Fresh

PerkinElmer®
For the Better

HUMAN HEALTH | ENVIRONMENTAL HEALTH

VOLUME 13 | WINTER EDITION 2010
INDIA ANALYTICAL SCIENCES

WISHING YOU A CLEANER SAFER HEALTHIER 2010

Fresh
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E D I T O R I A L

Dear Customers & Readers of FRESH

We at PerkinElmer would like to wish you all a very "Happy and Prosperous New Year 2010"

Each and every one of us looks back to the passing year and tries to recollect what was so special about it and what can we take from that to the coming year.

We at PerkinElmer look back and see a lot of changes that were made to keep us up to date with the ever changing environment. We went for a brand new look, the For the Better, which is something we stand by and carry with us everywhere we go.

Another positive impact we take from 2009 was the birth of our newsletter Fresh. Fresh was destined to be a monthly reminder to our customers of our presence in their institutions, their facilities, their day-to-day work, and even in their lives.

Every edition with Fresh brought with it infinite possibilities with how PerkinElmer participates in every facet of life, be it in the environment, pharmaceutical drugs, food testing, fuel, energy, health etc. And keeping in tune with this belief, we understand the need to stay Fresh in everything we do.

In 2010, you will see Fresh with a whole new look and feel. However our focus remains unchanged and will continue to be for Human health and Environmental health.

We will position Fresh as a magazine not just for the die-hard technical enthusiast, but also as a news letter that can be enjoyed by one and all.

Fresh will now carry articles of general interest reading, a technical topic, current events that affect our lives, what we as a company are doing in India and many, many more.

We also want to hear from you. You always hear what we have to say, month after month. Now you too will get a chance to open up and tell us what you think – on just about anything!

We hope you enjoy this brand new Fresh from us.

Team Marketing
PerkinElmer (India) Pvt.Ltd.

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The Importance of Food Testing Laboratories: The Why's and the How's

- By Bernard Tulsi
- Reproduced by LabManager

The agricultural production in the globe was the necessity for the life on the planet earth. As the population grows the demand for the food grows. To meet these increasing demands; various experimentation and chemicals are used to get better yield of the crops. The advent of technologies also suggests the preservatives and packaging. These also shows the darker side of the consumable food and effects of the chemicals, hygiene and water quality.

A series of food safety crises, including melamine contamination in pet foods; E coli-tainted spinach, peppers and green onions; and a Salmonella typhimurium outbreak in peanut products—linked to nine deaths and 637 illnesses in 44 states and Canada—have transformed food analysts from vigilant sentries into veritable centurions stridently safeguarding the quality, regulatory compliance and safety of our food.;

Common sources of food contamination include antibiotics, accumulated pesticide residues, pathogens, and pollutants in soil and water. But unwanted impurities

may enter at any stage between production and consumption. Increasing global trade adds more concern, particularly when foods originate in places that still use chemicals banned in the importing country and where detection and monitoring are less robust. The consumption of unsafe food may impact health, thereby capturing public attention. But while food safety is a primary function, food labs have broader responsibilities, such as monitoring overall quality, including freshness, taste, and nutrient and calorific content, as well as physical characteristics such as texture and crispiness. They also assess fats and sugars in food and the suitability of packaging materials, among other analyses.

Food labs have state-of-the-art tools for sample preparation; physical, chemical and biological analyses; and data management. Some also have organoleptic capabilities—the use of sensory organs to evaluate appearance, odor, flavor and mouth feel. Food labs also guard against counterfeiting— for example, passing off lower quality olive oil as extra virgin, different strains of rice as the prized basmati, or farm-raised salmon for wild Pacific salmon. In general, such economic interferences cheat consumers by delivering an inferior product at a higher price. Sometimes, however, the results of such adulterations are disastrous, such as the unscrupulous addition of melamine to artificially inflate protein content measurements in baby food in China and pet food in the United States.

"An excellent assessment of the risk associated with melamine, showed that human adults, not babies, were unaffected by melamine at concentrations of less than 250 parts per million."

