PATENT ACQUISITION AND COLLABORATIVE RESEARCH AND TECHNOLOGY DEVELOPMENT (PACE)

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Patent Acquisition and Collaborative Research and Technology Development (PACE)

1. PREAMBLE

The scheme Patent Acquisition and Collaborative Research and Technology Development (PACE) aims at facilitating acquisition of early stage technologies from academic and research institutions, including industry and other sources in India and abroad by Indian industries on an exclusive or a non-excusive basis with a view to manufacture "Made in India" products. The scheme also aims at supporting up-scaling of a lab-scale technology for development and demonstration of innovative products and processes that can be commercialized. Support is provided for proposals which give clear evidence of existence of proof-of-concept and aim at developing an innovative content for fulfilling an unmet need. Development and demonstration of technologies can be undertaken by industries alone (including in-house R&D centres of the industry recognized by DSIR) or in collaboration with Universities, Public Funded Research Institutions or academic institutions in India or abroad. The technology development projects supported under the scheme aim at development of a new product or a process with attractive market potential which will result in significant benefits to the industry concerned in terms of raising its technological level, turnover, energy and material savings/recovery, export sales etc. Focus sectors include (i) Energy & Environment, (ii) Affordable healthcare including Drugs & Pharmaceuticals and Medical Equipment & Devices (iii) Agriculture, food & nutrition, (iv) Engineering (auto-components, machine tools & foundry), (v) Specialty Chemicals etc.

2. OBJECTIVES

The objectives of the scheme are:

- To facilitate Indian industries to acquire patented technology at an early stage from within the country or overseas on an exclusive as well as non-exclusive basis, add value to the acquired technology for exploitation in Indian/foreign markets and develop "Made in India" innovative and socially relevant products for public consumption in India and abroad.

- To encourage and accelerate development and demonstration of indigenous product / process technologies by in-house R&D centres of the industry for commercialization.

- To create enabling environment for collaborative research between Indian Industry and R&D organizations/ academic institutions/ universities in India or abroad and formulate collaborative projects for development and demonstration of lab scale technologies aimed at commercialization of new products and processes.

- To develop a dynamic database on existing expertise and IPs available in the R&D organizations/ academic institutions/ universities in India or abroad to facilitate PPP and tie-ups with Indian industry for collaborative projects.

3. PROJECTS/ACTIVITIES DURING 2015-16

Details of important projects/activities that were completed or were in progress during the year under report are given below:

3.1 Facilitating Technology Acquisition

Eight workshops on technology acquisition were conducted during 2013-14. It emerged from the workshops that most of the SMEs are unaware of the specific technologies/patents needed for innovative product/process development. Therefore, efforts were continued during 2015-16 to deploy intermediary agencies/consultants who need to engage with SMEs in a cluster for a reasonable period of time to assess their precise technological requirements/needs and then, map the SME needs with appropriate technologies/patents from technology suppliers with a view to facilitate technology acquisition by SMEs.

This process requires specific skills in Technology Assessment and Forecasting, Patent or Technology landscaping, IP Valuation etc. besides experience of working with SME clusters. Recognising that CSIR-Tech is a Company engaged in facilitating SMEs in scouting specific technologies/patents to add value to their products and services, several meetings were held with CSIR-tech to explore its possible role in the process of technology acquisition. Discussions were continuing to engage agencies like CSIR Tech for doing the necessary due diligence and assisting DSIR in facilitating technology acquisition to SMEs.

3.2 Technology Development and Demonstration

3.2.1 The following proposals were continued during the year

i. Technology up gradation of pelletization facility for herbal veterinary feed supplements: Demonstration in terms of value addition to produce quality supplements at low cost - Natural Remedies Pvt. Ltd., Bangalore

M/s Natural Remedies Pvt. Ltd., Bangalore have undertaken to demonstrate a steam sterilization based pelletization facility using semi-automated equipment and improved pelletization machine for herbs & herbal powders to produce improved quality veterinary feed supplements with reduced microbial load and minimal wastage of biomass. The company plans to produce the three existing products viz. Zigbir (hepatoprotective – it helps in optimizing growth, weight gain, feed conservation ratio (FCR) and livability in poultry), Natchol (Choline replacer – it is a natural choline supplement that helps in mobilization of liver fat) and Phytocee (Vitamin C and electrolytes supplier – it is a natural Vitamin C source which helps in reducing free radical formation induced lipid peroxidation) with the new pelletization facility. The project will lead to production of microbe free herbal feed supplements for the benefit of livestock, such as Poultry, aqua ruminants, small ruminants, etc. which will not only protect the animal but also protect human's health who are end consumers of animal products viz. meat, egg and milk.

