

Release No: 33716

THE ROLE OF WATER ACTIVITY IN ENSURING THE SAFETY OF READY-TO-EAT COOKED MEAT PRODUCTS

Ready-to-eat meat products such as pepperoni and jerky are popular both as a snack and for use as pizza toppings. These products have a particular advantage for customers and retailers in that they can be stored safely at room temperature. This is because the preparation process destroys pathogens and reduces the water activity to a level at which microorganisms cannot grow. Note that water activity represents the energy status of the water in the system and is equal to the relative humidity of the air in equilibrium with a sample in a sealed chamber; water activity (often referred to as a measure of the 'available water') is therefore the characteristic of interest in relation to food safety, rather than moisture content.

Different pathogens have clearly defined limits of water activity at which they can be sustained; whereas the limit value for *Escherichia coli* (E-coli) is 0.95, that for *Staphylococcus aureus* is 0.88. It is generally accepted that reducing the water activity to 0.85 results in a 'safe' product in which all pathogen growth is stopped regardless of factors such as pH level and temperature, though suitable preservatives and/or packaging are necessary to inhibit mould growth, as moulds have a limiting water activity level of 0.70.

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There are some people who believe reducing the water activity to an even lower level makes a ready-to-eat (RTE) cooked meat product 'safer' but this is not the case. Moreover there are several disadvantages to doing this: further drying removes more water, which can impact on profitability through increased processing costs and the fact that RTE meat products are generally sold by weight; also the reduced water activity can have an adverse affect on the product's tenderness, succulence and palatability. Clearly water activity has to be closely controlled, as it must be neither too high (which could be unsafe) or too low (which impacts on quality and profitability).

Hazard Analysis and Critical Control Point (HACCP) plans have been used for over a decade to reduce food contamination by pathogens. The measurement of water activity is a key point in HACCPs for RTE cooked meat products. The USDA Generic HACCP Model 10 for Heat Treated, Shelf-Stable Meat Products identifies 0.85 as the critical water activity value for shelf stability and the USA's FSIS (the Food Safety and Inspection Service of the US Department of Agriculture, USDA) suggests the use of an instrument with an accuracy of $\pm 0.003 a_w$.

Traditional methods for determining water activity are time-consuming and expensive, meaning that the feedback loop for controlling the production process is so long that considerable quantities of out-of-specification product may have been manufactured before the problem can be identified. Fortunately there are now cost-effective benchtop and handheld instruments that can provide a measure of water activity within minutes.

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AquaLab benchtop instruments measure the water activity of small (up to 14 ml) samples using the chilled mirror dewpoint method. The latest version, the AquaLab Series 4TE, can even control the temperature, which gives further reassurance that readings are taken on the same basis each time - and across different production sites if necessary. Easy to operate and maintain, the AquaLab provides readings within approximately five minutes to an accuracy of $\pm 0.003 a_w$.

Similar in many respects but utilising the dielectric humidity measurement method, the AquaLab Lite is a smaller benchtop instrument that is also quick and simple to use. The Lite measures at ambient temperatures and has an accuracy of $\pm 0.015 a_w$. The handheld Pawkit water activity meter also uses the dielectric humidity method and has an accuracy of $\pm 0.02 a_w$. Despite the accuracy being lower than that recommended for HACCPs, the AquaLab Lite and Pawkit can still be make a valuable contribution to routine quality assurance processes.

Labcell Ltd is the sole UK distributor for the AquaLab, AquaLab Lite and Pawkit instruments, all of which are manufactured in the USA by Decagon Devices. For more information telephone +44 (0)1420 568150, email mail@labcell.com or visit Labcell's website at www.labcell.com.

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