

EXPRESS NEWS

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Coffee Talk: A Topic Close to the Heart of Dr. Ameika

By Julie Higgins, Environmental Express Technical Sales Representative

James A. Ameika, FD, FACS and his wife Karin have been the owners of the 21-acre Kona Cloud Coffee Estates on the big island of Hawaii for 14 years. The beans are grown there and roasted in Jonesboro, AR, where Dr. Ameika maintains his "day job" as a Cardiothoracic and Vascular Surgeon. The following is a breakdown of the fascinating medical aspects of coffee as shared by Dr. Ameika.

The coffee bean is comprised of several types of compounds, including carbohydrates (50%- mainly sucrose, depending on ripening and which species of coffee plant), proteins (10-13%) and a few other components, such as alcohols and alkaloids like xanthines, including everyone's favorite: **CAFFEINE!**



Let's focus on the health effects of these smaller components. First, the alkaloid, trigonelline, has been shown to prevent cavities due to its apparent ability to hinder *Streptococcus mutans* from adhering to teeth. Caffeine makes up 1-2% of the dry weight of the coffee bean, depending on the species, and does more than clear that morning fog. The amount of caffeine in your morning cup of Joe depends on how that cup was prepared. Xanthines, including caffeine, are known to be smooth muscle relaxants and are often given to asthma patients. Caffeine is also administered to newborns with apnea. Yes, even little ones have a need for caffeine.

Clot-busters? Regular coffee drinkers have been shown to have increased rates of fibrinolysis, or the breakdown of clots in the body. It is thought that caffeine is the responsible

party here, as decaf drinkers do not show this trait. Our Monday morning's best friend is also known to stimulate lipolysis, or the breakdown of triglycerides into fatty acids, and may be of use to endurance athletes as a way to increase fatty acid metabolism, generating much needed energy during an event. Although it is a known appetite suppressant, the long term

effects of caffeine on one's weight remains unknown, so it might still be best to use it as a boost during the big race rather than to eliminate the physical activity altogether.

Finally, caffeine has taken the blame for increased cholesterol, but there is no evidence to back this claim. While some coffee drinkers display elevated cholesterol levels, it is actually the alcohols, cafestol and kahweol, in coffee that have been implicated. On the other side of the coin, these alcohols have been shown to be anti-carcinogenic in animal studies. These components are removed when a coffee filter is in use, so you might want to keep that French press after all! So at the end of the day (or the beginning), it seems that this morning vice so many of us know and love does more than just perk us up!



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Our technical sales staff will be traveling to shows and events in the next few months. Scheduled events are listed on our website at: envexp.com/conferences

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October 27-28
West Palm Beach, FL
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Radiobioassay & Radiochemical Measurements Conference
October 31-November 4
Destin, FL
www.rrmc.com

Professional Conference on Industrial Hygiene
November 5-8
Baltimore, MD
www.pcih2011.org

"Kona Coffee has a richer flavor than any other, be it grown where it may, and call it by what name you please"

- Mark Twain

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Cyanide: The Molecule and its Analysis A Simple Compound with Complex Problems

By Edward F. Askew PhD, Askew Scientific Consulting

Part 4: Visible Spectroscopy of the Koenig Reaction Products

This fourth part of the cyanide series focuses on the Koenig reaction color development of the cyanide sample and its quantitation by visible spectroscopy. In the previous part of this series, the requirements for cyanide distillation were covered. To review, that process relies on the volatility of hydrogen cyanide gas in a refluxing acidic aqueous solution that is then transported with a stream of air and collected in a sodium hydroxide solution as sodium cyanide salt.

Once the distillation has been completed, the cyanide salt in the hydroxide solution is then reacted through a 3-step process to produce a magenta colored solution whose concentration is measured by visible spectroscopy.

