VATIS UPDATE

Ozone Layer Protection

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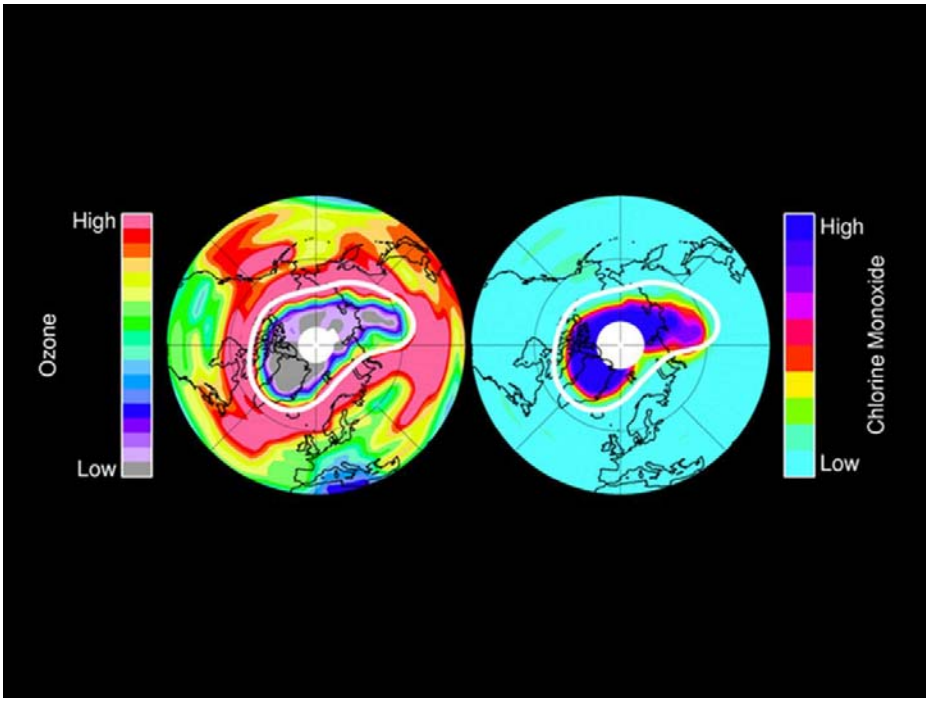
Highlights

- Arctic ozone hole breaks all records
- Safe filling system for R1234yf
- Organic solvent for textile cleaning system
- Efficient, low-GWP blowing agent for foam insulation
- Fungi could replace ozone-depleting pesticide
- Plant extract checks potato pests



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OZONE CELL
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The Centre will achieve the above objectives by undertaking such functions as:

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- Networking and partnership with international organizations and key stakeholders; and
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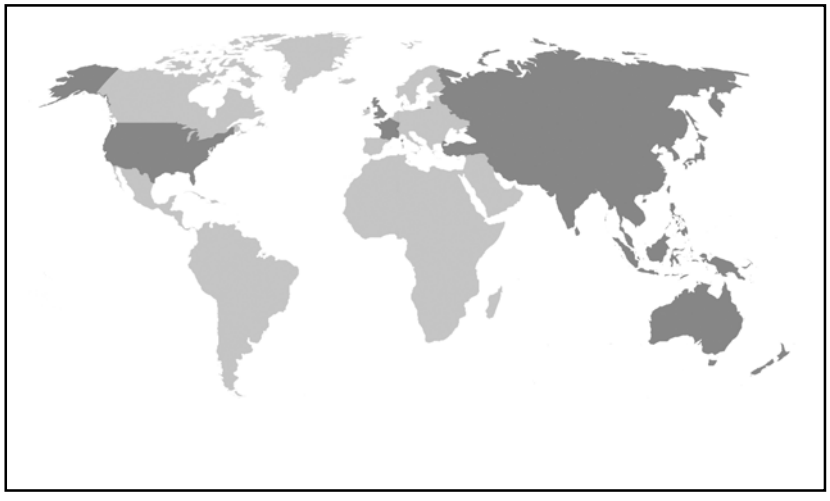

The shaded areas of the map indicate ESCAP members and associate members

Cover Photo

Left: Ozone in Earth's stratosphere (at about 20 km altitude) in mid-March 2011, near the peak of the 2011 Arctic ozone loss. Right: chlorine monoxide – the main agent of chemical ozone destruction in the polar stratosphere – for the same day and altitude.

(Credit: NASA/JPL-Caltech, the United States)

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Ozone Layer Protection
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CONTENTS

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SCIENCE OF THE OZONE LAYER

NOAA: Ozone hole will begin to close in the next decade

Within the next decade, the human-caused hole in the ozone layer will finally begin to heal, state scientists at the National Oceanic and Atmospheric Administration (NOAA), the United States. "Our study says at the end of the decade we will see the first sign of a slow down in ozone depletion," said Ms. Birgit Hassler, a researcher at NOAA's Earth System Research Laboratory in Boulder and lead author of the study. "This is not a total recovery – this will just be the first time that we can see the effects (of the ban)."

Over the last 25 years, NOAA's Global Monitoring Division has taken regular, year-round measurements of ozone using balloons launched from the South Pole. The delay in the closing of the ozone hole is related to the fact that the atmosphere above Antarctica has been saturated with ozone-depleting gases, opined Mr. Steve Montzka, an ozone expert at NOAA. "It is going to take some time to get down below that saturation level," he said. "We have to get back below that threshold."

The results of Ms. Hassler's study show that the time is coming when the scientist will be able to actually see the impact of the global ban on ozone-depleting gases with the ozone hole beginning to close. (Source: www.dailycamera.com)

Arctic ozone hole breaks all records

In the first three months of 2011, something unprecedented happened in the skies over the Arctic. A large hole appeared in the ozone layer – far bigger than any seen there before. The Arctic ozone layer suffers a little damage every winter, but the effect is normally short-lived. "This is a clear step beyond that," says Mr. Neil Harris of the University of Cambridge, the United Kingdom. As the measurements came in, ozone researchers began to debate whether the loss could be compared to that seen over the Antarctic.

Between 18 km and 20 km up, over 80 per cent of the ozone content was destroyed. "The loss in 2011 was twice that in the two previous record-setting Arctic winters, 1996 and 2005," says Mr. Nathaniel Livesey of the Jet Propulsion Laboratory, California, the United States. The hole was similar in size to those seen in Antarctica in the 1980s. The question now vexing atmospheric scientists is why the hole grew so large, and whether it will happen again. Mr. Livesey and his colleague Ms. Michelle Santee say the hole formed because the stratosphere remained cold for many months longer than usual. The cold air allowed water vapour and nitric acid to condense into polar stratospheric clouds, which catalyse the conversion of chlorine into chemically active forms that destroy ozone.

Climate change could be partly responsible. That may seem counter-intuitive, but global warming occurs only at the bottom of the atmosphere. "Climate change warms the surface but cools the stratosphere," Mr. Harris explains. In 2007 the Intergovernmental Panel on Climate Change concluded that "there has been global stratospheric cooling since 1979". "Whether that is because of climate change is speculation," Ms. Santee says. (Source: www.newscientist.com)

United Nations body issues update on ozone layer

Even though ozone depletion over the Antarctic is expected to be typical throughout 2011, long-term concerns are troubling the World Meteorological Organization (WMO), the United Nations' weather group. WMO stated that the prevailing temperatures and cloud activity over the Antarctic suggest the so-called ozone hole will be about average when compared with previous years, but added that it is too early to make definitive predictions on the actual size.