Alessandra Rasmussen
Chromatography Business Director
PerkinElmer Life & Analytical sciences

Alessandra Rasmussen, chromatography business director of PerkinElmer Life and Analytical Sciences, states that regulations are becoming stricter. "More pesticides are being added to the regulations list, and in Europe, about 22 to 30 are being evaluated for possible addition to the list."

"We are also seeing new regulations for known contaminants. One issue now is what level of melamine is 'acceptable,' a determination that is heavily dependent on the age of the person ingesting it," says Rasmussen.
A recent FDA study which is described as "an excellent assessment of the risk associated with melamine," showed that human adults, not babies, were unaffected by melamine at concentrations of less than 250 parts per million. We are now being asked to find melamine in food down to 250 parts per billion, or 100 times lower than what is believed to be risky. The question is, to what benefit?

Everyone agrees about wanting safe food, but there is great disagreement about how to accomplish it.

The next big question that remains unanswered is Who says?

Consumers assume that food is safe because it was tested, but, with increasing frequency, we are seeing that is not the case.

The big question: Is testing a service or facility that the government provides, or is it the responsibility of the retailers or producers of the raw materials or the makers of the end product? Ultimately, who is responsible for testing?" Also to be figured out are some enforcement issues, for e.g. When a company tests and the product turns out bad, how do you enforce that the product is not shipped?

Lab settings

Today's food analysts ply their trade mostly in at least one of three settings—in-house laboratories at raw material suppliers or food manufacturers, contract or third-party independent laboratories, and regulatory and compliance laboratories operated by governmental agencies such as the FDA. Several academic institutions also maintain impressive food laboratories for instructional and research purposes.

The in-house corporate laboratories of food producers and food product manufacturers occupy a central place in the food testing area. They focus acutely on the corporate business model, in which the goal is to produce safe, wholesome food for sale. These facilities are a part of the entire manufacturing process; in a way, they are not different from, say, accounting or marketing.

In some cases, some manufacturers' labs have grown substantially, having acquired some degree of independence and may even offer their services to other food companies.
Essentially, there are two types of in-house labs: R&D and QA/QC. In general, food companies and most tech-heavy companies conduct R&D in house in order to safeguard intellectual property, ensure that they develop new products before competitors do and maintain a marketing edge. To be sure, some R&D work is outsourced, but the companies maintain control because this is the major source of their competitive and economic advantages.

With the QC laboratories, competitive advantage is less of an issue, and the choice of in-house versus outsourcing is always cost-based. In addition to cost, the decision may be influenced by time constraints. In-house QC labs are highly suited to facilitate the production process— whereby a batch often cannot progress to the next level without analysis, and several tests done in quick succession may be required. Private labs came in to provide evidence that particular merchandise was fit and suitable for its intended use.

Even though many food companies have in-house laboratories, there are strategic reasons to use third-party services. They rely on them for independence and specialized expertise. There are very few inhouse labs with the capabilities to test for melamine as well as to take on overflow work.
The most important distinction is the independence. Since being third-party there is no connection to the outcome of the findings and no financial interest in the merchandise being tested. It may be

science for hire, but having a third party status gives greater independence."

Certified Laboratory, like other private facilities, offers testing services spanning microbiology, challenge studies, validation studies, chemical analyses and artificial color analyses, among others. Its unique food forensics department serves the spice industry and some foreign food importers. It also offers organoleptic analysis for seafood.

We're on the clock

A common factor among the different labs is the enormous time pressure under which they operate. This is seen in regulatory labs when dealing with a crisis. This is true for manufacturers' labs also if a product is recalled and all raw materials have to be rechecked. There are many reasons a food producer lab is under the gun. In some cases, it may have to do less with safety than with deciding whether they are paying the right price for raw materials or answering questions about the flavor, texture and odor of food products or ingredients.

In the contract testing labs, the mission is to provide data, often to a food producer or manufacturer. Here, speed is of the essence, because until they provide the results, it may not be possible for the next step to occur.
Rasmussen says that in these tough economic times, food labs are keen to improve their productivity and efficiency, especially as they relate to their analytical capabilities.