Reaction

The reactions steps as per 4500 CN- E in *Standard Methods for the Examination of Water and Wastewater* (Eaton 2005) are:

- 1 Addition of an acetate-acetic acid buffer to maintain a constant pH of 4.5.
- 2 Addition of Chloramine T to selectively chlorinate the cyanide to form cyanogen chloride. Then react the cyanogen chloride compound with pyridine to open the pyridine ring and form a di-aldehyde under acidic conditions.
- 3 The di-aldehyde then reacts with 2 equivalents of barbituric acid to form the final Koenig compound through an aldol condensation.

But, there are inconsistencies in the final concentrations seen by

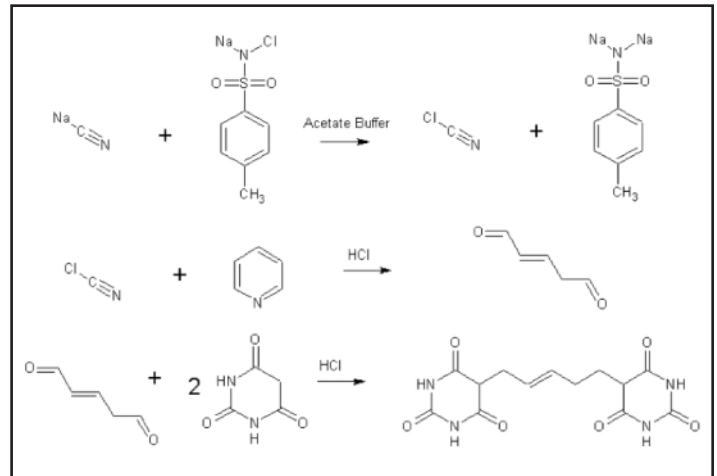


Figure 1: Koenig Reaction

laboratories analyzing by this process. Review of the past EPA cyanide method 335.2* (EPA 1980) and the current *Standard Methods* 4500 CN- E cyanide method shows a time requirement or window needed for the magenta color to develop and remain stable. (*: EPA method no longer approved for regulatory compliance under 40 CFR Part 136)

The EPA 335.2 method requires: **“Allow 8 minutes for color development then read absorbance at 578 nm in a 1 cm cell within 15 minutes.”**