However, while the international community was making strides in eliminating ozone-depleting chemicals, it might take several decades for the atmospheric concentrations to fall below benchmark levels of the 1980s, WMO cautioned. The fluctuation in the ozone layer above Antarctica is a seasonal phenomenon that is brought on by extreme cold and the presence of ozone-depleting substances. (Source: www.upi.com)

ODS PHASE-OUT IN INDIA

Minister calls for determination to protect the Earth

Ms. Jayanthi Natarajan, the Minister of State for Environment and Forests (Independent Charge), said India has successfully phased out completely the production and consumption of chlorofluorocarbons (CFCs), carbon tetrachloride (CTC) and halons. With the active cooperation of industries, production and consumption of CFCs ceased from 1 August 2008, 17 months ahead of the Montreal Protocol schedule. Speaking as the Chief Guest at International Ozone Day celebrations, Ms. Natarajan said that the 19th Meeting of the Parties (MOP) held in September 2007 had decided to advance the phase-out of hydrochlorofluorocarbons (HCFCs) by 10 years. The baseline for production and consumption of HCFCs will be determined on the average of the years 2009 and 2010 for production and consumption respectively. The freeze will be from 2013 and 10 per cent reduction from the baseline in 2015 for Stage I reduction as per the accelerated phase-out schedule.

Referring to Climate Change and pollution control, Ms. Natarajan said that one of the important principles enshrined in the United Nations Framework Convention on Climate Change (UNFCCC) is the principle of common but differentiated responsibility. A concrete manifestation of this principle is the Kyoto Protocol. She appealed to the gathering to act in effective ways to control pollution. The Minister asked them to be alert and determined and take up responsibility to reduce carbon foot prints. (Source: www.internationalnewsandviews.com)

International Day for the Preservation of the Ozone Layer

The United Nations General Assembly adopted a resolution 49/114 that proclaims 16 September as the International Day for the Preservation of the Ozone Layer, to commemorate the signing of the Montreal Protocol on the Substances that Deplete the Ozone Layer on the day in 1987. As a party to the Montreal Protocol, India's Ozone Cell has been celebrating the International Ozone Day since 1995 at the national and state level. "HCFC phase-out: a unique opportunity" was the theme for the 17th International Day for the Preservation of the Ozone Layer in 2011. The Ozone Cell of the Ministry of Environment and Forests celebrated the day by organizing the following activities on 16 September:

- Publication of booklet *The Montreal Protocol: India's Success Story*, which apart from the evolution of the Montreal Protocol gives the various initiatives taken by the Government of India to fulfil the obligation of the Montreal Protocol;
- Publication of a poster, pledge and a sticker for distribution to industries, institutions, government departments and students, to raise public awareness; and
- Various competitions for children on painting, poster, slogan writing, model making, skit and quiz. (Source: www.ozonecell.com)

HPMP-India draft strategy procedure adopted

The preparation of the country's Hydrochlorofluorocarbon (HCFC) Phase-out Management Plan (HPMP) was initiated as early as in September 2009. A Sectoral Working Groups meeting was organized on 24 and 25 September 2009 at New Delhi. The meeting was very well attended by the stakeholders from industry, industry associations, research and development organizations, non-government organizations (NGOs), concerned line ministries and the implementing agencies. The main objectives of the meeting were to create awareness among the stakeholders and take them on board and identify the sectors which are consuming HCFCs in manufacturing of equipment/products and in other applications. Based on the outcomes of the meeting, the Road Map for the implementation of phase-out of HCFCs in India was updated and launched.

The Sectoral Working Groups meeting, through two days of intensive deliberation, identified three major HCFC consumption sectors – refrigeration and air-conditioning (RAC) manufacturing, RAC servicing and foam manufacturing. HPMP has been prepared in close cooperation with industry associations. The Memorandum of Agreements (MOAs) were signed between the Ozone Cell,

the Ministry of Environment and Forests (MoEF), and Refrigeration and Air-conditioning Manufacturers Association (RAMA) and Indian Polyurethane Association (IPUA) for preparation of RAC manufacturing and foam manufacturing sectoral strategies. RAMA and IPUA organized awareness workshops in close cooperation with Ozone Cell, one each in the major industrial hubs of Chennai, Delhi and Mumbai, during June-July 2010. These workshops were well attended by stakeholders, especially from the foam and RAC sectors. RAMA and IPUA made extraordinary efforts to involve small and medium enterprises (SMEs) in these workshops to create awareness among them. Overall, these workshops proved to be very effective in reaching out to large enterprises as well as SMEs who are involved in manufacturing RAC equipment and foam.

RAMA and IPUA also carried out detailed surveys involving market research consulting agencies for collecting data on enterprises using HCFCs for the past three years. After collation and analysis of the information, RAMA and IPUA submitted sectoral strategies to the Ozone Cell in March-April 2011. However, these sectoral strategies did not having complete enterprise-wise data on consumption of HCFCs and details of baseline equipment used. In cooperation with the United Nations Development Programme (UNDP), the Ozone Cell sent a revised questionnaire to those enterprises and collected data on HCFC consumption and baseline equipment. The data was collated by the Ozone Cell/UNDP, and finally the sectoral strategies were updated. The RAC servicing sector strategy was prepared by the Servicing Sector Group of the industry under the guidance of GIZ, Government of Germany as implementing agency in cooperation with the Ozone Cell.

A two-day stakeholder workshop was held on 21-22 October 2011 for finalizing sectoral strategies and the HPMP. A large number of stakeholders participated in the deliberation and provided their inputs. The HPMP was finalized by the lead implementing agency in association with other implementing agencies – United Nations Environment Programme (UNEP), United Nations Industrial Development Organization (UNIDO) and GIZ – in close cooperation with the Ozone Cell, taking into account the inputs received in the workshop. (Source: Ozone Cell, MoEF, Government of India)

IN THE NEWS

Aviation takes action on ozone and climate protection

At the working group meeting in August 2011, the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer heard from the Protocol's Halons Technical Options Committee (HTOC) and the International Civil Aviation Organization (ICAO), a specialized United Nations agency, on another successful step in phasing out halons in fire extinguishers on aircrafts. Halons are among the most potent ozone depleting substances and greenhouse gases.

Phasing out halons used in fire extinguishers on aircrafts has proved to be a difficult challenge because of their effectiveness in fire-fighting that, in turn, helps increase passenger safety. However, in 2003, the Parties to the Montreal Protocol asked the Ozone Secretariat of the United Nations Environment Programme (UNEP) and its technical experts to begin to work with ICAO to look into the possibility of modifying the regulatory requirements that mandate the use of halons on new aircrafts without compromising the health and safety of airline passengers.

With assistance from HTOC, ICAO has amended two of its Technical Annexes containing standards related to aircraft operations and airworthiness. Both Annex 6 – *Operation of Aircraft* – and Annex 8 – *Airworthiness of Aircraft* – were amended to include a related environmental requirement. ICAO will continue to monitor the research and development of halon alternatives to ensure that the target dates are met and will follow up on research into a viable halon alternative for cargo area fire-extinguishing systems. (Source: new.unep.org)

Philippine environment forum underscores phase-out of HCFCs

In the Philippines, a recent regional environment forum of the Environmental Management Bureau (EMB 12) of the Department of Environment and Natural Resources (DENR) has emphasised the gradual phase-out of the use of hydrochlorofluorocarbons (HCFCs). The first stage of the HCFC

phase-out programme is to freeze its consumption relative to the baseline of 3,635.08 tonnes by the year 2013. The next stage would be a 10 per cent reduction by the year 2015, said EMB Director for Region XII, Mr. Datu Tungko M. Saikol. EMB 12 has already gathered the baseline data relative to the HCFC Phase-out Project. About 20 establishments using HCFCs – particularly as foaming agents and refrigerants – have been identified.

Mr. Saikol allayed fears of some attendees of the Forum about the negative effects of the impending HCFC phase-out on the business sector. He explained that several alternative measures have been taken in consultation with industry groups, including car manufacturers, to "soften the blow" of the phase-out. As regards regulation, he said that DENR issues chemical control orders to regulate the entry of controlled substances into the country. (Source: www.pia.gov.ph)

Royal launch in Bhutan for new ozone and climate plan

The Royal Government of Bhutan has unveiled a new commitment to phase out ozone-depleting substances (ODSs). The initiative, which has the support of the United Nations Environment Programme (UNEP), was launched by Bhutan's royal bride-to-be, Ms. Ashi Jetsun Pema, in the courtyard of Tashichho Dzong, the seat of the nation.

