SEED COMMUNICATIONS  
A Quarterly News Letter

SEED AND CSIR - CFTRI ENTER INTO STRATEGIC PARTNERSHIP TO FURTHER R&D ON SOLAR ENERGY BASED NEW AND INNOVATIVE FOOD PROCESSING TECHNOLOGIES

We are happy to report that Society for Energy, Environment & Development (SEED) has entered into a strategic partnership with CSIR - Central Food Technological Research Institute (CFTRI), Mysore and entered into a Memorandum of Understanding on 12th August 2019 at Hyderabad. Dr. K.S.M.S. Raghava Rao, Director CFTRI, Mysore and Dr T. Jyothirmayi, Head, CFTRI Resource Centre, Hyderabad visited the SEED R&D Centre on 12th August 2019 for the purpose.

In view of synergy in the objectives of the two institutions, it was felt desirable that CSIR-CFTRI and SEED enter into a Memorandum of Understanding (MOU) to further promote cooperation and collaboration in Research and Development Projects and Training endeavors. The MOU was signed by Dr. K.S.M.S. Raghava Rao, Director, CSIR-CFTRI and Prof M. Ramakrishna Rao, Founder & Director-R&D, SEED.

R. Shyamala,  
General Secretary, SEED

FOR SOLAR DRYERS AND SOLAR PROCESSED FOOD PRODUCTS CONTACT :

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<table>
<thead>
<tr>
<th>AVAILABLE PRODUCTS:</th>
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<tr>
<td>Roll Box - 100 gm</td>
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<tr>
<td>Mango/Sapota/Durian/ Fig/Pineapple/ Jackfruit/Mixed Fruit</td>
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<tr>
<td>Fruit Bars - 100 gm</td>
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<tr>
<td>Mango/Sapota/Guava/Mixed Fruit</td>
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<tr>
<td>No Sugar added Mango bar - 100 gm</td>
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<tr>
<td>Fruit Bars - 25 gm</td>
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<tr>
<td>Mango/Sapota/Guava/Mixed Fruit</td>
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<tr>
<td>Regal Malt - 20 gm</td>
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<td>Amla Supharn - 30 gm</td>
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<td>Curry Leaf Powder - 30 gm</td>
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Green leafy vegetables (GLVs) form an important part of the diet of people. Green Leafy Vegetables are known to be the rich sources of nutrients like calcium, iron and phosphorous, vitamin C, carotenoids, chlorophylls, apart from dietary fiber, protein and bioactive compounds such as total polyphenols and total flavonoids. These bioactive compounds act as antioxidants and protect human body against degenerative diseases, such as heart diseases, tumors and aging processes.

GLVs exposed to browning, cooking/ frying process before consumption facilitates easy digestion, increase in sensory parameters, and safety in terms of microbiology, bioavailability of bioactive compounds and retention of antioxidant activity. Both cooking in water or frying in oil enhances total polyphenols, flavonoids, and antioxidant capacity compared with fresh leaves. Blanching of GLVs at 80°C for 1 min and treatment with 0.5% potassium metabisulphite (KMS) shown a good retention of vitamin C to preserve nutritional quality and antioxidant activity. Extensive studies on Solar Drying of GLVs such as Amaranth (Amaranthus viridis), Curry leaves (Murraya koenigii), Gongura (Hibiscus cannabinus), and Mint (Mentha spicata) were carried out in India and abroad and it was found that the dried products had very good retention of essential nutrients and possessed excellent organoleptic and rehydratable qualities.

The GLVs being highly perishable in nature, have very short shelf life. Drying is one of the oldest technologies to preserve the agricultural produce with lower water activity for longer period with dense nutrients in and product. Nowadays, solar drying has become most preferred due to favourable economics, simplicity of operation and use of green energy. The solar drying system is highly dependent on solar radiation and ambient temperature. Work done on solar drying of green leafy vegetables with suitable UV protection at SEED, Hyderabad as well as in Tanzania have shown very encouraging results in terms of organoleptic, rehydration and cooking quality as well as good retention of essential nutrients and bioactive compounds in solar dried GLVs. Dried green leaf powders were used in the preparation of various traditional food products, leaf mixtures and instant spice mixes with good sensory acceptability.