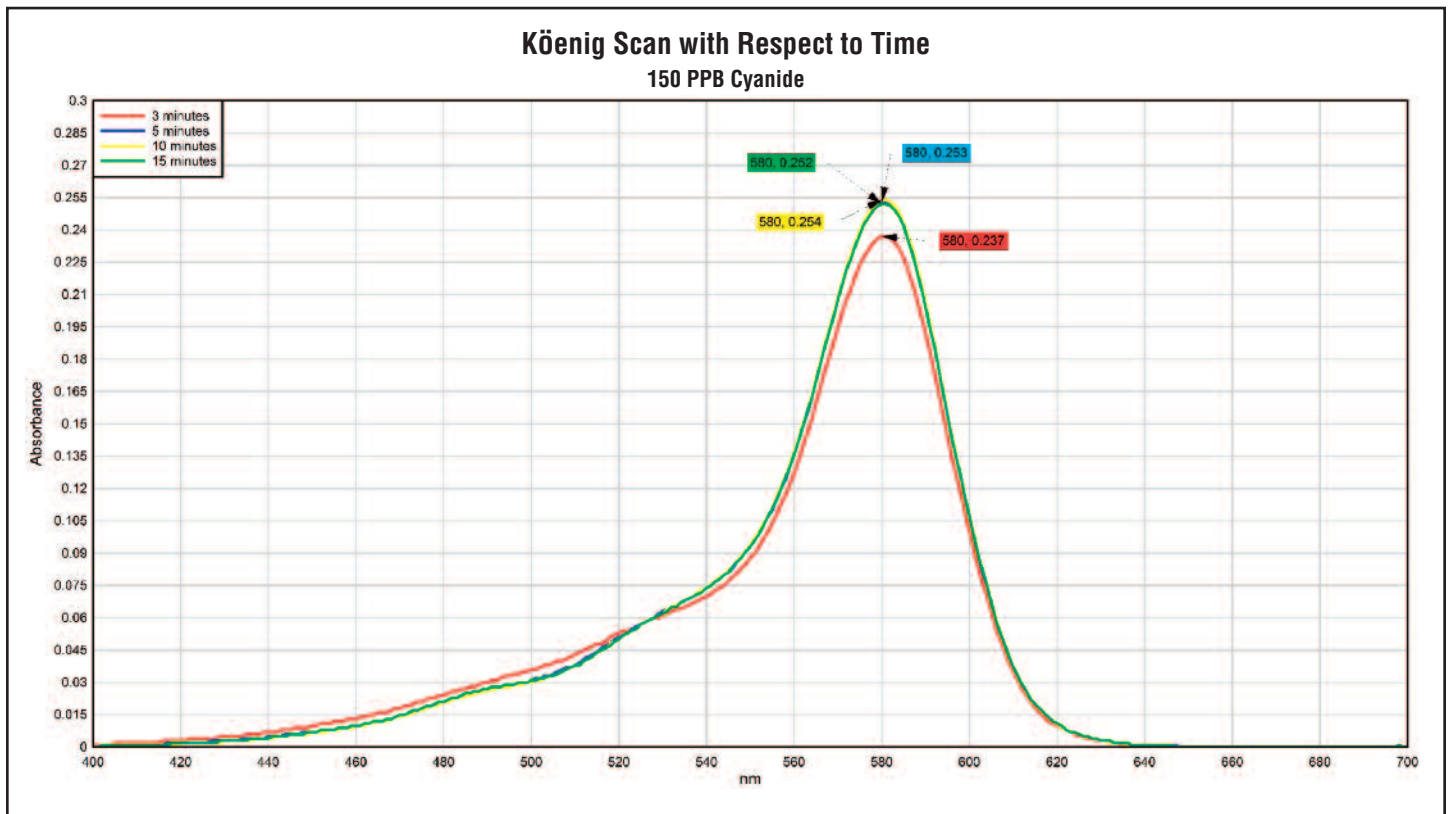


Figure 2: Stability and Molar Absorbance with Respect to Time of the Koenig Product (3 minutes to 15 minutes)