The project has been supported by DSIR through a soft loan of Rs. 200.0 Lakhs out of a total project cost of Rs. 599.30 Lakhs in November 2014. Two Project Review Committee meetings have been held to assess the project progress.

Erection of upgraded pelletization plant is underway and equipments & machineries are at various stages of procurement and commissioning at the project site of M/s Natural Remedies Pvt. Ltd. Trial productions on equipment have been conducted at vendor's site where assessment of microbial burden, in-vivo & in-vitro efficacy studies and stability studies have been carried out for trial batches. The company has finalized formaldehyde based method

of microbial reduction for Sterilization / decontamination. Trial batch production in upgraded pelletization plant is expected by around mid 2016 and first instalment of loan shall be released upon commissioning of equipment.

Conversion of Ashwagandha powder into pellets conducted at vendors site

Pulverizer equipment for installation at NRPL site

ii. *Development of Genetically Engineered Cellulose-free Alkaline Xylanase through submerged fermentation process (SMF) - Kaypeeyes Biotech Pvt. Ltd., Mysore*

M/s. Kaypeeyes Biotech Pvt. Ltd., Mysore is a company engaged in the manufacture of industrial enzymes like Pectinase, Amylase, Xylanase, Cellulase, Phytase, Amyloglucosidases, Beta-Glucosidases, Acidic & Alkaline proteases and Neutraceuticals, Probiotics for food, feed, therapeutics and other industrial applications. The company had purchased *Bacillus pumilus* culture from RRL, Trivandrum for producing Cellulase free Xylanase at laboratory level. They characterized the kinetics of production of xylanase and developed two products viz. Chlorzyme – AX (Xylanase for bio-bleaching of paper pulp) and Recyclase – X1 (for use in Bio-refinery). These two products were evaluated by CPPRI, Saharanpur and found suitable for paper industry use. The company however found that yields of the products were inconsistent because of deployment of Solid State fermentation (SSF) method. Also bulk production of products in SSF in wheat bran media had reduced storage stability. Therefore the company took recombinant route of expressing the gene viz. *Bacillus pumilus* in *Pichia pastoris. Pichia pastoris* is a well studied host used in the production of recombinant enzymes world over and being methyl tropic in nature can produce large quantity of enzyme. The company plans to develop, validate and produce recombinant Cellulase - free alkaline Xylanase for application in paper and pulp industries.

The company has successfully transformed *Pichia pastoris culture* which can produce Xylanase in large quantities and is now conducting trial production in 14 Lts fermentor. They have installed and commissioned other pilot plant equipments & machinery including 14 Lts. & 100 Lts. Fermentors. They have also equipped their Laboratory with analytical equipments required for molecular biology experiments. Transformation and screening of recombinant xylanase produced by *Pichia pastoris* including biochemical studies have been completed. The shaker flask studies with aims of maximum cell density production during fermentation have been observed and pilot level studies are in progress. The company has constituted "Institutional Bio Safety Committee (IBSC)" approved by RCGM-DBT which has approved the company's facility.

The project has been supported by DSIR with a soft loan support of Rs. 206.00 Lakhs out of a total project cost of Rs. 468.00 Lakhs in November 2014.

The I Installment of Loan Amount of Rs. 82.50 lakhs has been released. Two meetings of the Project Review Committee have been held to assess the progress of the project.

Fermentors at Kaypeeyes Biotech Pvt. Ltd., Mysore

(iii) ***Design, Manufacturing, Proving, Supply of Three Roller Flow Forming Machine - Paras Flowform Engineering Ltd., Mumbai***

M/s. Paras Flowform Engineering Ltd., Mumbai are mainly in the business of manufacturing of Flow-forming chambers for missiles & rockets; CNC Machining for aerospace & defense industries; turn key projects for non-ferrous mining & metallurgical industries, heavy machining & fabrication of the same; special purpose machines; rolling mill equipments & turn key electronic systems for communication, radar, sonar, fire control, etc for Indian Army & Navy. They have taken up design and manufacture of a new 3 Roller CNC Flow-forming machines with advance controls after successful in-house refurbishment of 3 roller Flow-forming machine (procured as scrap) from overseas in the year 2010. The refurbished machine is presently producing Pinaka Motor Tubes etc.

