National Engineering Research and Development Centre of Sri Lanka

NERDC NEWS

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NERDC provides an innovative solution resolving key issue of hygienic re-filler for drinking water industry: An Automated 19 Litre Water Bottle Washing Machine

The concept of "drinking water in a bottle" (bottled water) was introduced to Sri Lankan market during the last two decades of the 20th century. Since then, the demand for bottled water has increased tremendously due to various reasons by now. The continuous development of tourism, rapidly grown health issues due to unsafe drinking water, improved lifestyle of the people, increased undesired levels of pollution in surface & ground water, soil pollution, incurred natural disasters and social issues are to name a few. Although a proper regulatory framework was not applied for bottled water manufacturing industry at the inception, it is under the strictly levied regulations today.

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NERDC way of discussing ideas

Adding a remarkable page to the NERDC history, the NERDC research fellows have formulated a Journal Club to advance engineers' exposure and their confidence. There was a journal club discussion among engineers & interested technical staff on "Hydro Electricity driven drip irrigation systems: potential & constraints in Sri Lanka" by Eng. Sunil Karunawardana and Eng. H.A.K. Hapuarachchi. Under the peer learning program, for the month of July 2021, only one session was able to be conducted using an internal resource person. The presentation "Product Development" was conducted by Diputy Director General - Services Eng. A.A.S.P. Jayasinghe. The presentation was to understand the principles of product development, current trends in product development, and how to implement them to improve NERDC products. The Chairman, Director General, senior management and other staff members of NERDC actively participated in the session.



Eng. Sunil Karunawardhane, Eng. Ashan Krishantha and Eng. A.A.S.P. Jayasinghe

"Dream Big"

To enhance the research and development (R & D) culture at NERDC by incorporating modern research strategies with traditional knowhow, the monthly research presentation using external professionals was held on 29th July 2021 via zoom platform. The topic of the presentation was "Dream big: Path to innovation & invention". The Chairman, Director General, senior management and all engineers of NERDC participated in the session. The resource person was Dr. Kushan Wijesundara, who currently serves as a Senior Lecturer in the Civil Engineering Department at the University of Peradeniya.

Dr. Kushan Wijesundara

The presentation was highly focused on discussing engineering & technological marvels spanning the length and breadth of construction, town planning, tank building, irrigation, and craftsmanship in art & sculpture during the eras throughout Sri Lanka's proud history. And finally, he pointed out that this is the high time for awakening our younger generation to show that dreaming big is the path to innovation & inventions which lead our nation to regain lost pride and to drive the nation forward.

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NERDC to take part in pushing boundaries for Sustainable Agriculture

The National Engineering Development Centre, being the apex national institute for engineering research and development, has been involved in many engineering and technological developments throughout its 45-year history towards the socio-economic development of the country. With raised restrictions on importing chemical fertilizers into the country, the focus on organic fertilizers developed within the country is highly demanded. With the request of His Excellency President Mr. Gotabaya Rajapaksha, the Honorable State Ministress of Skills Development, Vocational Education, Research and Innovation, Dr. (Mrs.) Seetha Arambepola has advised NERDC on developing required machineries and appropriate technology for the rapid organic fertilizer process, which can be utilized locally.

Meanwhile, NERDC also identified the manufacturing of organic fertilizer as one of the prioritized actions which is nationally important and where its expertise and resources can be shared accordingly to the advice provided by the Chairman, Prof. Leelananda Rajapaksha & Board of Directors and the guidance provided by the Director General, Eng. D.D. Ananda Namal. This special project is coordinated & supervised by the Deputy Director General-Services, Eng. Shantha Jayasinghe and supported by Deputy Director General-Researh & Development, Eng. Ajith Jayasooriya.

Shredder Machine developed by NERDC

Based on the ground surveys carried out in relation to the required machinery for the process of manufacturing organic fertilizer, it was proved that although few large-scale machines are imported, there is a considerable demand for domestic and medium-scale machinery. Those three kinds of machinery are domestic-scaled shredding cum pulverizing machines, medium-scaled shredding cum pulverizing machines and medium-scaled compost turners.

As the first step, NERDC has worked on the manufacturing of a shredder as a result of the choice of an appropriate technology. The team involved in the completion of work comprises of engineers namely Eng. K.Y.H.D. Shantha, Dr. Anjana Liyange, Eng. Dahanayake, Eng. Shalinda Silva, Eng. Sivasudhan & Eng. Yamuna Pathiraja and other workers in the Agricultural Engineering & Machine Development Department and was led by Eng. K.Y.H.D. Shantha, the Director of the department. It was a real challenge to complete the manufacturing of this shredder within two weeks of the time duration, during the 4th wave of the covid-19 pandemic era. And it will be launched to the open market in the near future by completing its field trials in real time. NERDC was able to complete it to support small and medium-scale entrepreneurs to keep going with their ventures to support the country during the prevailing economic crisis.