"Contamination or recall has a huge financial impact on food companies; hence, they want to have the necessary watchdog systems to ensure that their final products are free of adulterants and contaminants," says Rasmussen.
On the managerial side, she says that while there is an utmost need for the same level of performance, laboratories are looking for much greater ease of use. This means that less-trained personnel—not necessarily PhD-level chemists—should be able to run the equipment and get the required data. "This is especially true in areas of the food industry that are not so research-oriented but still need the right result for informed and critical results," says Rasmussen.

Melamine detection tools

Melamine detection is one area that was attacked very vigorously by instrumentation manufacturers, and today a number of solutions have been offered by several major analytical instrumentation designers and manufacturers.

Melamine first came to light around March 2007, when the deaths of some pet cats and dogs in the United States were traced back to deliberate adulteration by some unscrupulous raw material suppliers in China.

When food is assessed, the protein content is usually analyzed as a mark of quality. The problem is that the Kjeldahl method that is used for this analysis is a measure of nitrogen content and not specific to protein at all. Melamine, a readily available by-product of plastic manufacturing, has high nitrogen content— so when it is added to food, if tests are not specifically for melamine (and none were a few years ago), then the melamine is, in effect, interpreted as protein.

In 2008, PerkinElmer launched its melamine analyzer, which consists of the Clarus 600 T GC/MS with PSS injector and liquid autosampler, TurboMass GC/MS software, consumables, and a melamine application CD. PerkinElmer's Clarus 600T GC/MS melamine analyzer.

"Melamine is not a contaminant that was usually tested for, so a new method needed to be developed so that operators with varying skill sets could do the analysis using the FDA-approved GC/MS method," says Rasmussen.

In collaboration with an independent testing lab, PerkinElmer scientists developed a method following the FDA guidelines, wrote the standard operating procedure for running melamine on the GC/MS and packaged it as part of the melamine analyzer, according to Rasmussen.

"This enabled customers to get up and running quickly on the method—it takes just about 1.5 hours from when the instrument is installed to when the customer can actually run the melamine analysis," says Rasmussen.

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Trace Elemental Characterization of Edible Oils with Graphite Furnace Atomic Absorption Spectrophotometer

Praveen Sarojam PhD, PerkinElmer Inc.

The determination of the inorganic profile of oils is important because of the metabolic role of some elements in the human organism. On the one hand, there is knowledge of the food's nutritional value, which refers to major and minor elements. On the other hand, there is the concern to verify that the food does not contain some minerals in quantities toxic for the health of the consumers, regardless whether this presence of minerals is naturally occurring or is due to contamination during the production processes. The quality of edible oils with regard to freshness, storability and toxicity can be evaluated by the determination of metals. Trace levels of metals like Fe, Cu, Ca, Mg, Co, Ni and Mn are known to increase the rate of oil oxidation. Metals like As, Cd, Cr, Se etc. are known for their toxicities. The development of rapid and accurate analytical methods for trace elements determination in edible oil has been a challenge in quality control and food analysis. However, sample pretreatment procedures are required in order to eliminate the organic matrix. Different digestion methods were applied for oil digestion prior to spectrometric measurements. GFAAS is a suitable and widely used technique for the trace level determination of metals due to its selectivity, simplicity, high sensitivity, and its capability for determination in various matrices.

Experimental

The measurements were performed using the PerkinElmer® AAnalyst™ 800 Atomic Absorption Spectrophotometer (PerkinElmer, Inc., Shelton, CT, USA) equipped with WinLab32™ for AA Version 6.5 software, which features all the tools to analyze samples, report and archive data and ensure regulatory compliance. PerkinElmer high efficiency double beam optical system and solid-state detector provide outstanding signal-to-noise ratios. The AAnalyst 800 features longitudinal Zeeman-effect background correction for furnace and the solid-state detector which is highly efficient at low wavelengths.