The company has tied up with IIT, Mumbai and ARDE, Pune for up-scaling in the areas like Design, Electronics before commercialization. The innovation lies in carrying out the mechanical fabrication maintaining the roundness, concentricity & straightness of the tubes with high precision.

The company has finalized the Machine design & specifications, completed manufacturing drawings & documentations, initiated manufacturing of machine parts & the sub-assemblies including items like Machine Bed, Saddles, Beams, Gear Box, Covers and Roller Shafts etc. They have also procured critical purchase parts of the machine like LM Guides, Ball Screws, Servo Motors etc.

The project has been supported by DSIR with a soft loan of Rs. 500.00 Lakhs out of a total project cost of Rs. 1900.00 Lakhs in November 2014. The I Installment of Loan Amount of Rs. 200.00 lakhs has been released. A meeting of the Project Review Committee was held to assess the progress of the project.

Flow-formed tubes produced at M/s. Paras Flow form Ltd.

(iv) To manufacture Magnesium Hydroxide from Dolomite mineral and Calcium Nitrate as by product - Rudraksha Allied Chemicals Pvt Ltd., Nagpur

M/s. Rudraksha Allied Chemical Pvt. Ltd., Nagpur have undertaken to demonstrate the manufacture Magnesium Hydroxide (MHD) from Dolomite mineral at a pilot plant, having specifications same as commercially available pharmaceutical grade MHD from sea water source, but with a lower cost and Calcium Nitrate as a byproduct. The company claims that Dolomite has never been used to

manufacture Calcium and Magnesium compounds separately and Pharmaceutical grade MHD from dolomite will be the first time in the country. The processes and technology for production of Magnesium largely depends on the availability of raw material. The most abundant source in mineral form is Magnesite ($MgCO_3$). The current Indian deposits have limitation of purity ranging only upto 80-85% MgO. Magnesium carbonate occurs along with Calcium carbonate in Dolomite ($CaCO_3.MgCO_3$) mineral. Commercially viable production of Mg and Ca cannot be realized by existing technologies. Sea water brine is the biggest source of Magnesium element when high purity up to 98-99% is desired. On the other hand Dolomite ($CaCO_3.MgCO_3$) mineral is cheaply priced and is abundantly available in various parts of India. The production cost of MgO from dolomite is one fifth of that from Magnesite and the comparative cost of production of MHD from dolomite can be 33% lower than that from sea water.

The project has been supported by DSIR with a soft loan of Rs. 66.50 Lakhs out of a total project cost of Rs. 170.80 Lakhs in November 2014. One meeting of Project Review Committee has been held to assess the progress of the project.

The company has been able to scale-up the process for production of MHD upto a batch size of 240 Kg and is working to increase the batch size to 400 kg level within the same pilot plant by improving the process characteristics. Magnesium Hydroxide specifications have been achieved as per Indian Pharmacopoeia (IP) specifications. The company is test marketing the product for commercialization. The company has said that it will be able to complete the project without DSIR's financial support.

(v) Macroalgal Biorefinery for CO_2 Sequestration and Production of Biofuel and Value-Added Compounds - AquAgri Processing Pvt. Ltd., New Delhi & DBT-ICT Centre for Energy Biosciences & CSIR-CSMSRI, Bhavnagar