The Hydrochlorofluorocarbon (HCFC) Phase-out Management Plan (HPMP) commits Bhutan to phasing out HCFCs, which are both ODSs and greenhouse gases (GHGs), 10 years ahead of the Montreal Protocol schedule. "We want to phase out HCFCs as soon as possible and maintain our country's status as a net sink for greenhouse gases," said Dr. Ugyen Tshewang, Secretary of the National Environment Council (NEC) of the Royal Government of Bhutan. HCFCs in Bhutan are primarily used in air-conditioning and refrigeration units in its large industrial establishments, hotels and resorts, governmental sectors, corporate offices as well as domestic servicing sector.

The OzonAction Programme of UNEP's Division of Technology, Industry and Economics (DTIE) has been supporting Bhutan to develop HPMP through stakeholder consultations and a survey of HCFC consumption in the country. To achieve the targets set in the Plan, Bhutan will follow a three-pronged approach for HCFC phase-out comprising the following elements: limiting the supply of HCFCs; reduction of the demand for HCFCs for servicing existing equipment; and limiting new demand of HCFCs. This approach aims to reduce the dependence on HCFCs until the final phase-out in 2020. (Source: new.unep.org)

Islamic Republic of Iran celebrates world ozone day

Proud to have received a plaque of appreciation from the United Nations for their efforts to protect the ozone layer, Iranians gathered in the Environment Protection Organization along with representatives from the United Nations Environment Programme (UNEP) and other international environmental bodies to commemorate the signing of the Montreal Protocol and the International Day for the Preservation of the Ozone Layer.

The Islamic Republic of Iran initiated its national programme to protect the Ozone layer in 1994. It was the first country in the Asia-Pacific to successfully phase out the use of chlorofluorocarbons (CFCs). The nation is firm about meeting its Montreal Protocol obligations, and the Office for the Protection of the Ozone Layer has kicked off its second two-year programme. The Islamic Republic of Iran has to freeze its consumption of hydrochlorofluorocarbons (HCFCs) by 2013 and reduce that number by 10 per cent till 2015. It currently consumes annually 5,000 tonnes of HCFC and has received US$11 million to take steps necessary to meet the phase-out target. (Source: www.presstv.ir)

China and UNIDO partner to phase out ODSs and GHGs

In July 2011, China signed an US$265 million agreement with the Multilateral Fund for the Implementation of the Montreal Protocol to reduce its use of hydrochlorofluorocarbons (HCFCs) by 17 per cent. "Chinese HCFC-consuming industries have made a significant step to meeting the first reduction targets under the Montreal Protocol. However, due to a rapidly growing economy, China still remains the world's largest producer and consumer of HCFCs," said Mr. Sidi Si Ahmed,

Director of UNIDO's Montreal Protocol branch. HCFCs are being phased out worldwide as they are both ozone depleting substances (ODSs) and potent greenhouse gases (GHGs).

US$119 million, or roughly 45 per cent of the total amount received from the Multilateral Fund, will be allocated to the United Nations Industrial Development Organization (UNIDO) for technology transfer and capacity building services. The funds that remain will go to partners like United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), the World Bank and the Governments of Germany and Japan. China's air-conditioning, refrigeration, foam and aerosol sectors will face the challenge of converting hundreds of production lines in order to freeze the country's consumption of HCFCs by 2013 and reduce its consumption by at least 10 per cent by 2015 in line with the Montreal Protocol's control measures for HCFCs.

Once implemented, the programme expects to help eliminate 3,320 tonnes of HCFC consumption in China, increase transfer of technology and other know-how, as well as to significantly contribute to global efforts on mitigating climate change. (Source: www.unido.org)

Indonesia stresses its commitment to reduce HCFCs

In Indonesia, Environment Minister Mr. Mohammad Gusti Hatta led the International Ozone Day celebrations on the anniversary of the Ministry of Environment, with the theme "HCFC Phase-out: A Unique Opportunity". Efforts to eliminate hydrochlorofluorocarbons (HCFCs) provide a unique opportunity, he said, to not only prevent the ozone layer destruction, but also to simultaneously prevent the occurrence of global warming. Initiatives to eliminate HCFCs offer the industry an opportunity to choose the HCFC replacement technology that not only avoids ozone destruction, but also to lower energy costs and maximize climate benefits. By limiting the impacts of global climate change sustainable development can be achieved, he said.

Elimination of HCFCs will be achieved in stages, starting in 2013 with the reduction of HCFC consumption by 10 per cent in 2015, to a reduction of 97.5 per cent in 2030. Beginning 1 January 2008, the Government of Indonesia had banned the imports of chlorofluorocarbons (CFCs) and methyl bromide for application of non-quarantine and pre-shipment application. In addition, import of other ozone depleting substances – such as halons, carbon tetra chloride and methylchloroform – has also been prohibited. (Source: sains.kompas.com)

Viet Nam's phase-out of HCFCs on target

Viet Nam may complete the phase-out of hydrochlorofluorocarbons (HCFCs) – ozone-depleting substances (ODSs) and powerful greenhouse gases (GHGs) – by 2025, five years earlier than the deadline, if it receives sufficient financial and technological support from its international partners, said Mr. Nguyen Khac Hieu, Deputy Director of the Ministry of Natural Resources and Environment's Department of Hydro-Meteorological and Climate Change. "The financial aid will cover 80 per cent of the expenditures; the enterprises have to contribute the remaining," Mr. Hieu said. In Viet Nam, HCFCs are used in air-conditioning, foam manufacture and industrial refrigeration. In 2010, the country consumed about 3,700 tonnes of HCFCs.

Mr. Hieu said that the proposal for a HCFC Phase-Out Management Plan for Viet Nam has been approved by the Multilateral Fund (MLF) for the Implementation of the Montreal Protocol for the period 2012-1206. During this phase, Viet Nam would receive a financial aid of US$10 million. The main component of the project in the first phase would be to eliminate 500 tonnes of HCFC-141b and nearly 2,000 tonnes of polyol blended with HCFC-141b in 12 enterprises that produce insulating foams. Cyclopentane, a compound that is not a threat to the ozone layer or the climate, will replace HCFC-141b in the production line.

Another component would be to reduce the consumption of HCFC-22, a refrigerant widely used in the seafood processing industry, as well as the new instalment of HCFC-22-based refrigerators. The Department will compile the new plan for the next phase and start fund-raising activities from 2015. It is estimated that Viet Nam will need an additional US$20-25 million to achieve complete HCFCs phase-out. (Source: english.vietnamnet.vn)

Pakistan promotes ozone-friendly technology

Pakistan is fully committed to its international obligations towards protecting the Earth and its fragile atmosphere and is making all-out efforts to meet the target for phasing out the use of ozone depleting substances (ODSs) and conversion of concerned industries into ozone-friendly technology, Dr. Ishfaq Ahmed, Senior Advisor, Climate Change and Development, said while addressing a recent workshop on "HCFC Phase-out: A Unique Opportunity", organized by the Ozone Cell, Planning Commission, Planning and Development Division. Pakistan has phased out the first generation of ODSs by 31 December 2009 and thus stayed compliant to Montreal Protocol, he pointed out.