Transformation through strategy and innovation

According to research in the food sector; fruit and vegetable post-harvest losses at present in Sri Lanka are about 30% to 40% in the process from harvesting to consumption. In this, a considerable fraction of fresh produce is wasted during short-term storage, in transit and in transportation under unsuitable and non-scientific conditions. During the first COVID-19 wave, the NERDC noted the colossal waste of locally produced fresh fruit and vegetables due to many factors, and the negative impact of such waste on the country's food security and sustainability. The lack of suitable infrastructure support at, the farmer level, to alleviate problems of this nature was highlighted and discussed in detail. The NERDC-Refrigeration group, formed with internal engineers from various disciplines, under the guidance of the present Chairman, Prof. Leelananda Rajapaksha, initiated a R & D project to produce a feasible buffer storage system (to retain the quality of harvested produce) with a climate (indoor) control system to be used at the community level for farmers to hold fruit and vegetables for a period of 3 – 4 weeks, which would allow farmers to meet favorable market conditions with the least amount of money. The idea was reinforced, among many other potential research ideas generated on the theme of food security, at the stakeholder meeting held at the NERDC in July 2020.

While integrating the above broad objectives, the key design targets were to achieve a storage system that would be low in cost to produce and to operate; while maintaining indoor conditions (temperature and relative humidity) at scientifically proven appropriate levels to retain the freshness of stored produce. All the necessary hardware and software were designed and custom built by NERDC engineers, and the storage module carries a monitoring system that enables the user to monitor indoor conditions and performances remotely through a mobile application (android/ios App).

Although the design and development of the system was mainly led by the Refrigeration group under the supervision of the Chairman & Director General, many engineers were engaged & shared their expertise during fabrication and assembling to make the designed storage adaptable for mobilization & operating at any remote location. The assembled unit was tested with no load and the module has shown satisfactory results, maintaining desired temperature and humidity patterns. The next action is to carry out load tests on fresh vegetables and gather power consumption data. Analyzing the power consumption of the system, integrating with renewable energy options shall be under Phase II. In the current phase of testing, the NIPHM in Anuradhapura collaborates with NERDC.

Work in Progress of Proposed Vegetable Cold Storage

The above could be considered as the main tangible outcome so far. However, there have been few important and valuable intangible outcomes for the NERDC as a research organization that are noticeable to anyone who takes a close look with due interest.

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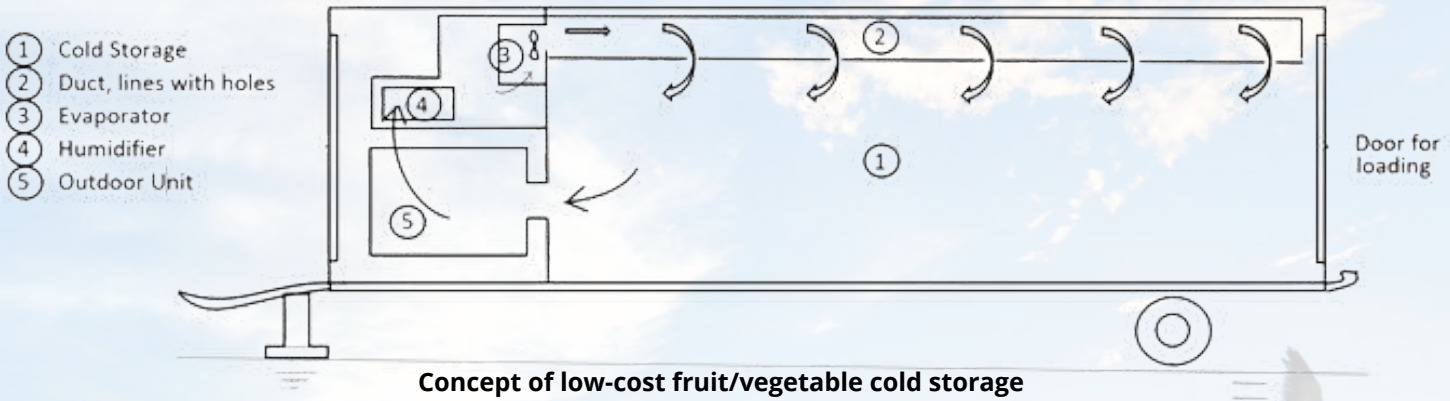
This exercise, which combines the expertise of many sectors, has strengthened the bonds even further within the individuals involved. The slow but gradual changes in the research culture within the centre, activities that reinforce the R & D environment at NERDC, gradually started to bloom with the encouragement of young engineers to get involved and experiment on their own. A true spirit of scientific team work started to emerge and prevail.