M/s AquAgri Processing Pvt. Ltd., New Delhi in collaboration with DBT-ICT Centre for Energy Biosciences, Institute of Chemical Technology (ICT), Mumbai and CSIR- Central Salt & Marine Chemicals Research Institute, Bhavnagar (CSIR-CSMCRI) have undertaken to demonstrate the concept of sequestration of CO_2 through large scale controlled growth of macroalgal species (Ulva) in closed photo-bioreactors using CO_2 generated by power plants or other industries, and making the technology sustainable through conversion of the grown macroalgal biomass to bioenergy and other value-added products. Globally the dry sea plants are used to manufacture hydrocolloids and these have a wide application in food, cosmetics and toiletry industry. Aqua Sap derived from the fresh living algal plants is a plant nutrient, which contains substantial amounts of micro and macronutrients, naturally occurring Plant Growth Regulators (PGRs) and amino acids. The PGRs such as Auxins, Cytokinins and Gibberellins, accelerate the metabolic function of the plant there by boosting yield and productivity. The concept of a multi-product macroalgal refinery using modular photo-bioreactors for CO_2 capture and growth of ulva in vertical glass reactors to demonstrate efficient CO_2 sequestration coupled with downstream processing technologies for biomass deconstruction and separation of value-added products for economic sustainability is an innovative concept.

This project has been supported by DSIR through a soft loan of Rs. 225.00 Lakhs to M/s AquAgri Processing Pvt. Ltd., New Delhi and grants of Rs. 85.00 Lakhs to ICT and Rs. 45.00 Lakhs to CSIR-CSMCRI out of a total project cost of Rs. 580.00 Lakhs in November 2014. Two Project Review Committee meetings have been held to assess the project progress.

ICT and CSIR-CSMCRI have been able to achieve cultivation of *Ulva* species through vegetative propagation with daily growth rate (DGR) > 20% at light intensities > 90Klux and temperature of 30-32pC using a prototype flat panel photobioreactor and patents

are being filed. Complete replacement of expensive macro as well as micro nutrients with organic manure to maintain >20% DGR has been demonstrated. Extraction processes for value added products including SAP, ulvan, protein, bio-methane using ulva biomass have been established. Commissioning of a 3,000 L photo-bioreactor for u*lva* cultivation is underway at ICT. Parallely, a 10KL extraction unit for downstream processing of ulva biomass has been commissioned at M/s Aquagri project site. Subsequent to demonstration of ulva cultivation in 3000 L photo-bioreactor at ICT, the process will be scaled upto 100KL at M/s AquAgri plant site.

3000L Photo-bioreactor system designed and developed at DBT-ICT Centre for Ulva cultivation

(vi) Chitosan Based Drug Delivery system for Dental and Oral Diseases - ICPA Health Products Ltd., Ankleshwar & Govt. College of Pharmacy, Amravati

M/s. ICPA Health Products Ltd., Ankleshwar, leader in Oral Health Care and has proposed to scale-up production of chitosan films from lab scale (400 units/ batch/day) to pilot scale (20,000 units/ batch/ day). They intend to complete successfully pilot batches and target at 200,000 patches/ batch/day to cater to the market demand. The company has signed MOU with Govt. College of Pharmacy, Amravati on various chitosan based technologies. Govt. College of Pharmacy, Amaravati has developed chitosan based thin film at lab-scale wherein film patches are casted manually. They have been producing 75 pieces of chitosan films in 4 hours costing at Rs. 6.50 lakhs a piece manually.

The project has been supported by DSIR with a soft loan of Rs. 72 Lakhs to M/s. ICPA Health Products Ltd and a grant of Rs. 72 lakh to Govt. College of Pharmacy, Amravati out of a total project cost of Rs. 260.00 Lakhs in December 2014. A Project Review Committee meeting is scheduled shortly to assess the progress of the project

(vii) Development of Portable Power Supply (Desktop Model) using Lithium Ion battery - D-Espat Pvt. Ltd., Chennai

M/s d-ESPAT Pvt. Ltd, Chennai have undertaken to design, develop and manufacture a high quality (light weight, high energy density) modular portable power supply with output range of 600W to 1000W and operation time capability of up to 6 hours" using high capacity Li-ion battery with AC/DC charging including solar input. The portable power supply shall have features like capability of re-charging quickly in 2-3 hours, modular design with facility to plug and play depending on operation time requirement, option for output as AC, DC or dual output portable, single chip microcomputer control, LCD display, LED indicator, easy switching, ergonomic design, 2 minutes automatic shutdown & efficient in conservation of energy, high current output and multiple charge modes i.e. AC charging or solar charger. Packing more power in a small area is a key requirement in every consumer product today and Li-ion battery packs are much lighter and smaller than other batteries making them highly suitable for LED lighting and UPS backup applications. The concept of using lithium ion/ polymer battery in medium sized invertors/UPS or other forms of power supply for commercial/ industrial or residential use is relatively new in India. Given the constraints of Indian grid power situation, varied climate conditions & power availability situations in the city and sub-urban areas, the

proposed product provides a huge opportunity for storage, recovery and use of electrical power for critical systems like computers, lighting, cooling needs, communication and other business needs.