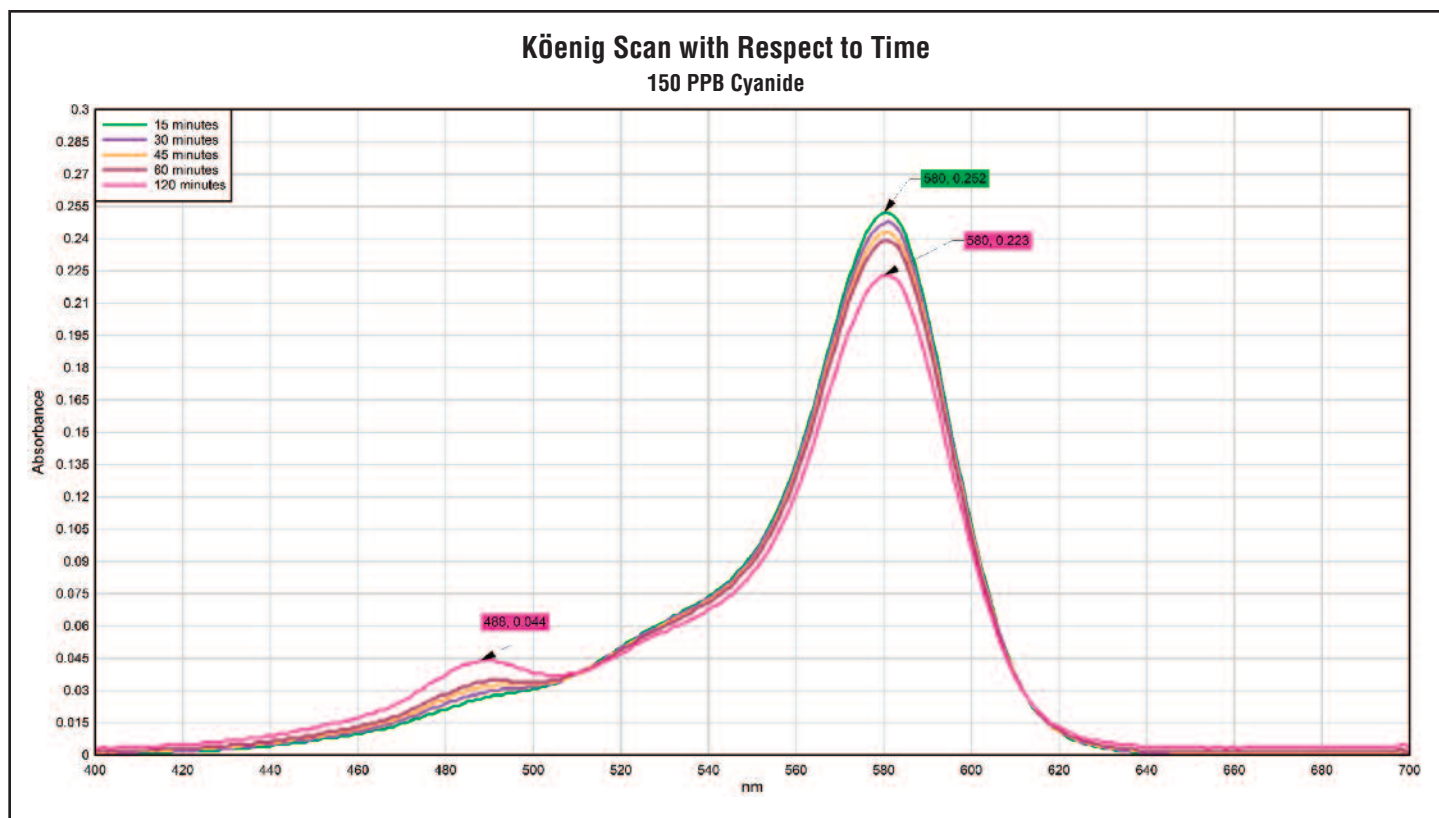


Figure 3: Stability and Molar Absorbance with Respect to Time of the Koenig Product (3 minutes to 15 minutes)

The *Standard Methods* method 4500 CN- E requires: “Add 5 mL pyridine-barbituric acid reagent, dilute to volume with distilled water, mix thoroughly, and **let stand exactly 8 min.** Measure absorbance against distilled water at 578 nm.”

This time requirement for a stable compound or intermediate to form within the timeframe of 8 to 15 minutes is supported by previously reported observations (Chien, Chang et al. 1980; Ma and Liu 1992) and spectroscopic data collected for this article.

Ma measured an initial aldol condensation intermediate in the Koenig reaction that had a wavelength maximum at 494 nm. The absorbance maxima from this intermediate decreased rapidly over 3 minutes, while the peak at 580 nm grew in. After 5 minutes, the secondary aldol condensation intermediate peak at 580 nm was the dominant peak. This is the peak** that is measured in the *Standard Methods* and EPA cyanide method. (**: 578 nm in the methods)

Chien measured a more stable product that appeared over a longer period of time (~ 20 hours) in the Koenig reaction. This more stable product had an absorbance maxima that appeared at 490 nm as the secondary aldol condensation peak at 580 nm decreased.

These absorbance changes due to the intermediates are confirmed with analytical results summarized in Figures 2 and 3.

The Koenig reaction product reached a maximum molar absorbance at 5 minutes after the addition of the final reagent and remained at this high level for 15 minutes total. After 15 minutes had elapsed, the absorbance decreased and a new peak appeared at 488 nm. The raw absorbance around the 580 maximum peak are summarized in Table 1.

The percentage of the 580 nm peak at each time interval compared to the maximum absorbance at 10 minutes is summarized in Table 2.