Sample Preparation

Three common edible oils: coconut oil, sunflower oil and soybean oil were bought from a local supermarket and were used without any pre-treatments. ~0.25 g of each sample, accurately weighed in duplicate was transferred to the digestion vessels of the microwave digestion system and the sample digestion was done in accordance with the program given in Table 1. The digested samples were diluted with 0.2% HNO3 and made up to 25 mL in polypropylene vials. A heated injection at 90 ˚C was used for all the GFAAS experiments.

Conclusions

A simple method for the sequential quantitative determination of trace metal impurities in edible oil samples was developed. The patented THGA tube used in the AAnalyst 800 provides a uniform temperature distribution along its entire length. This eliminates cooler temperatures at the tube ends and removes most interference. There is no re-condensation, carry-over and memory effect is eliminated. With the THGA tube design, accuracy and sample throughput are improved by reducing the need for the time-consuming standard additions technique. With the longitudinal Zeeman effect background correction, the amount of light throughput is doubled by eliminating the need for a polarizer in the optical system. All other commercial Zeeman designs incorporate inefficient polarizers that reduce light throughput and diminish performance. With this unique design, the AAnalyst 800 provides the lowest detection limits available. The high performance AAnalyst 800 uses enhanced power control circuitry to

Table 1. Program used for Edible Oil Digestion with MDS.

Sequence	Power	Ramp time (min)	Hold time(min)	Fan
1	600	5	2	1
2	900	5	2	1
3	1400	15	20	1
4	0	0	15	3

Weight Taken ~250 mg HNO3 5 mL, H2O2 3 mL
Rate 0.3 bar/sec, HCl 1 mL Press 55 Bar

Table 2. Method Detection Limits (MDLs).

Metal	MDL (µg/kg)
Pb	19.8
Cd	0.8
As	48.4
Se	167.9

maintain a uniform heating rate, irrespective of the location of the instrument, one can be sure that it provides out-standing, and consistent performance. The AAnalyst 800 atomic absorption spectrophotometer also produces highly accurate, fast and reproducible results with difficult matrices such as edible oil. The developed method has been validated by using reference material and the method has been successfully applied for the analysis of different edible oil samples. The Multiwave 3000 microwave digestion system has proven to be an excellent tool for digesting difficult matrices such as edible oils.

Making a new purchase?

Buy the solution To your needs!

- Reproduced from LabManager

One of the most complex responsibilities when running a lab is not necessarily the end-purpose for what the lab is destined to do, but rather deciding what kind of equipment is needed in the lab – and what to look for in them.

With the market being flooded with highly competent major instrument players, along with small, but dominant product leaders, scientists, end-users and purchase managers are getting an increasingly wider variety for their money – but certainly not an easy decision to where they must put that money. As a whole new breed of young men and women now grace the companies with increasing responsibilities, a ready reference of what to look for when purchasing an instrument can really come in handy. That is why we at PerkinElmer have decided to come out with something new every month with Fresh – a handy guide to buying analytical instruments.

GC Systems

Gas chromatography (GC) systems are similar to HPLC systems in that they are used to identify, separate and quantify compounds of interest. However, GC systems use an inert, gaseous mobile phase, as opposed to a liquid phase, to bring about the separation of molecules. The basic components of a GC system include an injection system, an oven, a column, a detector and a computer system to analyze results.

There have been significant changes in GC in the past decade, and most of them have focused on maximizing throughput and decreasing run time. One of the factors limiting throughput has been the rate at which proper oven temperatures can be reached. Recent efforts have led to the development of ultrafast GC systems that incorporate advanced column heating devices and controls that can rapidly heat and cool columns. Improving speed of analysis also has been the driving force leading to changes in column technology. The use of small, nanobore capillary columns has improved throughput without sacrificing efficiency or precision. There is a growing market out there for ultrafast GC columns, although they need specialized instrumentation to run it. The GC columns also have undergone improvements in sensitivity that offer lower detection limits and ultralow column bleeds. The deactivation process has improved significantly in the past few years and has led to low activity on the column.