Concept of low-cost fruit/vegetable cold storage

In addition, subject wise, the refrigeration team was one of the groups formed according to the idea of the Chairman to develop practical engineering fields in the centre, to cater to the industry's needs, both in theoretical and practical aspects, under the leadership of the Research Fellows in the centre. This group (the Refrigeration group) was able to deliver and unite researchers, engineers, and the NERDC community around one goal, while achieving such an objective to a greater extent. Although this is a very basic design exercise in refrigeration, by being involved in it under the guidance of Prof. Rajapaksha, the team acquired significant knowledge in many allied areas and subjects, theoretical and practical aspects such as unsteady operation, various controlling aspects, different refrigerants & their characteristics. Now, the team is in a position to analyze even complex refrigeration systems and conduct optimization studies based on the laws of thermodynamics.

NERDC provides an innovative solution resolving key issue of hygienic re-filler for drinking water industry: An Automated 19 Litre Water Bottle Washing Machine

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Incremental entries of suppliers due to high demand, mal hygienic practices adapted by certain manufacturers, consumer protection and non-availability of proper user friendly technology in re-filling were some of the facts that govern by the current regulatory framework.

Most of the plastic bottles used for bottling water are made of Polyethylene Terephthalate (PET), a material which is recommended due to its' recyclable ability. The market available PET bottles vary in its' sizes from 0.5 litre to 20 litre and differ in shapes. The most common size used for water dispensers as refilling bottles is 19 litre. When considering the bottled water industry in Sri Lanka, a huge numbers of large & medium scale water refilling stations are established and over 175 number of 20 litre bottles are daily refilled in some stations. There is a potential for the growth & occurring of fungus & algae in and around the neck of the bottle if these bottles are not cleaned properly.

By identifying the issue of lacking of a proper washing technique, National Engineering Research and Development Centre developed an automated power brushing machine for the purpose of washing 19 litre water bottles. This machine is in built with a mechanism for removing the bottle lid, lid washing facility and proper washing of inside & outside of the bottles. It includes operational safety features according to the global standards. This machine will be a milestone for the industry due to its' speedy operation, minimal labour usage and reduced water usage in washing. (water usage 1 to 1.5 litres/bottle).

The Demodara Nine-Arch Bridge: A perfect blend of indigenous engineering technology with British Colonial Design

The Demodara nine-arch bridge is one of the best examples of blending indigenous engineering technology with colonial planning & designing in rail way construction in the world. This bridge is located at Gotuwala, between Ella and Demodara railway stations, at a height of 3100 meters above sea level. The total length of the bridge is 91.44 meters (300ft), the width is 7.62 meters (25ft) and the height is 24.8 meters (80ft), whereas the number of spans is nine (9). And the bridge was designed by Mr. Harold Cuthbert Marwood, the designer of Railway Construction Department of Ceylon Government Railway, during that period.

Historical evidence states that world war began among the empires of Europe, directing all available steel to the battlefront. Due to this steel scarcity, the construction project for the bridge came to a standstill. When this type of structure is built, steel plays a major role in holding the tensioned force. If we need to build this kind of structure without steel, the issue is how to hold the structure without tensioning. For not having the tensioned forces in this kind of structure, shape and the mix of the mortar play critical roles.

Demodara Nine-Arch Bridge

These kinds of marvel structures were built in our glorious history during the King's era, commencing from Anuradhapura & Polonnaruwa kingdoms. It seems this technological knowhow is prevailed in word of mouth but not properly documented during the ancient time. But the ordinary villager, Mr. P.K. Appuhamy of Keppetipola village, had this ideology as well as the knowhow, and he got the opportunity to join with colonial engineers and Mr. D.J. Wimalasurendra, the distinguished Sri Lankan engineer who headed the upcountry railway construction project at that time. As a result, this massive nine-arched bridge was built entirely of solid rocks, bricks, cement, and a mortar made using limestone, mud, and cement, but without using a single piece of steel. It was commissioned in the year 1921 and by now it has lasted for a century indicating a novel construction incorporated our traditional knowhow in a superior blend.

Today, the Demodara nine-arch bridge in Sri Lanka is known as one of the most attractive destination for local and foreign tourists due to its nature of construction as well as the natural beauty of the surrounding environment. It will last for another few centuries with the blessings of the nation.

NERDC in the development of an oxygen concentrator (oxygen generator)

Oxygen concentrators can easily replace compressed gas cylinders and produce 90–95% concentrated oxygen from ambient air by omitting its constrained nitrogen. Generally, such portable units produce 4–10 l/min and are capable of being kept in operation 24/7. Oxygen should be given to patients who are chronically hypoxic or who have developed a need for supplemental oxygen.