Dr. Ahmed explained that the global community, especially the developing countries, are facing the challenge of the elimination of hydrochlorofluorocarbon in the refrigeration and foam industries. The member countries to the Montreal Protocol have to freeze its consumption in 2013 at the average of 2009-2010 and then gradually eliminate its consumption during 2015-2030. The Ozone Cell, Dr. Ahmed said, has undertaken several measures to facilitate implementation of the Montreal Protocol. These primarily include projects undertaken with the industry, policies and regulatory actions, creating awareness among the stakeholders, training and capacity building and information exchange on ODS phase-out. (Source: www.sananews.net)

Nepal pins hopes on its climate change policy

Nepal's Prime Minister Dr. Baburam Bhattarai has called for vigorous national and international efforts for the protection of the ozone layer. Delivering a message on the International Day for the Preservation of the Ozone Layer on 16 September, he pointed out that four decades have passed since raising the issue of ozone layer depletion from chlorofluorocarbons (CFCs), methyl bromide and other substances produced by human activities. In his message, Dr. Bhattarai said it has been expected that effective implementation of the country's Climate Change Policy-2067 B.S will contribute to protect the ozone layer from Nepal's side. (Source: www.thehimalayantimes.com)

REFRIGERATION/ AIR-CONDITIONING

Researcher bags award for small ammonia heat pump

Mr. Behzad Abolhassani Monfared, a researcher at Royal Institute of Technology in Sweden, has bagged 2nd place among the three Eurammon Natural Refrigeration Awards 2011. The award was given to Mr. Monfared's project "*Design and Construction of a Small Ammonia Heat Pump".* Most of the synthetic refrigerants, in case of leakage or release, are harmful to the environment as they contribute towards global warming or stratospheric ozone layer depletion. Among alternative refrigerants, ammonia, a natural refrigerant with zero global warming potential (GWP) and ozone depletion potential (ODP), can be a sensible choice, Mr. Monfared says.

In Mr. Monfared's project, a small heat pump with about 7.5 kW heating capacity at -5°C and 40°C evaporation and condensation temperatures is designed and built to work with ammonia as refrigerant. The heat pump is expected to produce enough heat to keep a single-family house warm in Sweden and to provide tap hot water for the house. The project proposes to install the heat pump in a house to test it throughout a winter season to study its performance in real working conditions. Since ammonia is inflammable and toxic in high concentrations, the refrigerant charge kept low in the heat pump; the compact design of the heat pump helps reduce the refrigerant charge. Considering the limited space normally reserved for installation of a heat pump in a house, the compact design of the heat pump is necessary, Mr. Monfared says. (Source: www.scanvac.net)

Safe filling system for R1234yf

R1234yf, the replacement refrigerant for R-134a, needs special filling systems in final assembly in view of its inflammability. Dürr Somac GmbH, Germany, has developed such a filling system with high standards of safety. R1234yf, although it has almost the same thermodynamic properties as R134a, has a global warming potential

(GWP) of only 4 compared with 1,400 for R134a. However, R1234yf is classified as a hazardous substance due to its high inflammability, and all filling equipment must meet high safety standards.

For its R1234yf filling systems, Dürr Somac, working in cooperation with the TÜV Rheinland Group of Germany, has developed an integrated safety concept that eliminates risks even in cases of malfunction. Alongside reliable components, additional sealing materials in all threaded connections and an associated ventilation system ensure that explosive mixes cannot occur. The continuous, automatic seal tightness testing of selected sections of the filling system during operation ensure additional safety. Individual sections can also be shut off and drained separately for maintenance or in the event of faults.

High safety standards also apply to the interface with the vehicle, i.e. the actual fill point for the air-conditioning system in the car. A pneumatically clamping filling adapter is used to ensure that R1234yf does not run out while filling. Any excess volume of refrigerant remaining is also sucked out on completion of the filling process. The filling system is available either as mobile "Compact" unit or as stationary "ProLine" model; both can be integrated easily into existing assembly lines. (Source: www.durr.com)

New technology allows safe use of hydrocarbons in MAC

Obrist Engineering GmbH, Austria, targets a safe strategy to use low-GWP and high-efficiency hydrocarbons (HCs) in mobile air-conditioning (MAC). The Thermal Event Suppression System (TESS) from Obrist is such a safety system that helps replace R134a with HC-based refrigerants. TESS, developed for engine compartment, comprises a bottle that contains an aerosol compound, a cooling zone and exit ports. It has three activation levels: signal from crash sensor; signal from air-conditioning system (pressure release); and direct activation by heat (fire). The non-pressurized aerosol gets ignited by 0.5 A current or temperatures above 280°C. When ignited, TESS creates aerosol particles in micron size, based on potassium nitrate. The chemical reaction of mainly potassium radicals with the free radicals in the fire zone suppresses the fire.

Obrist has investigated several natural refrigerants, both single substances and mixtures, calculated their coefficient of performance (COP), refrigerant charge and maximum cooling performance. R436B – hydrocarbon mixture of 52 per cent propane (R290) and 48 per cent of isobutene (R600a) – showed the best results, with 18 per cent higher COP, 57 per cent less charge and 12 per cent higher maximum cooling performance when compared with R134a, said Mr. Martin Graz, Technical Director of Obrist. In addition, R436B is a drop-in solution. (Source: www.hydrocarbons21.com)

R290 chillers and heat pumps

Bundgaard Køleteknik A/S is a Danish manufacturer of chillers and heat pumps that use natural refrigerant R290 (propane). The company produces up to 50 state-of-the-art hydrocarbon systems each year, for application ranging from comfort cooling in large offices and production plants, to swimming pools, stables and farms. The industry segment continues to grow, as R290 systems are among the most environmentally friendly systems on the market.

The global warming potential (GWP) of the refrigerant R410A is 1,720 compared with just 3 for R290, according to Technology and Economic Assessment Panel (TEAP). The low charge requirement offers a direct economic benefit as the lower volume of refrigerant requirement means less investment. However, R290 is an inflammable gas that requires adequate safety measures. Bundgaard uses coils, filters, EVRE solenoid valves and KP-E pressure controls especially developed for hydrocarbons by Danfoss, one of the largest industrial companies in Denmark. Danfoss components are not only reliable, but they also help to significantly lower customers' operating and maintenance costs, Bundgaard says. (Source: www.hydrocarbons21.com)

New console air-conditioners

The latest York console air-conditioning units from Johnson Controls, the United States, use R410A gas refrigerant that has zero ozone depletion potential (ODP), says the company's General Manager, Mr. Neil Cameron. Traditional console air-conditioning units are not very efficient and they use R22, an ozone-depleting refrigerant that

is being phased out. The new consoles deliver additional benefits as they use of inverter compressors and are heat pumps, resulting in a high electric efficiency and low running costs, he adds.

The York R410A Inverter Heat Pump console units are 30 per cent more efficient in energy use for cooling, release no ozone depleting gases and run more quietly than normal console units, Mr. Cameron states. The units have a cooling capacity range of 2.6 kW to 5.3 kW. Instead of the hard and noisy start/stop of the compressor on the R22 units, the addition of an inverter on the compressor on the R410A unit ensures more smooth and more consistent run, cutting down on noise pollution and the mechanical wear of parts, as well as on energy spikes on hard starts and stops. (Source: www.engineeringnews.co.za)

World's first R290 split AC production line

Gree Electric Appliances, China, has set up the world's first production line of split air-conditioner units that use the hydrocarbon refrigerant R290 (propane). Although R410A is a popular alternative to R22, which is to be phased out by 2030 under the Montreal Protocol, its high global warming potential (GWP) prevents its wider use. R290 is getting accepted as an environmentally friendly alternative refrigerant throughout the world, as it has zero ozone depletion potential (ODP) and a very low GWP of 3.