Another development in the GC field has

focused on the use of multidimensional systems that incorporate different columns and detection systems to improve sample resolution and throughput. The strategy involves using multiple columns to facilitate the separation of co-eluting peaks, such as enantiomers, or of samples that contain complex mixtures or a large number of components. A switching valve is used to route portions of effluent from one column to another column, and under certain conditions, the columns can be operated independently to increase throughput. The ability to incorporate a variety of different detectors within the system also is a huge benefit. Mass spectrometry is fabulous as a universal detector, but we are seeing resurgence in the use of selective detectors for very specific types of applications. In some systems you can now have an MS and three other detectors that can work in tandem. However, to take advantage of these improved technologies, customers must first understand what it is that they need. Customers really need to know what they want to do with the system or they are going to waste a lot of money buying things they don't need. Since most methods for GC analysis are well standardized and documented, the application and protocol often determine the types of columns, detectors and other accessories to be used. The lab managers need to think carefully about what the GC system is going to be used for, the skill level of the personnel using it and where it is going to be used. This will help them make cost effective decisions as they go through their configuration processes. Taking the type of sample, the sample load and the sample preparation into consideration also is important. Thinking through these issues will determine if any special equipment is needed and will ensure that the samples don't overwhelm certain components of the GC system. There also are other accessories like syringes, filters and septa that play important roles in sample analysis. Whenever people are involved in new method development, they try a series of different columns and sometimes find that they are not getting the results they are looking for. Often, when things don't work people blame it on the GC column, but the choice of liner and the septa are equally as important. Planning ahead and consulting with the vendor are important, as technologies and applications continue to evolve. Talk to your vendor, because they have experts who know those instruments and applications inside and out, and they can be an extraordinarily valuable resource. Another useful suggestion would be to advise GC users to regularly scan resources on vendor websites. There is not just product information, but there is detailed information on specific applications [as well as] work flow solutions—from sample collection to analysis. A lot of companies have resources on their Web pages that help users make informed decisions.