This project was supported by DSIR with a soft loan of Rs. 60.00 Lakhs out of a total project cost of Rs. 178.31 Lakhs in January 2015. The company has withdrawn the project after sanction by DSIR in view of their inability to furnish bank guarantee for availing the loan.

3.2.2 The following proposals, recommended by the TAC were at various stages of approval as on 31st December 2015.

(i) Development of Controller Release [CR] Formulation of Natural Highly-Purified Human Chorionic Gonadotropin [hCG] - Sanzyme Ltd. Hyderabad & ICT Mumbai

Sanzyme Ltd., Hyderabad in collaboration with Department of Pharmaceutical Sciences & Tech., Institute of Chemical Technology, Mumbai had submitted a project proposal on "Development of Controlled Release [CR] Formulation of Natural Highly-Purified Human Chorionic Gonadotropin [hCG] for possible support under PACE-TDD scheme. 99% pure hCG is used as a surrogate for LH [Lutenising Hormone] for triggering ovulation and maintenance of pregnancy. However recent developments, have shown that the role of hCG is not restricted to infertility treatment alone but has wider applications in the field of metabolic disorders such as Diabetes and other clinical conditions where hCG is being used for a process known as angiognessis in the fields of vascular surgery and CNS surgery. Currently two forms or variants of hCG are available either as highly purified form or the recombinant version of hCG. Despite recombinant being available, only a single dosage form is available for clinical use. The project aims to improve compliance and reduce the frequency of injections and make the treatment more affordable and available to masses rather than class alone. The CR- release formulation using nano technology with release rates of either 15 or 30 days will reduce the frequency of injections required in infertility problems, maintenance of pregnancy and controlling metabolic disorders such as Diabetes. The project has been recommended by the Technical Advisory Committee and has been accorded financial concurrence. The project proposal was being processed for final administrative approval after which agreement will be signed and sanction will be issued.

(ii) Cold plasma based technology development for green ammonia/urea production - Nagarjuna Fertilizers and Chemicals Limited, Hyderabad

Nagarjuna Fertilizers and Chemicals Limited, Hyderabad had submitted a project proposal "Cold Plasma based Technology Development for Green Ammonia / Urea Production" for possible support under PACE-TDD scheme. The project aims at developing a technology platform for production of Green Ammonia / Urea by non-conventional production route using cold plasma based technology and process simulation & engineering design and upscaling the process to multi ton stage. The project shall develop a non-conventional source for ammonia/urea production where the requirement of pressure is not limiting. The process once optimized can be operated in integrated manner with existing urea/ ammonia industries and it will also be possible to decentralize production. Therefore, to validate the technology it is essential to study the developed technology at higher scale. Additionally, strategies for production of ammonia/urea will also be studied in packed bed reactor which may be cold plasma based or packed bed reactor connected to cold plasma with metal oxide catalyst to maximize the production capabilities. The project has been recommended by the Technical Advisory Committee and has been accorded financial concurrence. The project proposal was being processed for final administrative approval after which agreement will be signed and sanction will be issued.

(iii) Cost-effective 3G/4G based Multimedia Video Conferencing Service – Intellisys Technologies & Research Ltd., Kolkata

M/s Intellisys Technologies & Research Ltd., Kolkata is a high end global R&D company in the area of videoconferencing technology and communication space. One of its previous products "Enlitor"- a learning management system developed in joint collaboration with NSE.IT Ltd., (a 100% subsidiary of National Stock Exchange of India) was implemented across the country. The company has developed a product "Vennfer"- unique H.264 high definition software based multiparty multipoint video conferencing solutions on multicast network transmission protocol. The company plans to build a suite of products & services on the "Vennefer Mobility Cloud" which will produce unified collaboration across a range of standard audio visual rooms, business desktop solutions, smart-phones & tablets. The proposal envisages offering video telephony (point-to-point) and conferencing (multipoint-to-multipoint) as a service, for building this application, the company will need technologies for SoftMCU, WebRTC to SIP gateway & SIP to H.323 interoperability module, which they plan to acquire from Synergy Research, USA and Doubango Telecom, France or could even develop them in-house. The company will be scaling up relay & media server bandwidth up to 32 kbps using cluster methodologies for 4 lakhs subscribers and host the application with M/s. TATAs as the ISP/TELCO. During the commercialization phase, the company will host the application to data centers of ISPs or TELCOs and would generate revenue on pay per use basis. The company expects to have around 50 lakh licenses in 5 years of commercialization and expects revenue of Rs. 10 crore / month @ Rs. 20 per user per month. The project has been recommended by the Technical Advisory Committee and is being processed for approval and support.