Table 2 shows that the decrease in peak height after 15 minutes will be significant for cyanide analysis at lower concentration. It may lead to false

negatives for samples developed and measured outside of the 15 minute maximum time.

More importantly, if the standards are read too early or too late, the low absorbance readings will impact the slope of the calibration line. This shallower slope may cause the calculated cyanide in a sample to appear higher than what it actually is. This can lead to false positives being reported by the laboratory

Conclusion

The useable analysis time window of 5 minutes to 15 minutes is not clearly indicated in the *Standard Methods* 4500 CN- E, but is clearly prescribed in the older EPA method 335.2. What this means to the laboratory analyst and manager is that the color development step is critical to the accurate determination of cyanide. The use of any instrument from a flow injection analyzer to a discrete analyzer or even a manual spectrophotometer will require the following checks to be put in place in the laboratory's method/SOP:

- 1 Scan a developed sample to determine the absorbance maximum. In the EPA and *Standard Methods* cyanide methods, the absorbance maxima is given as 578 nm. But on the spectrometer used in this study, it was 580 nm. This slight variation is instrument dependent and must be corrected for in the laboratory method/SOP.
- 2 In the laboratory's method/SOP clearly state the allowable time window (5-15 minutes) for developed cyanide sample measurement. This will make sure that the last sample in a batch is measured within the allowed time window.
- 3 For discrete analyzers and flow injection analyzers, measure the total development time for the sample to make sure that development and absorbance measurement happens in the correct time window.
- 4 Make sure that the standards and samples are developed and analyzed as soon as possible after distillation.

Table 1: Absorbance vs. Time

Wavelength nm	Time and Absorbance							
	3 minutes	5 minutes	10 minutes	15 minutes	30 minutes	45 minutes	60 minutes	120 minutes
576	0.228	0.243	0.244	0.243	0.238	0.234	0.230	0.215
577	0.231	0.247	0.248	0.246	0.242	0.237	0.233	0.218
578	0.234	0.249	0.250	0.249	0.244	0.240	0.236	0.220
579	0.236	0.252	0.253	0.251	0.246	0.242	0.238	0.222
580	0.237	0.253	0.254	0.252	0.247	0.243	0.239	0.223
581	0.237	0.253	0.254	0.252	0.248	0.243	0.239	0.223
582	0.236	0.252	0.253	0.251	0.247	0.242	0.238	0.222
583	0.234	0.250	0.251	0.249	0.245	0.240	0.237	0.221
584	0.231	0.247	0.248	0.246	0.242	0.237	0.233	0.218

Table 2: Percent Absorbance at 580 nm vs. Time

Wavelength nm	Time and Absorbance							
	3 minutes	5 minutes	10 minutes	15 minutes	30 minutes	45 minutes	60 minutes	120 minutes
580	93.3%	99.6%	100.0%	99.2%	97.2%	95.7%	580	93.3%

5 Make sure the standards are developed in the same time window used for the samples. That is really critical if you are using a discrete analyzer or flow injection analyzer.

The next newsletter article will focus on low PPB measurement of cyanide in water and wastewater and the improvements in measurement techniques utilizing the Koenig reaction and sensitive optical instruments. For previous issues visit www.envexp.com/express-news.

References

Chien, C.-C., F.-C. Chang, et al. (1980). "Study of color-developing factors in

spectrophotometric determination of cyanide by the pyridine-barbituric acid method." *Mikrochim. Acta* 2(1-2): 9-16.

Eaton, A., Glesceri, L., Rice, E., Ed. (2005). *Standard Methods for the Examination of Water and Wastewater 21st Edition. 4500-CN. Washington D.C., APHA, AWWA, WEF*

EPA (1980). *Method 335.2 Cyanide, Total (Titrametric; Spectrophotometric), Environmental Protection Agency: 1-10.*

H. Ma and J. Liu (1992). "Flow-injection determination of cyanide by detecting an intermediate of the pyridine-barbituric acid chromogenic reaction." *Anal. Chim. Acta* 261(1-2): 247-252.