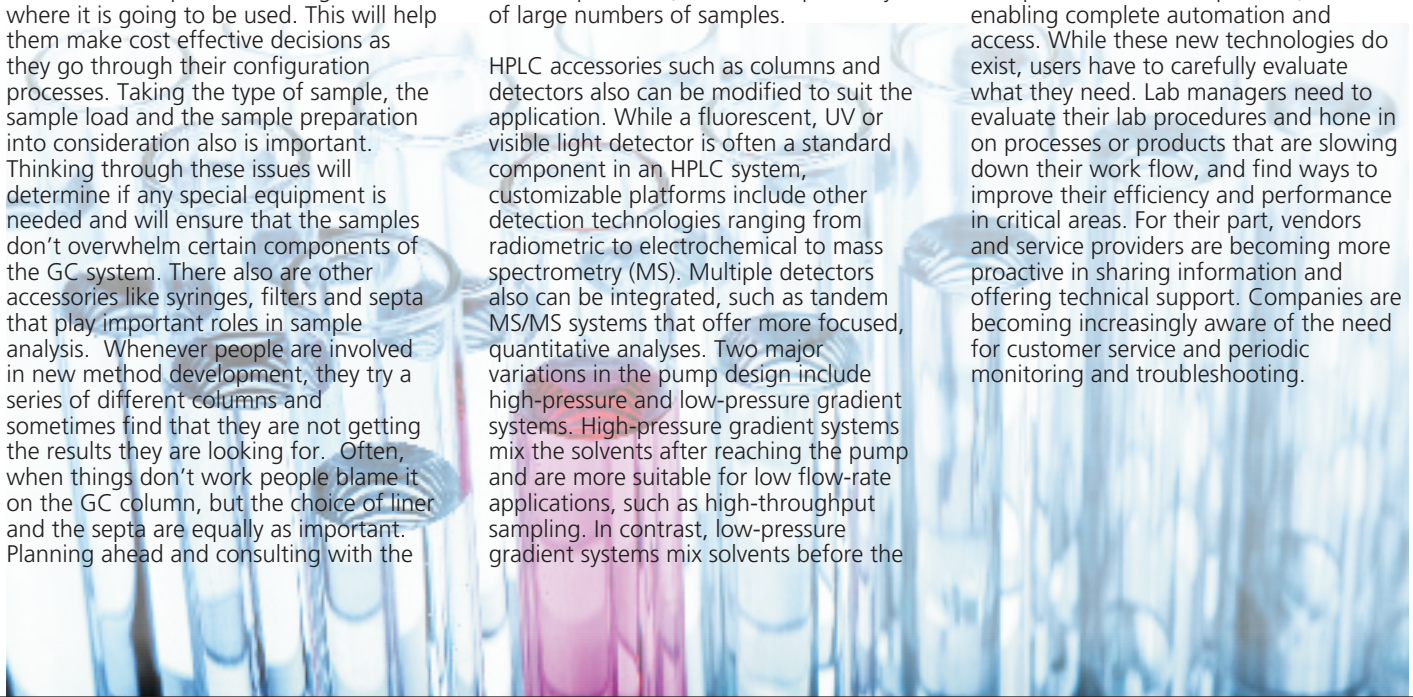
HPLC Systems

While the fundamental components of a high-performance liquid chromatography (HPLC) system—pumps to deliver solvent, an injector, a column for separating the constituents of a sample, a detector and computing software—have remained the same, there continues to be innovations in their design and capabilities. The selection of an HPLC system is predominantly driven by the end users' needs; however, the availability of specialized, customizable platforms has given rise to many more options. Preparative HPLC, for instance, is ideal for large-scale purifications of small molecules or peptides, while high-throughput HPLC systems, optimized for short run times and integrated with autosampler units, allow for rapid analysis of large numbers of samples.

HPLC accessories such as columns and detectors also can be modified to suit the application. While a fluorescent, UV or visible light detector is often a standard component in an HPLC system, customizable platforms include other detection technologies ranging from radiometric to electrochemical to mass spectrometry (MS). Multiple detectors also can be integrated, such as tandem MS/MS systems that offer more focused, quantitative analyses. Two major variations in the pump design include high-pressure and low-pressure gradient systems. High-pressure gradient systems mix the solvents after reaching the pump and are more suitable for low flow-rate applications, such as high-throughput sampling. In contrast, low-pressure gradient systems mix solvents before the pump inlet and may operate in a higher flow-rate range. Additional components, such as column ovens and autosamplers, also can be integrated, depending on the customers' needs.

There also has been significant innovation in column technology. Newer columns, such as the monolith, amide, polar embedded and fused particle, are more resistant to changes in temperature, pH and flow rates, and they allow users to explore new methodologies and applications. The recent shortage in acetonitrile, the most common solvent for HPLC analysis, also is causing people to reevaluate their protocols and chromatography systems. Some of the new column technologies, for instance, are certainly amenable to the use of other solvents like water, methanol and THF. Using columns with smaller particle size not only reduces costs but also improves the throughput. Smaller particle size is where the industry is headed. Ultra performance liquid chromatography (UPLC) systems use columns with polymeric particles less than two microns in size that allow rapid analysis of samples at sub-micromolar flow rates.

Besides the systems and the accessories, the software programs for HPLC also are getting more sophisticated in order to handle and organize the large and complex data files generated. Web-based operations now allow data sharing across multiple users and multiple sites, while enabling complete automation and access. While these new technologies do exist, users have to carefully evaluate what they need. Lab managers need to evaluate their lab procedures and hone in on processes or products that are slowing down their work flow, and find ways to improve their efficiency and performance in critical areas. For their part, vendors and service providers are becoming more proactive in sharing information and offering technical support. Companies are becoming increasingly aware of the need for customer service and periodic monitoring and troubleshooting.



