

Influences That Effect Contamination Testing

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The Ionograph was designed to be a simple, fast and accurate means of testing for ionic contamination as compared to the expensive, time consuming, and highly technical alternative of chromatography. However, the accuracy of the instrument is dependent on the condition of the Ion Extract Solution. The Ionograph uses a IPA (Isopropyl Alcohol) / Water Extract Solution. This solution is also referred to as K75I which is a 75% IPA / 25% Water solution by volume. If the condition of the solution is allowed to vary, then the accuracy and test repeatability will also vary.

A method of measuring the condition of the solution is by measuring the conductivity, or its reciprocal - resistivity, and temperature. The conductivity of the solution is measured by applying a small alternating current(ac) across 2 metals plates at a constant ac voltage, and then measuring the amount of current passing between the 2 plates. Knowing the voltage and the current, Ohm Law can be applied (conductivity = current divided by the voltage). The Ionograph uses a standard plate separation distance of 0.01 centimeters. The temperature of the solution is measured by a RTD (resistive temperature device). ***The condition of the solution is affected by the %IPA, the quality of the air that the solution is in contact with, and temperature.*** Changes in the %IPA is due to normal evaporation of the solution. The isopropyl alcohol normally evaporates at a faster rate than does the water, therefore it is normal for the %IPA to decrease under normal use. As the %IPA decreases, the conductivity of the solution increases.

A major air quality affect is the volume of carbon dioxide (CO₂) present. Carbon dioxide absorbed into the solution may form carbonic acid and will cause the conductivity of the solution to increase. Ionization of the air itself also causes an increase in the conductivity of the solution.

The quantity of non-ionic contaminants in the solution also affect the quality of the extract solution. Though they are not ionic, a build up of the contaminants will cause the solution not to react in a predictable manner. Some of these contaminants, such as polymers, will coat the de-ionization resin used in the de-ionization (DI) filters, causing a premature failure of the filters.

The condition of the DI filters is also a very important influence on the quality of the extract solution. The filters are made up of a mixed bed resin, containing both an anion(+) and a cation(-) to restore the solution to a non-ionic state, making it less conductive.

The effect of temperature is probably the most significant influence. As temperature increases, so does the ability to extract and ionize contaminants into the solution. The Conductivity of the solution also significantly increases with this increased ability to ionize contaminants. This also includes the increased ability ionize more CO₂ from the air.

There are many influences that effect the quality of the solution which effects the performance of the instrument. The quality of the solution can be easily maintained by having an awareness of these influences and monitoring them for changes. One of the best ways of monitoring is by using a test log such as the one provided. Should a problem arise, this log makes it easy to visibly examine each column and determine what has changed.

A small effort is also required in maintaining the instrument. The %IPA should be checked daily and adjusted as necessary. Historical research has shown the optimal performance of the solution to be in a range of $75\% \pm 3$.

The performance of the solution should be verified daily after the %IPA has been checked and adjustments made. This is done by performing the verification procedure programmed into the instrument. Should the Verification fail, review the Test Log to determine the cause, and re-calibrate the instrument if necessary. *After the initial calibration, it is not necessary to calibrate the instrument unless it fails to verify.* To prevent a build up of non-ionic contamination, the IPA should be replaced approximately every 6 months.

The DI filters should be scheduled to be replaced approximately once a year.

With a small effort directed toward monitoring and maintenance, the instrument will perform optimally, providing accurate and repeatable results.

Ionograph 500

Test Log

[illegible]

*Type: C=Calibration, V=Verification, T=Test