In this global pandemic situation of COVID-19, in spite of the economic recession that the world is experiencing, the number of patients affected by the virus is increasing rapidly worldwide. Medical oxygen is an essential medicine in the treatment of Covid-19 patients with a respiratory tract infection, or mostly with shortness of breath. Furthermore, the incremental number of patients in intensive care units who need the support of supplemental oxygen has spotted a red light for the government health sector to find alternatives to fulfill the supply of continued concentrated oxygen at an affordable cost. According to the Governments' Medical Officers Association, Sri Lanka has reached third place in South Asia in its requirement for oxygen for COVID-19 patients, which stresses the importance of the above-mentioned point again. Currently, all oxygen concentrators are imported from global markets, and imposed import restrictions may make it less favorable to buy such a unit.

His Excellency President Mr. Gotabaya Rajapaksha, and the State Ministry of Skills Development, Vocational Education, Research & Innovation, led by State Ministress Dr. Seetha Arambepola, have devoted NERDC to the challenge of engineering a pilot unit of an oxygen concentrator to examine the feasibility of manufacturing it using locally available resources. The NERDC, with the vision of becoming the best engineering research and development center in South Asia, accepted the challenge with the advice of the Chairman, Prof. Leelananda Rajapaksha, and the Board of Directors, as well as the leadership of the Director General, Eng. D.D. Ananda Namal. This special project, which demands high efficiency and accuracy, is coordinated and supervised by the Deputy Director General-Services, Eng. Shantha Jayasinghe, and supported by the Deputy Director General-Research & Development, Eng. Ajith Jayasooriya.

This oxygen generator, which operates on the principle of Pressure Swing Adsorption (PSA), is expected to be manufactured locally to meet the demand. At the moment, relevant engineering work at NERDC is at a peak. WHO guidelines on 'Technical specifications for oxygen concentrators' and ISO 80601-2-69-2020 Medical equipment-69: Particular requirements for safe operation and essential performance of oxygen concentrating equipment are to be complied with during the process of developing the unit. With the guidance and advice of Dr. Anupa Herath (Consultant anesthetist), who is attached to the District General Hospital at Trincomalee, processing for obtaining required approvals from NMRA and other relevant authorities began. The NERDC team involved here is Dr. T.A.S. Anuruddha, Eng. Kapila Peiris, Eng. Nandana Edirisinghe, Eng. Nalaka Samarasinghe, Eng. Hemantha Kumara, Eng. Praveen Weerasinghe, Eng. Saranga Senarathne, Eng. Sameera Wanasinghe and supporting staff. After completion of acquiring necessary approvals & the successful results revealed, the technology for manufacturing the oxygen concentrator will be disseminated through the process of technology transfer by creating licensing agreements.

NERDC holds "Technology Clinic" for SMEs in Kandy District

The Vidatha Sector of State Ministry of Rattan, Brass, Pottery, Furniture and Rural Industry has scheduled a series of "Technology Clinic" to hold in each district and to complete the first set of 25 clinics by the end of the year 2021. Although the fourth technology clinic was scheduled to be held in Kandy, due to the prevailing situation of the country due to Covid-19 pandemic, it was agreed to hold the clinic in two phases via the zoom platform. The first phase was held on 08th July 2021 via Zoom technology aiming of Kandy districts' small & medium entrepreneurs (SME). NERDC delivered an awareness program during the session supporting SMEs with possible technological & marketing interventions for their businesses. 128 participants took part for the session. Participants were interested in various technologies that were relevant to cottage industry, solid & liquid waste management and packaging technologies. The second session was held on 2nd August 2021 for a selected group of SMEs, who required engineering & technological support and even for marketing guidance to develop their existing businesses. There were 25 number of SMEs participants in the second session.

Global measures taken to reduce adverse climate change effects

Currently global warming increasing rapidly is the highlighted issue that earth is facing and due to that various issues have been arisen. Specially melting glaciers and rising sea water level, extinction of animals like polar bears, changing weather patterns and appearing various new deceases and so on. So special attention of all human should be paid on this great tragedy. In order to correct the situation the Kyoto protocol was established. The Kyoto protocol is an international protocol which was adopted on 11th of December 1997 in Kyoto Japan. This treaty was aimed to control global warming up to some level by reducing greenhouse mainly controlling carbon emission. And industrialized nations are advised to cut their carbon emission under this. Reduction of emission by 5.2% below the recorded level in 1990 by 2012 was the main goal of this protocol. Individual reduction target had been set for each country to achieve this 5.2% overall collective goal. As well as a range of market mechanisms have been introduced. Some of them are Clean Development Mechanism (CDM), International Emissions Trading, Joint implementation (JI). Rich countries can offset emission through out of these mechanisms and start low carbon projects in low income countries.

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