At Gree, the R290 air-conditioners passed the inspection of an expert panel from China Household Electrical Appliance Association (CHEAA) in December 2008. About two years later, the Association for Electrical, Electronic and Information Technologies (VDE) – one of the largest technical and scientific associations in Europe – released its first certificate for R290 air-conditioners to Gree. Subsequently, the German government inked an agreement with the Ministry of Environment Protection of China and CHEAA through GIZ, the German Agency for International Cooperation, to fund Gree to design and construct an R290 air-conditioner production line with annual production capacity of 100,000 units. The production line can produce non-inverter and inverter split type air-conditioners, window type air-conditioners and movable air-conditioners. (Source: www.cr-expo.com)

SOLVENTS

Azeotropic compositions for cleaning applications

E.I. du Pont de Nemours and Company, the United States, has patented certain azeotropic or azeotrope-like compositions comprising a fluorinated olefin with the formula E- or Z-C_3F_7CH-CHC_3F_7, and at least one alcohol, halocarbon, hydrofluorocarbon, fluoroether or alkanes and combinations thereof (such as methanol, ethanol, iso-propanol, n-propanol, trans-1,2-dichloroethylene, cis-1,2-dichloroethylene, n-propyl bromide, etc.). These compositions are useful in cleaning applications as a degreasing agent or defluxing agent for removing oils and/or other residues from surfaces, such as integrated circuit devices. *Contact: E.I. Du Pont de Nemours and Company, 1007 Market Street, Wilmington, Delaware, DE19898, United States of America.* (Source: www.freepatentsonline.com)

Environment-friendly oxygen systems cleaning

Maintaining the cleanliness of oxygen lines is of vital importance to the safety of aerospace vehicle crew. When contamination is discovered, the lines must be cleaned. This used to entail dismantling and removing the oxygen lines from the aircraft, cleaning with chlorofluorocarbons (such as CFC-113) or hydrochlorofluorocarbons (such as HCFC-141b), and then reinstalling on the vehicle. This procedure resulted in emissions of CFCs/ HCFCs – both ozone depleting substances (ODSs) – high labour costs and long periods of downtime.

A project at the Technology Evaluation for Environmental Risk Mitigation (TEERM) of the United States National Aeronautics and Space Administration (NASA) aimed at demonstrating, validating and qualifying multiple technologies that would eliminate the use of ODS and lower costs. Two technologies were chosen for testing, hydrofluoroether-7100 (HFE-7100) and an aqueous cleaning system. HFE-7100 was used in a transportable onboard solution as a direct replacement for the ODSs, while the aqueous cleaning system was used in several off-board demonstrations. Both solutions met the set acceptance criteria and

modified testing specifications. The onboard line cleaning system utilizing HFE-7100 was later successfully incorporated into the aircraft precision cleaning regime.

While the benefits have not been fully reported, it is estimated that these alternatives can result in cost avoidances of up to US$1 million per aerospace vehicle by eliminating the consumption and emission of tens of thousands of litres of ODSs annually and reduction of labour costs and aircraft downtime. These technologies can also potentially be applied to other applications such as oxygen lines for tanks, machinery and hospitals. Knowledge gained from this project is being utilized in a NASA TEERM follow-on project to evaluate next-generation oxygen system cleaning products as substitutes for Class II ODSs such as HCFC-141b. (Source: teerm.nasa.gov)

Organic solvent for textile cleaning system

Eminent Technologies LLC, the United States, has obtained a United States patent on a textile cleaning system that utilizes an organic cleaning solvent and pressurized fluid solvent. The system has no conventional evaporative hot air drying cycle. Instead, it utilizes the solubility of the organic solvent in pressurized fluid solvent as well as the physical properties of pressurized fluid solvent. The new cleaning system is claimed to reduce solvent consumption and waste generation as compared with conventional dry-cleaning systems. Use of conventional solvents – typically, ozone-depleting tetrachloroethylene – is avoided, and machine and operating costs are reduced as compared with currently used pressurized fluid solvent systems.

After an organic solvent cleaning cycle, the solvent is extracted from the textiles at high speed in a rotating perforated drum in the same way conventional solvents are extracted from textiles in conventional evaporative hot air dry cleaning machines. Instead of proceeding to a conventional drying cycle, the extracted textiles are then immersed in pressurized fluid solvent to extract the residual organic solvent from the textiles. This is possible because the organic solvent is soluble in pressurized fluid solvent. After the textiles are immersed in pressurized fluid solvent for a certain time, that solvent is pumped out from the drum. Finally, the drum is de-pressurized to atmospheric pressure to help evaporate any remaining pressurized fluid solvent, yielding solvent-free and clean textiles.

The organic solvent is preferably selected from terpenes, halohydrocarbons, certain glycol ethers, polyols, ethers, esters of glycol ethers, esters of fatty acids and other long chain carboxylic acids, fatty alcohols and other long-chain alcohols, short-chain alcohols, polar aprotic solvents, siloxanes, hydrofluoroethers, dibasic esters, and aliphatic hydrocarbons solvents or similar solvents or mixture of such solvents. The pressurized fluid solvent used in the present invention could be an inorganic substance such as carbon dioxide, xenon, nitrous oxide or sulphur hexafluoride, though densified carbon dioxide is preferred. Conventional additives may be used in the cleaning system. (Source: www.freepatentsonline.com)

Fluoropropene compositions as solvents and cleaning agents

Fluorocarbon-based fluids have found widespread use in many commercial and industrial applications, including as the working fluid in heat pumps, air-conditioners and refrigerators, and as solvents, cleaning agents and aerosol propellants. However, many of these materials are associated with environmental problems, such as relatively high global warming potential (GWP), high ozone depletion potential (ODP) and volatile organic compound (VOC) content. Honeywell International Inc., the United States, has filed for patenting environmentally safe and VOC-free compositions that can be used as solvents, propellants, cleaning compositions, heat transfer mediums, blowing agents and compatabilizing agents.

The new compositions consist of one or more fluorinated alkene compounds, particularly certain tetrafluoropropene compounds, and preferably 1,1,1,2-tetrafluoropropene (HFO-1234yf), cis-1,1,1,3-tetrafluoropropene (cisHFO-1234ze) and trans-1,1,1,3-tetrafluoropropene (trans HFO-1234ze) and certain monochlorotrifluoropropene compounds. Honeywell has found that each of these compounds has the advantageous property of not being a VOC [a Maximum Incremental Reactivity (MIR) that is less than that of ethane], has

a relatively low toxicity value, no substantial ODP (not greater than 0.5) and a low GWP (not greater than about 150). It states that the use of such compounds in the compositions and/or as per the methods stated can dramatically improve the environmental desirability of the compositions. (Source: www.patentstorm.us)

Environment-friendly azeotropic cleaning solvents

Chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and hydrochlorocarbons (such as 1,1,1-trichloroethane and carbon tetrachloride) have been employed in a wide variety of solvent applications such as drying, cleaning (for example, the removal of flux residues from printed circuit boards), and vapour degreasing. These materials have been shown to contribute to depletion of the Earth's ozone layer and/or have been linked to global warming. 3M Innovative Properties Company, the United States, has patented environment-friendly azeotrope and azeotrope-like compositions which contain 1,1,1,2,3,3-hexafluoro-3-methoxypropane and 1-bromopropane, as well as methods of using azeotropes and azeotrope-like compositions to clean substrates, deposit coatings, transfer thermal energy and lubricate working operations.

Besides their low ozone depletion potential (ODP) and low global warming potential (GWP), these compositions based on hydrofluoroethers (HFEs) have sought-after characteristics that include boiling point ranges suitable for a variety of solvent cleaning applications, low inflammability, low toxicity, no flash points and the ability to dissolve both hydrocarbon-based and fluorocarbon-based soils. In some instances, HFEs can form azeotropes with one or more co-solvents to modify or enhance the solvent characteristics of the HFE. Many azeotropes possess properties that make them useful solvents. For example, azeotropes have a constant boiling point that avoids boiling temperature drift during processing and use. In addition, when an azeotrope is employed as a solvent, the properties remain constant because the composition does not change during boiling or reflux. Azeotropes that are used as solvents also can be recovered conveniently by distillation. (Source: www.freepatentsonline.com)

FOAMS

One-component-foam with non-liquefied inert propellant

One-component-foam (OCF) formulations have gained popularity especially as adhesive, sealants and insulating materials that are sold in pressurized containers and dispensed through a hose or tube optionally fitted with a dispensing gun. OCF formulations typically use a polyurethane pre-polymer formulation and a propellant that contains hydrocarbons, dimethyl ether and/or compressed liquefied gases such as fluorinated olefin (HFO) compounds. The propellant expels the polyurethane pre-polymer formulation and foams it as it cures with moisture in the atmosphere to form polyurethane foam. Inert non-liquefied propellants such as carbon dioxide and nitrous oxide are desirable because they are more eco-friendly than the conventional propellants.