Cyanide In Our Food

Cyanide is a naturally occurring chemical, generally considered to be poisonous if consumed in large enough amounts. According to the U. S. Agency for Toxic Substances and Disease Registry the following foods naturally contain Cyanide:



- Almonds
- Bamboo Shoots
- Cassava
- Lima Beans
- Millet Sprouts
- Soy
- Spinach

Additionally Cyanide is found in most fruits that have pits or cores like cherries, apricots and apples. The site reports that no foods are consumed in large enough amounts to be toxic.

Cyanide can also be produced by certain bacteria, fungi, algae and as a by-product of industrial manufacturing and waste. If an industry is producing cyanide it could creep into the local water supplies and into plants that are being grown using that water. Fortunately this does not apply to fish as they do not absorb cyanide. This is something to be aware of but it is not necessary to worry over the small amounts of cyanide in foods. In fact, small amounts of cyanide may even be good for you because it helps to lower blood pressure.

Source: www.healthaliciousness.com/blog/

Harnessing Wind Energy with the WindWheel™

Superior Efficiency - Cost Effectiveness – Noise Reduction

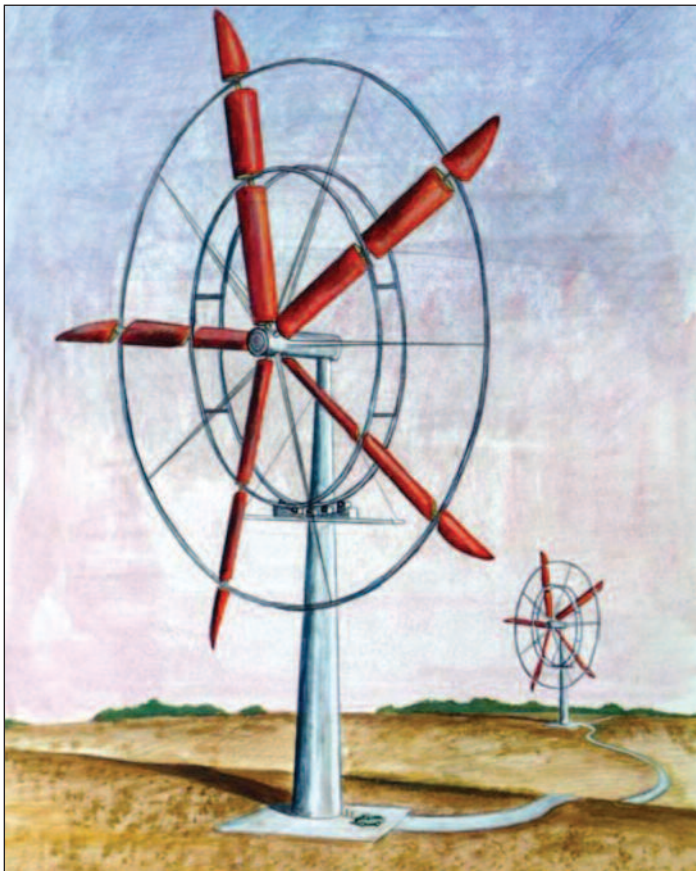
One of the more exciting high-tech innovations coming out of the technology corridor emerging in South Carolina's upstate is the WindWheel™ concept by Greenville entrepreneur and inventor, Jerry Barber.

A successful inventor with over 38 patents, Barber has recently garnered eight new US and international patents pending on his unique approach to the wind turbine industry. Barber grew up in the carnival industry and combined his experience with amusement ride technology with a degree in Physics to create one of the world's largest amusement ride manufacturers. Recently he has applied that technology to his knowledge of wind patterns to create a more efficient wind turbine that can support a larger diameter wheel while reducing maintenance and installation costs.

Barber's design addresses wind turbine applications from the small individual turbines required by an individual or small business to the large offshore turbines that feed the grid. The WindWheel™ features a structural ring that supports five blades (rather than the traditional three) and drives the external generators eliminating the need for an expensive, high maintenance gear box. Steel cables support the rim. Five blades which rotate slowly are more efficient and reduce noise pollution. Additionally, the components are constructed in sections that can be transported easily.