CFTRI Resource Centre, Hyderabad worked on dehydration of Boerhavia diffusa, a lesser-known leafy vegetable known for its health benefits... It is known to help in reducing glucose levels, creatinine and phosphate levels in blood serum and reduce the need for dialysis treatment in people with critical kidney disease. Experiments were conducted at CFTRI - RC, Hyderabad to study the effect of different drying methods such as solar, sun, shade, vacuum, microwave and cabinet tray drying on B. diffusa. The results indicated lower polyphenol content (592 mg/ 100 g) and higher antioxidant activity (IC50 values of 4 mg/ml and 0.5 mg/ml for DPPH and ABTS assay) for solar dried leaves compared to the product obtained by other methods of drying. The tray dried leaves exhibited higher polyphenol content (721 mg/100 g) and lower antioxidant capacity (IC50 values of 8 mg/ml and 0.75 mg/ml for DPPH and ABTS assays). Solar cabinet drying was found to be the best technology to preserve leafy vegetables with high nutritious value and antioxidant activity, which can be recommended for farmer producer organisations (FPOs) and researchers.
**SOLAR DRIED DRAGON FRUIT BAR**

Dragon fruit is one of the tropical fruits under the cactus family. In India, Dragon fruit was introduced into India in late 1990s and is currently grown in Andhra Pradesh, Telangana and Karnataka States. Dragon Fruit is gaining importance as a delicious table fruit with many health benefits. Mainly there are two types of dragon fruits cultivated in India, i.e., pink dragon fruit (Hylocereusundatus) and the white dragon fruit (Hylocereuspolymyrsus). Dragon fruit shows future promise in India as a sustainable horticulture crop.

While processing technologies for value added products are readily available for indigenous fruits, the same are not readily available for exotic fruits like Dragon fruit. In recognition of the need to develop post-harvest technologies for Dragon fruit, work was undertaken at SEED - R&D Center to develop the technology to convert the Dragon fruits into ready to eat and nutritious bars using Solar drying processing.

**HEALTH BENEFITS OF DRAGON FRUIT:**

Dragon fruit is rich in nutraceutical and nutritional attributes. It is credited to lower blood sugar in type 2 diabetes.

Eating fruit is considered beneficial for regulating carbohydrate metabolism, strengthening bones and teeth, healthy blood and tissue formation, strengthening immune system, faster healing of bruises and wounds, respiratory tract infections etc. Dragon fruit also acts as a mild laxative due to substantial fibre content.

**NUTRITIONAL VALUE:**

- Energy: 60 Kcal
- Carbohydrates: 12.94g
- Sugars: 7.65g
- Dietary fiber: 2.9g
- Protein: 1.13g
- Vitamin A: 59 IU
- Vitamin C: 2.5mg
- Calcium: 107 mg (Source: USDA Nutrient Database).

**DRAGON FRUIT BAR:**

Fully mature, soft and fresh dragon fruits were selected, washed, peeled and cut into pieces. These pieces were made into pulp using pulp extractor. Dragon fruit pulp was heated at 90°C with constant stirring to inactivate the enzymes. The basic ingredients of this fruit bar are Dragon fruit puree, pectin powder, sugar, water, glucose syrup and Class II preservatives. Fruit puree and sugar syrup were mixed in a blender for 2 minutes before adding the other ingredients.

The dragon fruit mixture was spread on stainless steel trays and then dried in a solar cabinet dryer at 55 to 60°C to a moisture content of 12%. The dried sheets were de-panned, cut into slabs of suitable size and packed in suitable packing material.

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**SEED’ JOINS HANDS WITH THE ENERGY AND RESOURCES INSTITUTE (TERI) FOR A PROJECT SPONSORED BY INDO-US SCIENCE AND TECHNOLOGY FORUM**

Society for Energy, Environment and Development (SEED) and The Energy and Resources Institute (TERI) have been jointly awarded a Project on "Solar Dryer Based Self-Employment Model for Tribal Communities, Women and Differently Abled Persons" by the prestigious Indo-US Science and Technology Forum, New Delhi.

TERI and SEED propose to work on the novel concept of utilizing Solar Energy based hybrid solar biomass dryer technology (including thermal storage) to create sustainable self-employment and livelihood opportunities to families, especially tribal women and differently a able persons. It is proposed to adopt a community based implementation approach employing 5 solar dryers systems in 5 clusters to create sustainable and cost efficient business model for marketing the value added products in urban and semi-urban markets.

The proposed project is expected to have highly significant impact on the tribal and other vulnerable sections of population in terms of generating and augmenting their income levels.

The prestigious project was awarded by the Ministry of New and Renewable Energy (MNRE), US Embassy and Indo-US Science and Technology Forum (IUSSTF) at a ceremony held on 20th September 2019 at New Delhi.

SEED looks forward to successfully associating with TERI on this important project and accomplish results that would impact the livelihoods and well being of rural and tribal and differently abled population.

Upon successful completion of this project, it is proposed to replicate the same nationally and across other developing countries.

By Dr. M.M. Krishna