre has provided us by bringing different domains to one place

The TCTD experience: The relation with TATA centre will remain forever and I can never forget each amazing moment I spent with the people here. The high end fabrication lab has helped to make our end to end innovation, more formal and presentable.



Ramprasad V.

M.Tech, Technology and Development, CTARA

Project: Design and Fabrication of Portable Water Purifiers for Rural Areas

Motivation: Upholding the faith that IITB, Tata Trust and my parents have in me, and doing something productive.

The TCTD experience: It's been a fantastic experience doing prototype development in Tata Centre's Product Realisation Lab, writing for the newsletter, being part of the Water discussions, visiting MIT and Gadchiroli and interacting with people of various backgrounds.



Deepak Gupta

M.Tech, Chemical Engineering Department

Project: Low cost 3D scaffolds for bone reconstruction

Motivation: Addressing the basic problems of society which affects the lower and middle class sector.

The TCTD experience: From the first batch of Tata Centre, I'd be glad if TATA Centre continues to take up projects like this in healthcare and in other fields to provide better and economic solutions to the developing countries.



Modelling the Solutions

The final presentation put together by Tata Fellows in their first year took place on the afternoon of 3rd May 2016. Students presented in groups on varied topics and also demonstrated the workings of their prototypes.

Driven by the benefits of low cost composting, Group A ideated a single rotating drum. This drum was proposed to have two compartments meant for continuous composting and daily waste collection respectively. The creation of their prototype involved the usage of various machines like lathe, band saw, bench grinder, jigsaw, hand drill, among others.

An environment friendly electric bicycle was the brainchild of Group B. Applying a funnel approach, they selected electrical sub-assemblies, consequently choosing power transmission and electrical power sources. The prototype of the motor mounting plate was created in the form of an acrylic layer cutting sample at the Tata Lab.

Group C highlighted the tediousness and inefficiency in sorting heavy and light materials from food waste in campus. After discussions with experts, the team decided to formulate their ideas along the lines of Ball Milling. A prototype created mainly using drilling and grinding machines was showcased.

A newly designed Viscometer was also discussed. Group D ideated this device in an attempt to find another method to identify the striking point in jaggery making. It was proposed to create a rotating cylinder which would be filled with fluid. The prototype of the cylindrical rotating shaft was created using acrylic plates.

- Devika Gupta

Editorial Team: Gayathri Thakoor & Devika Gupta
Design Team: Mrunal Phansalkar & Hiren Mone
Photo Credit: Dr Suhas Zambre & Romit Patil
Support: Dr Jibi Jacob, Suhail Shaikh

Tata Centre Office, 2nd Floor, L2, Lecture Hall Complex(LHC),
Opp.KReSIT, IIT Bombay, Powai, Mumbai-400 076, India

www.tatacentre.iitb.ac.in