The deep water offshore design is mounted on a floating barge to capture the stronger ocean winds, be out of sight of land and away from migratory bird routes and be easily moved out of the path of hurricanes.

For more information on this innovative approach to harnessing wind energy visit www.barberwind.com.



Five-blade design with supportive rim is more efficient than the cantilevered three-blade model.

ELEMENT OF THE MONTH

Be

*By Joe Boyd
Technical Specialist, Environmental Express*

Beryllium is an alkaline earth metal (Atomic Number 4 on your Periodic Table) that is light-weight, non-magnetic, an excellent heat conductor, and has a very high melting point (1287°C). Beryllium, atomic symbol Be, is mainly used in nuclear reactors as a neutron reflector and in the aerospace industry for aircraft and missiles due to its light mass. Other applications for Beryllium are in microwave ovens, non-magnetic tools, and x-ray tubes. Recently Beryllium has been used in the Large Hadron Collider where the stiffness of the metal allows a powerful vacuum to be created.



Exposure to Beryllium can cause severe health effects. Acute inhalation of high levels of Beryllium has been observed to cause inflammation of the lungs in humans. These symptoms are reversible when the short-term exposure ends. Chronic inhalation of Beryllium leads to Berylliosis, or Chronic Beryllium Disease, where noncancerous lesions develop in the lung. While studies have shown inhalation exposure to Beryllium causes lung cancer in rats and monkeys human studies have only shown an increased risk of lung cancer.

While there is a natural ingress of Beryllium into the water table, the greatest exposure of Beryllium occurs in the workplace. This often occurs in mining and metal refinery operations, coal burning factories, and discharge from aerospace and defense industries. If Beryllium is detected in drinking water it can be removed through various treatment processes such as activated alumina, reverse osmosis, ion exchange, or coagulation/filtration.

The EPA has established the maximum contaminant level (MCL) at 0.004mg/L or 4 ppb. OSHA has established the Time Weighted Average (TWA) exposure limit to be 0.002 mg/m³ with a maximum peak of 0.025 mg/m³. The ACGIH recommends an action limit of 0.05µg and other agencies are re-evaluating limits to insure they have a handle on the effects of Beryllium exposure.

ASTM has developed a new method specific to the sampling of beryllium dust on surfaces. ASTM D7707 titled "Standard Specification for Wipe Sampling Materials for Beryllium in Surface



Dust" has recently been published and requires wipes pre-moistened with DI Water at a specific size. Environmental Express is the sole manufacturer of wipes meeting the ASTM D7707 requirements, catalog # SC4250BE.

SPE vs. LLE for the 1664 Method

Which Technique is Better?

The determination of Hexane Extractable Material (HEM), better known as Oil & Grease, can be done by either Liquid-Liquid Extraction (LLE) or Solid Phase Extraction (SPE). LLE is the more traditional way of extracting liquid samples and involves the shaking of a sample with hexane in a separatory funnel. SPE involves the filtering of a sample through an extraction disk containing C-18 material and then eluting the HEM off of the disk with hexane.

Both techniques provide acceptable results and laboratories must weigh which option is better for them. Below are a few reasons why we at Environmental Express promote SPE over LLE for the 1664 Method:

- SPE eliminates emulsions which can be a major source of interference in LLE.
- SPE greatly reduces the amount of solvent needed for extraction, oftentimes by more than 50%.
- Decreased amount of solvents means decreased amounts of waste.
- LLE requires 3 successive extractions in a separatory funnel which is very labor intensive.
- SPE is much more capable of being automated.

Please visit our blog at <http://www.envexp.com/blog> and give us your opinion on SPE vs. LLE.

And look for our new SPE-XPress, the automated Oil and Grease analyzer that we previewed at PITTCON. Production units will be ready to ship in November.



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