Dow Global Technologies Inc., the United States, and three inventors have jointly patented an OCF formulation comprising an isocyanate compound, a polyol, an amine catalyst, an emulsifier, a cell opener, a surfactant (a silicone glycol copolymer) and a non-liquefied inert gas-based propellant. The propellant concentration in the formulation ranges from 5 to 35 weight-per cent, with at least 50 weight-per cent of the propellant being non-liquefied inert gases. The cell opener component is less than 0.01 weight-per cent of polyol weight. The formulation is compressed to a pressure of at least 15 atm and held in a container of five litres or more. The patent also covers a method for dispensing the OCF formulation from the container onto a substrate at an acceptable flow rate over a temperature range of 5-35°C and allowing the formulation to expand into a stable polymeric foam with a density of 45 kg/m^3 or less. *Contact: Dow Global Technologies Inc., 2040 Dow Centre, Midland, MI 48674, United States of America.* (Source: www.sumobrain.com)

Phenolic foam

Kingspan Holdings Limited, Ireland, has patented a phenolic foam composition that comprises a phenolic resin, a blowing agent, an acid catalyst

and an inorganic filler. The blowing agent consists of a blend of chlorinated aliphatic hydrocarbon (with 2-5 carbon atoms) and an aliphatic hydrocarbon (with 3-6 carbon atoms) mixed in a ratio of 60/40 to 95/5 parts by weight.

The inorganic filler is at least one selected from a metal hydroxide, a metal carbonate, a metal oxide and a metal powder. The phenolic foam has a pH of 5 or more and a water uptake less than 1 kg/m^2. A phenolic foam with a higher pH value when compared with conventional phenolic foam reduces corrosion risk when in contact with metallic materials. The phenolic foam maintains excellent long-term stability in terms of thermal insulation performance, low water uptake and fire resistance performance. Use of aliphatic hydrocarbon-based blowing agent ensures that no harm is caused to the environment by way of ozone depletion or global warming. *Contact: Kingspan Holdings Limited, Dublin Road, Kingscourt, Co., Cavan, Ireland. Tel: +353 (42) 9698000; Fax: +353 (42) 9667501; E-mail: admin@kingspan.ie.* (Source: patents.com)

Process for preparing open-celled rigid polyurethane foam

Huntsman International LLC of the United States, together with two Belgium-based inventors, has patented a process for preparing open-celled rigid polyurethane foam, the polyurethane foams that can be obtained using this process and the use of these polyurethane foams as heat insulating material. Rigid polyurethane foams, particularly closed celled polyurethane foams, are well known for their excellent heat insulating properties and widely used as heat insulating material in pipings, storage tanks, buildings and refrigerators.

Closed-celled polyurethane foams used to be made with blowing agents based on chlorofluorocarbons (CFCs) such as CFC-11 (trichlorofluoromethane). The heat insulating properties were, for a large part, determined by the thermal conductivity of CFC gases that filled the foam cells. As CFCs are phased out because of their ozone depleting property, alternative blowing agents are being used. However, it is very difficult to find substitute blowing agents for CFCs, which have very low thermal conductivity. The inventors have found it particularly advantageous to use water as the sole blowing agent. For very good results, the amount of water used may be 2 to 16 parts by weight per 100 parts of the polyol-containing reaction formulation.

The method for the preparation of low-density, open-celled, water-blown rigid polyurethane foams entails reacting a polyisocyanate component with a polyol composition comprising two polyol components, each containing at least one polyoxyalkylene polyol having oxyethylene residues and having an average nominal hydroxyl functionality of 2 to 4 and an average oxyethylene content of less than 50 wt%. The first polyol component has a hydroxyl number of not more than 60 mg KOH/g, while the second component has a hydroxyl number of not more than 135 mg KOH/g. The first polyol constitutes at least 70 wt% of the composition, while the second polyol constitutes at the most 30 wt%. *Contact: Huntsman International LLC, 500 Huntsman Way, Salt Lake City, Utah, 84108, United States of America.* (Source: www.sumobrain.com)

Batch foaming of expanded PP/PLA blend bead foams

Three scientists from Ningbo Key Lab of Polymer Materials, Ningbo Institute of Material Technology and Engineering, China, have studied at pilot-scale an autoclave-based batch foaming process (50 litres) to produce polypropylene (PP) and polypropylene/poly(lactic acid) (PP/PLA) bead foams. The process uses the isomeric hydrocarbon n-pentane, instead of ozone depleting substances (ODSs), as the physical blowing agent.

The resultant bead foams exhibited high expansion ratio of up to 44.4, good ellipse bead foam shape, well-defined cell structure and high cell density. PP exhibited a narrow foaming temperature window around 4-5°C, while the presence of 20 per cent PLA (which possesses high n-pentane solubility) broadened the foaming temperature window to 10-15°C and facilitated the foam expansion. The study also examined some fundamental issues such as pressure building in autoclave, n-pentane solubility, and various parameters to control bead foams' expansion and cell morphology. *Contact: Mr. Wentao Zhai, Ningbo Key Lab of Polymer Materials, Ningbo Institute of Material Technology and Engineering, Chinese*

Academy of Sciences, Ningbo, Zhejiang province, 315201, China. E-mail: wtzhai@nimte.ac.cn. (Source: cel.sagepub.com)

Efficient, low-GWP blowing agent for foam insulation

Honeywell International Inc., based in the United States, has introduced a new hydrofluoro-olefin-based liquid blowing agent in its growing family of materials with a low global warming potential (GWP). Solstice™ Liquid Blowing Agent can be used in a variety of insulation applications that include spray-foam, foam insulating panels and refrigerator insulation. Use of the new material can make refrigerators up to 10-12 per cent more energy-efficient than hydrocarbon-blown foam.

"Honeywell's new Solstice Liquid Blowing Agent excels in the four dimensions that are most important to blowing agent users: energy efficiency performance, environmental impact, safety in use, and cost-effectiveness," said Mr. Terrence Hahn, Vice President and General Manager for Honeywell Fluorine Products. Honeywell recommends a two-step approach when it comes to blowing agents. Appliance manufacturers can meet the Montreal Protocol regulations demanding a phase-out of hydrochlorofluorocarbons (HCFCs) by using Honeywell's Enovate, a hydrofluorocarbon (HFC-245fa) blowing agent. Enovate can be adopted as a near drop-in replacement for HCFC-141b. It is non-ozone-depleting, allowing manufacturers to meet the phase-out plans. In a second step, manufacturers can adopt Solstice Liquid Blowing Agent as needed to meet further regulation.

Solstice Liquid Blowing Agent has an extremely short atmospheric lifetime of approximately 26 days. It has a low global warming potential (GWP) of less than 7 and has no depletion impact on the ozone layer. Because Solstice Liquid Blowing Agent is non-inflammable, it does not require expensive explosion-proof equipment and handling, unlike hydrocarbon alternatives. It is also a near drop-in replacement for today's most commonly used blowing agents. If adopted globally, the product could save approximately 60 million tonnes per year of carbon dioxide equivalent, which is comparable to eliminating carbon dioxide emissions from more than 11.8 million cars every year, it is claimed. (Source: eqmaglive.com)

FUMIGANTS

Fungi could replace ozone-depleting pesticide

A certain fungus found in soil might be the natural alternative needed to help phase out the use of methyl bromide, one of the most potent ozone-layer depleting substances still being used in agriculture. Mexican researchers have identified a biological control in the form of a locally found *Trichoderma* fungus, which they claim could be a promising alternative to methyl bromide. *Trichoderma* fungi, which can grow in almost any agricultural soil, coil around host fungi and degrade the cell walls. Some strains even create antibiotic resistance that inhibits other fungi from attacking the plant.