Memories of 2009 PharmaExpo 2009 at 61st Indian Pharmaceutical Congress Ahmadabad (India)

PerkinElmer (India) Pvt. Ltd participated in the Pharmaceutical Congress (IPC) exhibition at Ahmadabad at Nirma University Ground. Gujarat is one of the pharma hubs in India and many Pharmaceutical companies and institutions are situated in and around Ahmadabad.

PerkinElmer's participation was with a theme of "SAFER MEDICINES –HEALTHY INDIA" which is in line with our corporate activities for Human and Environmental health. The big back drop narrating the ability of the PerkinElmer as "One Source" for the validation of any make any instrument was more promising to the visitors. Also our solutions for the Pharmaceutical industries right from the drug discovery to Research and Developments, Manufacturing , QA/QC as well as packaging ;was well taken as a message by the industry.
Some visitors from research areas have clearly spelt their interest in the hyphenation solutions and requested to furnish more inputs.

On product display side FLEXAR UHPLC was the centre of attraction to customers and competition as well. Spectrum 65 with promotional offer was also attracted enquires. The winning horse Clarus 500 GC with Headspace sampler and Autosampler fetched more crowds from the academia and quality assurance customers. This also was giving more interest in the genuine consumables and spares for which separate display was made. Visitors enjoyed the hand outs, latest version of FRESH and paper carry bags with PKI branding.

The exhibition began on 11th December 2009; our booth was inaugurated by Dr. Ramesh Dandala President R&D of Unimark Remedies Ltd. He was welcomed by Dr. Fedja Bobanovic- President PerkinElmer (India) Pvt. Ltd.. The formal ribbon cutting and booth opening ceremony was concluded at 10:30AM.

The exhibition was open for public and invitees till 13th of December 2009. We appreciate our entire sales, service, support, logistics, and our booth designers and creative teams who made this event as memorable for year 2009.

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Hyphenation Workshops Series December 2009

The world of Analytical Science is always changing. Technology is changing at such a rapid pace, that what was considered "Hot" 5 years ago, is now looked upon as a "Not".

PerkinElmer realizes this need for change, which is why we are always at the forefront of cutting-edge technology, and even more so why we feel the need to bring this technology to you – the user.

The buzzword in town is now Hyphenation. Hyphenation or hyphenated techniques is the coupling together of 2 instruments to gain insights previously unseen by either technique on its own.

Most common FAQs are :

Are you interested in how a material responds to a non-standard test environment like high UV levels or humidity changes?

Do you want to better understand how a material degrades or what gases evolve when that material burns?

Do you need confirmation of what happens as a drug is being used or tested?

If it's a YES to any of these questions, then Hyphenation is the answer. Hyphenation technologies will help you gain better insight and advance your laboratory. Remember – the more you know, the more you can do!

Recently, PerkinElmer had organized two workshops in our technical center in Mumbai on Hyphenation.

The event was conducted by Dr. Premchand Jain, who happens to be the Business Leader for Material Characterization. He was ably supported by two of our highly competent product specialists, Dr. Yogesh Satpute and

Garfield Rebello.

The event was graced by our President, Dr. Fedja Bobanovic and by Rajendra "Raj" Makhamale, Director of Technical Affairs.

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Climate Change And Its Impact on India

The buzzword in 2009 was definitely Climate Change. But what exactly comes to your mind when you hear this word and what impact does it have on India - and for our planet?

Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

Precisely at a time when India is confronted with development imperatives, we will also be severely impacted by climate change. Like other developing countries, several sections of the Indian populace will not be able to buffer themselves from impacts of global warming. With close economic ties to natural resources and climate-sensitive sectors such as agriculture, water and forestry, India may face a major threat, and require serious adaptive capacity to combat climate change. As a developing country, India can little afford the risks and economic backlashes that industrialized nations can. With 27.5% of the population still below the poverty line, reducing vulnerability to the impacts of climate change is essential.

It is in India's interest to ensure that the world moves towards a low carbon future. Many studies have underscored the nation's vulnerability to climate change. With changes in key climate variables, namely temperature, precipitation and humidity, crucial sectors like agriculture and rural development are likely to be affected in a major way.