(iv) HealthMon - Next Generation platform for managing Health Data in digital format - Persistent Systems Ltd. , Pune & Maharashtra University of Health Sciences(MUHS), Nashik

Persistent Systems Ltd., Pune in collaboration with MUHS, Nashik had submitted a project proposal "HealthMon - Next Generation platform for managing Health Data in digital format" for possible support under PACE-TDD scheme. The company envisages to develop a Health Monitoring System that will equip health-care workers with modern front-end tools to monitor and collect health data from a large number of people. The project has a strong social relevance. The project has been recommended by the Technical Advisory Committee and was being processed for approval and support.

3.2.3 The following projects though recommended for approval could not be taken up since the company was unable to furnish bank guarantee.

(i) Design and Development of low cost Switched Reluctance Motor & Controller for Electric Vehicle (EV) - Ampere Vehicles Private Limited, Coimbatore

M/s Ampere Vehicles Pvt. Ltd., Coimbatore have undertaken to indigenously design, develop and manufacture low cost, high efficiency, reliable Switched Reluctance Traction Motors (650W, 1500W and 3000W) for all types of electric vehicles (three wheelers & four wheelers) and other industrial applications. SR Motor is a technological innovation which saves energy and increase efficiency. SR motor for electric vehicle is a new idea that will create electromagnetism without the dependence on permanent magnets as in case of BLDC motors. Design of SR motors has the benefits of a motor free from magnets with high efficiency, high torque, high rpm and low cost which perfectly meets electric vehicles traction demand. Simple manufacturing process of the SR motors makes it possible for the motor to be produced locally. DC voltage operation of the SR motor makes it suitable for electric vehicle specific application as most EVs are DC based.

This project was recommended by Technical Advisory Committee for support by DSIR with a

soft loan of Rs. 183.00 Lakhs out of a total project cost of Rs. 442.00 Lakhs. The company has withdrawn the project in view of their inability to furnish bank guarantee for availing the loan.

(ii) Pilot / Scale-up studies and Commercialization of CLONZAb, a recombinant Monoclonal Antibody to treat Non-Hodgkin's Lymphoma - Clonz Biotech Pvt. Ltd., Hyderabad

M/s. Clonz Biotech Pvt. Ltd., Hyderabad has carried out cloning of heavy chain and light chain of anti-CD20 (Clonz Ab-di-cistronic) synthetic gene with the suitable vector of the licensed technology from Selexis, SA and has completed DNA sequencing. Further they have cloned the synthetic gene into Selexis DNA vector (pSLX-082) and expressed it in CHO cell line. They have established/ achieved proof-of-concept in a 10 Litre fermentor with a yield of 2 grams/liter and have completed pre-clinical safety studies by getting RCGM approval. The company proposes to scale up the technology by installing a 500 Liter fermentor and running five consistency batches for 10-11 days and hopes to bring down the cost of the technology. The project was recommended by the Technical Advisory Committee for a loan support by DSIR. However the company has withdrawn the project in view of its inability to furnish Bank Guarantee for availing DSIR's loan support.

3.3 Development of Database of Experts:

A dynamic database on experts available in the R&D organizations / academic institutions / universities / industries in India or abroad to facilitate PPP and tie-ups with Indian industry for collaborative projects is envisaged to be developed under the "PACE" scheme. A Database Advisory Committee (DAC) was constituted to suggest a structure of the database and to evolve a mechanism for launching and maintaining the database. It was also agreed that since the database would involve giving vide publicity, populating the database and updating it on a dynamic basis, it will have to be developed through an external expert agency. Proposals from suitable agencies are to be invited.