"We achieved up to a 63 per cent inhibition of pathogen attacks after experimenting with several *Trichodermas*," explained lead researcher Ms. Rufina Hernández, a microbiologist with Ensenada Centre for Scientific Research and Higher Education (CICESE), a scientific research institute based in Mexico. "For the past 25 years, scientists have studied several organisms' potential to be used as biocontrol agents, and *Trichoderma* is one of the most widely discussed for its antagonistic capacity against several other fungi," she added.

A research team led by Ms. Hernández identified two fungi – *Fusarium* and *Verticillium* – as the pathogens responsible for decreased plant productivity in Baja California's flower industry in the past decade. Both pathogens are notorious in agriculture for their devastating effects in crops. Once the harmful fungi were identified, the team investigated several biological control methods to help counter soil pathogens without the help of methyl bromide. The use of *Trichoderma spp*. was the most promising method. (Source: www.cosmosmagazine.com)

Environment-friendly fumigant better than methyl bromide

Linde Gases, a division of the Linde Group based in Germany, is launching a new fumigant in co-

operation with the Commonwealth Scientific and Industrial Research Organization (CSIRO) of Australia. The new fumigant, to be marketed as EDN, will be used to limit the impact of disease and pests on timber and in agriculture. EDN, which is based on ethanedinitrile, is an ozone-friendly alternative to ozone-depleting methyl bromide.

EDN surpasses the efficacy of methyl bromide, requires less dosage per crop, has a shorter fumigation period and has the additional benefit of leaving residues that degrade to become useful soil fertilizers. CSIRO Ecosystem Sciences Chief Mr. Mark Lonsdale said, "Ethanedinitrile presents a great opportunity to limit the impact of pests and disease in certain industries and is a viable alternative to the ozone-damaging methyl bromide. The new fumigant is the result of many years of research and is a patented technology of CSIRO's Ecosystem Sciences Division using ethanedinitrile as the active constituent." (Source: www.farminguk.com)

Plant extract checks potato pests

An organic pesticide developed from plant extracts has been observed to have both fungicidal and insecticidal effects on white potato in a recent research in the Philippines. The researchers from the Department of Agriculture-Northern Mindanao Integrated Agricultural Research Centre (DA-NOMIARC) investigated Antica, the organic liquid pesticide formulated by Mr. Gigi Zaballero, a chemical engineer and founder of Ahcil Laboratories. The researchers wanted to find out the effects of Antica on white potato diseases like bacterial wilt and blight, as well as on potato pests such as cutworms, aphids and whiteflies.

The researchers compared different doses of the Antica with pesticides used by farmers and the method recommended by NOMIARC. The farmers use different chemical fungicides and insecticides to protect their plants from diseases and insects. In the NOMIARC system, chopped wild sunflower is incorporated into the soil two weeks before planting. It was found that 30 days after planting, the plants that were sprayed with Antica at 80 ml per 16 litres of water had zero incidence of cutworms, aphids and whiteflies – significantly better than the infestation of plants that were not sprayed with any pesticide (control). Thirty days after planting, the control plants had 9 per cent incidence of cutworm, 27 per cent of whiteflies and zero per cent aphids.

In the case of the diseases bacterial wilt and leaf blight also, Antica proved to be promising. Thirty days after planting, the control plants had 9.2 per cent incidence of blight and 1.7 per cent incidence of bacterial wilt. Those sprayed with Antica at the recommended rate of 80 ml per 16 litres of water had zero per cent incidence of the two diseases. The researchers concluded that Antica holds a promise against pests and bacterial wilt and leaf blight management in potato. (Source: www.mb.com.ph)

Discounting methyl bromide fumigation in hotbed system

In the United States, researchers from University of California (Davis and Riverside) and Kearney Agriculture Centre have examined the need for methyl bromide fumigation in hotbed system for sweet potato plant stock. Previous research on this project had indicated that weeds are the main pest problem facing commercial sweet potato growers in hotbeds, and that nematodes and plant disease are inconsequential. To confirm these results under varied locations and systems, fumigation and non-fumigant alternatives to methyl bromide were evaluated in commercial sweet potato hotbeds at six locations in California in 2011. Fumigation alternatives were solarization, various rates of chloropicrin under totally impermeable film (TIF) tarp, and metam sodium. These were compared with a non-fumigated control or a standard methyl bromide + chloropicrin (53/47 per cent at 399 kg/ha) under LDPE tarp. At each location, five different herbicide treatments were evaluated within each fumigation alternative treatment. Herbicides included napropamide (Devrinol), 4.5 kg/ha equivalent; flumioxizin (Valor), 71 g/ha and 106 g/ha equivalent; 3,4-Dichloropropionanilide (DCPA, Dactha) 9.1 kg/ha equivalent; plus an untreated control. Treatments were evaluated for nematodes (especially root knot), *Pythium*, weed pressure, crop phytoxicity and plant production.

Nematodes were sampled by taking a 500 cc soil sample from each of the main plots in February before the beds were installed and again at plant harvest in May. At both sampling events, no root

knot nematodes (*Meloidogyne incognita)* or other plant parasitic nematodes were found. Soil analysis for potential root rotting pathogens too showed no significant differences among treatments. In all plots, *Pythium* populations were extremely low.

With the fumigation treatments, only methyl bromide provided adequate weed suppression. Even though chloropicrin was applied at very high rates under TIF, weed suppression was negligible. Most of the weeds, except yellow nutsedge, were effectively controlled by the herbicides evaluated at each location. Application of Devrinol or Valor significantly reduced the number of weeds as compared to not treating, with Valor having the greatest efficacy on the weeds present. Dacthal prevented most weed growth, but caused substantial crop injury. No crop phytotoxicity was observed as a result of the main plot fumigation treatments, and there were no differences in plant production between any of the treatments with the exception of Dacthal. Results strongly suggest that methyl bromide use is unnecessary in sweet potato hotbeds and can be replaced with other chemical herbicides. (Source: www.mbao.org)

Control of citrus pests with ethyl formate

Citrus fruit pests, including *Caliothrips fasciatus* (bean thrips) have been one of the challenges for the citrus industry. A systems approach has been adopted that involves special orchard practices and packinghouse procedures, and cutting of fruit from each orchard to be shipped to check for the presence of bean thrips. Occasionally, despite all these efforts, bean thrips are found in the fruit, which then needs be subjected to methyl bromide fumigation. With the phasing out of methyl bromide, a reliable, non-damaging alternative treatment is needed to assure control of bean thrips. Researchers at the Department of Plant Sciences, University of California-Davis, the United States, have developed an effective treatment with Vapormate™ fumigation that provides complete control of bean thrips. Vapormate contains 16.7 per cent ethyl formate (a natural plant volatile) by weight in liquid carbon dioxide.

Commercial fumigations were conducted in a 20 ft marine container. The chamber was loaded with 8 pallets of navel oranges infested with bean thrips, and the infested fruit were packed into boxes and randomly placed at different levels within each pallet. The container's refrigeration system was used to circulate the air and maintain the fruit at the treatment temperature of 5°C. After 24 hours, 5.2 kg of Vapormate was introduced into the chamber to achieve 31 mg/l ethyl formate concentration. After one hour commercial fumigation, infested oranges were retrieved and held at 20°C. Mortality evaluation was conducted on the following day by cutting thin slices through the orange peel and flesh starting just below the navel. A total of 35,511 thrips were included in the three fumigations and all three fumigations/replicates resulted in 100 per cent mortality. Laboratory experiments conducted to assess the quality of oranges after exposure to 1 per cent Vapormate and cold storage also showed 100 per cent bean thrips mortality.

