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Enhanced Autoradiography using EA-Wax (patent applied for)

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Overview

EA-Wax is a new medium which exhibits properties that enhance the detection of radioactive emissions from low energy radionuclides such as Tritium (3H), Carbon-14 (14C) and Sulphur-35 (35S), on a flat mat e.g. paper, polyester backed TLC plates, cellulose nitrate filters, etc.

When used with detection methods which rely on low energy radiation detection of light emissions, EA-Wax can dramatically enhance detection efficiencies and significantly reduce the time required to obtain experimental results.

The Enhanced Autoradiography process is a low-cost, environmentally friendly and inherently safe process. It requires no expensive capital equipment and is generally non-destructive of the sample. Enhanced Autoradiography using EA-Wax offers many benefits to researchers in University life science departments, hospitals, drug companies and research institutes world-wide.

Product Description

Autoradiography is a process whereby a sample on a flat matrix is held against x-ray film, in the absence of light, for a period of time sufficient to allow the film to detect the radioactivity in the sample. After development of the film, a negative is obtained which precisely displays the distribution of radioactivity within the sample.

For many years autoradiography has been the standard method for detecting radioactivity on a flat sample matrix. The process of detection is as follows:

When radioactive atoms decay, the emitted beta particles produce a latent image on the film of the decay event. The process works well when using high energy radioisotopes such as ^{14}C, ^{35}S, ^{32}P which have beta energies of 156, 167 and 1710 keV respectively. However, for Tritium(^{3}H) which has a maximum energy of 18.6 keV, the time required to obtain a usable image may be considerable. The low sensitivity of detection of low energy radioisotopes often results from the chromatographic separation process which precedes the autoradiography process. Following the application of the sample to the separating medium, the components diffuse through the medium rather than flow along its surface. The radioactive decay emission of Tritium(^{3}H) has such low energy it is only those events on the surface next to the film and those travelling in a trajectory towards the film that will be detected. All other emissions will be absorbed by the medium and remain undetected. As a result, autoradiographic detection is inefficient.

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Over the years attempts have been made to improve the efficiency of autoradiographic detection of weak beta emitting radionuclides such as Tritium (^{3}H). One such method, Fluorography, is still widely used. The process involves the use of a solvent containing the primary scintillator 2,5-diphenyloxazole (PPO). Following sample chromatographic separation, the paper is immersed briefly in this fluorographic cocktail and then dried leaving the PPO impregnated throughout the sample. The paper is then exposed to the photographic film. The advantage of Fluorography is the intimate contact between the radionuclide and the scintillator which when struck by a released beta particle, will absorb the energy and re-emit the energy as light. It is therefore no longer necessary for the beta particle to strike the X-ray film directly as the emitted light can travel relatively easily to the film increasing detection efficiency. However, within the matrix of the paper, the light will undergo substantial attenuation and will not be detected.

Enhanced Autoradiography overcomes these difficulties and can be applied to a wide range of samples. It involves the following:

Enhanced Autoradiography Wax, EA-Wax, is melted at low temperature (55^0C), as described in my patent, directly on to the sample matrix. The sample matrix will now be transparent when cooled. The EA-Wax a highly efficient medium that has the ability to convert almost every radioactive emission into light and a high percentage of this light can readily reach the X-ray film to be recorded. The detection efficiency is therefore increase by a factor of up to 50.

Placing the sample and X-ray film between two sheets of aluminium foil, which act as reflectors, further increases the detection efficiency.

Enhanced Autoradiography offers the following advantages:

1. The time required to obtain an autoradiographic image of a weak beta emitting radionuclide such as ^{3}H can be reduced dramatically.
2. The application of the EA-Wax is simple, quick, and inexpensive.
3. The method is in most cases non-destructive to the sample. The EA-Wax can be dissolved by washing in toluene or a toluene substitute, enabling further investigations of the sample to be undertaken.
4. The method does not involve any capital equipment.
5. The highest possible resolution is obtained.

With the EA-Wax applied to the sample membrane it will now be transparent. This allows positive location of all areas of interest on the sample.