Impacts are already being seen in unprecedented heat waves, cyclones, floods, salinisation of the coastline and effects on agriculture, fisheries and health.

India is home to a third of the world's poor, and climate change will hit this section of society the hardest. Set to be the most populous nation in the world by 2045, the economic, social and ecological price of climate change will be massive.

The future impacts of climate change, identified by the Government of India's National Communications (NATCOM) in 2004 include:

- Decreased snow cover, affecting snow-fed and glacial systems such as the Ganges and Bramhaputra. 70% of the summer flow of the Ganges comes from meltwater
- Erratic monsoon with serious effects on rain-fed agriculture, peninsular rivers, water and power supply
- Drop in wheat production by 4-5 million tones, with even a 1°C rise in temperature
- Rising sea levels causing displacement along one of the most densely populated coastlines in the world, threatened freshwater sources and mangrove ecosystems
- Increased frequency and intensity of floods. Increased vulnerability of people in coastal, arid and semi-arid zones of the country

Studies indicate that over 50% of India's forests are likely to experience shift in forest types, adversely impacting associated biodiversity, regional climate dynamics as well as livelihoods based on forest products.

India stands to lose on too many counts to allow a 'climate-politics-as-usual' scenario. Therefore, positive engagement with global climate negotiations at the next UNFCCC meeting in December 2009 is crucial. Although not an emitter historically, India currently has one of the fastest growing economies in the world. With a government target of 8% GDP to achieve developmental priorities16, a share of one sixth of the global population, and changing consumption patterns, India's emissions are set to increase dramatically.

Growing at an almost breakneck pace, and guzzling coal, gas and oil in large quantities4, we are today, the fourth largest emitter of greenhouse gases worldwide. Although our per-capita emissions are among the lowest in the world, our growth rates imply that the past is no predictor of the future8. The most recent IPCC report suggests that India will experience the greatest increase in energy and greenhouse gas emissions in the world if it sustains a high annual economic growth rate. The International energy Agency predicts that India will become the third largest emitter of greenhouse gases by as early as 2015.

India imports large quantities of fossil fuels to meet its energy needs, and the burning of fossil fuels alone accounts for 83% of India's carbon dioxide emissions. Nearly 70% of our electricity supply comes from coal.

Although India has maintained its clear economic and social development imperatives, the government recognizes that climate change is an serious problem, and that business as usual is no longer the way forward.

India on climate change

India has committed to actively engage in multilateral negotiations in the UNFCCC, in a 'positive and forward-looking manner. The government recognizes that 'global warming will affect us seriously' but maintains that the 'most important adaptation measure to climate change is development itself'8. This has ensured that India's position at the UNFCC has stubbornly remained 'common but differentiated responsibility'. Under the UNFCCC agreement itself, India is not subject to any binding emission reduction targets until the year 2012.

In spite of this guarded stand, India has 'declared' that even as it pursues its social and development objectives, it will not allow its per capita emissions to exceed those of developed countries. The 11th 5-year plan does make headway in reducing energy intensity per unit of GHG by 20 percent while boosting cleaner and renewable energy.

In June 2008, the Prime minister

India's accelerating emissions

An ultimate answer to monitor Ambient air pollution-Clarus 500 GC with TurboMatrix Automated Thermal Desorber

released the much awaited National Action Plan on Climate Change (NAPCC). The NAPCC outlines a strategy by which India will adapt to climate change, while maintaining a high growth rate, protecting poor and vulnerable sections of society and achieving national growth objectives. It focuses on eight areas intended to deliver maximal benefits to development and climate change (mitigation and adaptation). However, detailed action plans for each mission, and any clear targets are missing from the report8.

Although the action plan may be a missed opportunity for leadership on climate change, the good news is that change is coming. Realising that the market is changing, and not to be left behind in the global race, Indian businesses are beginning to take on climate change as a business issue.

What we need now is for the government of India to capitalize on India's position as a developing giant, take the lead and engage with governments of the world and the private sector for a low-carbon future.