Light brown apple moth (*Epiphyas postvittana*) is a threat to the agriculture industry, as its larvae feed on a wide range of plants, including fruit crops such as table grapes. Previous tests had shown that *E. postvittana* adults and larvae were much easier to kill with Vapormate than pupae and eggs. The scientists tested the tolerance of table grapes to ethyl formate, using one of the highest dose and exposure time treatments that have been demonstrated to be effective against all life stages of the pest – 124 mg/l for 4 hours at 15 or 20°C, was used to treat Thompson Seedless and Autumn King seedless table grapes. For both varieties, Vapormate treatment had no effect on berry firmness, soluble solids, titratable acidity, shatter or ethanol concentration. No ethyl formate residues were detected in the berries. However, the treatment caused berry browning in some cases. (Source: www.mbao.org)

The Montreal Protocol: India's Success Story

The booklet details the evolution of Montreal Protocol and the various initiatives taken by the Government of India to fulfill the obligation of the Montreal Protocol. For more information, contact:

Ozone Cell
Ministry of Environment & Forests
Core 4B, 2nd Floor, India Habitat Centre
Lodhi Road, New Delhi 110 003
Tel: +91 (11) 24642176; Fax: +91 (11) 24642175
E-mail: ozone-mef@nic.in
Website: www.ozonecell.com

RECENT PUBLICATIONS

Blowing Agents and Foaming Processes 2011 Conference Proceedings

Blowing Agents & Foaming Processes Conference returned in 2011 for the thirteenth consecutive year to highlight the academic and commercial developments in current and new polymeric foam applications. As the only conference to be tailored to the specific needs of the polymeric foam industry, the conference covered the latest thinking and best practice in new materials selection and processing technologies. These proceedings contain all the presentations from the conference, bringing the reader up-to-date on how to find cost-effective alternatives to traditional choices by discussing the numerous solutions on offer, such as new materials, resins, technology, processes and additives.

Contact: iSmithers, 425 West Market Street, Akron, OH 44303, United States of America. Tel: +1 (330) 762 7989; E-mail: info@ismithers.net.

Properties of Secondary Working fluids for Indirect Systems

Properties of Secondary Working Fluids for Indirect Systems (Secondary Refrigerants, Coolants, Heat Transfer Fluids) is a greatly expanded 2nd edition of the booklet "Thermophysical Properties of Liquid Secondary Refrigerants". It responds to rising use of secondary refrigerant systems used in applications ranging from solar heating at high temperatures to freezers in supermarkets. It provides comprehensive data on several aqueous solutions of ethylene and propylene glycol, ethanol, glycerol, ammonia, chlorides and potassium salts. Dozens of tables and charts enable readers to obtain data on 14 important working fluids.

Contact: International Institute of Refrigeration, 177, boulevard Malesherbes, 75017 Paris, France. Tel: +33 (1) 4227 3235; Fax: +33 (1) 4763 1798.

TECH EVENTS

23-25 Feb
Bangalore
India

ACREX INDIA 2012
Contact: ISHRAE Bangalore Chapter,
102, 2nd Floor, "Santa Clara",
2nd Main, Ashwini Layout,
100 Feet Road, Koramangala,
Bangalore 560 047, India.
Tel: +91 (80) 2563 4228, 4149 5045;
E-mail: info@acrexindia.org.in.

11-13 Apr
Beijing
China

CHINA REFRIGERATION 2012
Contact: China Refrigeration and
Air-conditioning Industry Association,
Floor 7(N), Guangan Mansion,
No. 6, Guangan South Street,
Henghua International Mansion,
Xuanwu District, Beijing, China.
Tel: +86 (10) 8356 0063, 8351 0099;
Fax: +86 (10) 83560060;
E-mail: craa@chinacraa.org.

08-09 May
Berlin
Germany

Blowing Agents & Foaming Processes 2012
Contact: iSmithers Rapra,
Conference Department,
Shawbury, Shrewsbury,
Shropshire, SY4 4NR,
United Kingdom.
Tel: +44 (1939) 250383, 252421;
E-mail: conferences@ismithers.net.

29 Jul-01 Aug
Kobe
Japan

10th IIR Conference on Phase Change Materials and Slurries for Refrigeration and Air-Conditioning
Contact: Mr. Hiroshi Suzuki,
Chairperson, 10th IIR Conference,
Faculty of Engineering,
Graduate School of Engineering,
Kobe University, Kobe, Japan.
Tel: +81 (78) 803 6490;
Fax: +81 (78) 803 6490;
E-mail: hero@kobe-u.ac.jp.

05-07 Sep
Singapore

REFRIGERATION ASIA 2012
Contact: IIR Exhibitions Pte. Ltd.,
205 Henderson Road #03-01,
Henderson Industrial Park,
Singapore 159549.
Tel: +65 6319 2668;
Fax: +65 6319 2669;
E-mail: clarence.ying@iirx.com.sg.

15-19 Oct
Antalya
Turkey

9th International Conference on Controlled Atmosphere and Fumigation in Stored Products
Contact: Dr. Ahmet Güray Ferizli,
Ankara University Faculty of Agriculture,
Department of Plant Protection,
06110 Ankara, Turkey.
Tel: +90 (312) 596 1136;
Fax: +90 (312) 318 70 29;
E-mail: frizli@agri.ankara.edu.tr.

PUBLICATIONS from APCTT

PERIODICALS

(Free access at www.techmonitor.net)

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- ❑ VATIS Update (6 issues/year)
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  - ❍ Non-conventional Energy (e-version)
  - ❍ Food Processing (e-version)
  - ❍ Ozone Layer Protection # (e-version)
  - ❍ Waste Management (e-version)

BOOKS	Indian Rupees* (India, Bhutan and Nepal)	US Dollars*
❑ Managing Innovation for the New Economy: Training Manual, 2002 Volume 1: How to Guide & Quick reference materials Volume 2: Articles & Lectures	1,000.00	50.00
❑ Regional Capacity-building for the Adoption of ISO-14000 and Transfer of Environmentally Sound Technology: Training Manual, 2000	600.00	30.00
❑ Small Rural Industries in the Asia Pacific Region: Enhancement of Competitiveness of Small Rural Industries in a Liberalized Economic Environment and the Impact of Poverty Alleviation, 2000	600.00	30.00
❑ Technology Transfer and Technological Capacity-building in Asia and the Pacific		
❍ Volume 1: Big Countries and Developed Economies, 1999	600.00	30.00
❍ Volume 2: ASEAN, NIEs, SAARC and the Islamic Republic of Iran, 1999	600.00	30.00
❍ Volume 3: Least Developed and Pacific Island Countries and Economies in Transition, 1999	600.00	30.00
❍ Volume 4: Emerging Issues in Regional Technological Capability-building and Technology Transfer, 1999	600.00	30.00
❑ Rural Industrialization as a Means of Poverty Alleviation: Report of the Regional Seminar on the Enhancement of Partnerships among Governmental, Non-governmental and Private Sector Entities for the Promotion of Rural Industrialization for Poverty Alleviation, 1999	600.00	30.00
❑ Institutional Development for Investment Promotion and Technology Transfer, 1999	500.00	25.00
❑ Ozone Depletion Substances Phase-out Technologies: Problems & Issues on Technology Transfer, Absorption and Generation, 1998	300.00	15.00
❑ Development and Utilization of S&T Indicators: Emerging Issues in Developing Countries of the ESCAP Region, 1998	300.00	15.00
❑ ODS Phase-out: A Guide for Industry, 1998	500.00	25.00
❑ Proceedings of the Consultative Meeting on Technology Management Education and Training for Developing Countries, 1997	800.00	40.00

Notes: Amount less than Rs 500 should be sent through a demand draft only. Otherwise, payment should be made by cheque/ demand draft/UNESCO coupon in favour of the Asian & Pacific Centre for Transfer of Technology, payable at New Delhi.

 # Print version supported by the Ozone Cell, Ministry of Environment & Forests, Government of India, for distribution to a select target group.

** Amount to be sent to APCTT with the order for covering costs and handling charges.*