

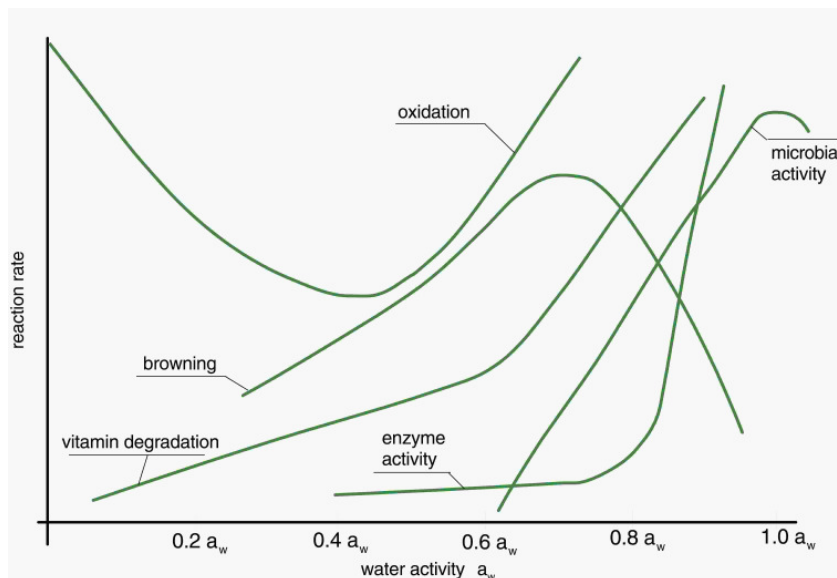
Water in dairy products with special reference on cheese production

The water activity (a_w -value) respectively the equilibrium humidity defines the degree of freedom of the water in a hygroscopic material. The water activity directly provides information about the physical, mechanical and chemical properties of the product and the microbial product stability.

To determine the a_w -value the relative humidity over a sample is measured after reaching the equilibrium humidity (partial water vapour pressure). This relates proportionally to the a_w -value. An accurate and significant a_w -measurement is only possible, if the sample shows a constant temperature during the measurement.

“Free” water in products is jointly responsible for the growth of undesirable organisms such as bacteria or fungi, which produce “toxins” or other harmful substances. But also chemical/biochemical reactions (e.g. the Maillard reaction) increasingly take place and possibly change the following factors of a product:

- Microbiological stability (growth)
- Chemical stability (see graph)
- Content of proteins and vitamins
- Colour, taste and nutritional value
- Stability of the compound and durability
- Storage and packing
- Solubility and texture



The optimisation and stabilisation of the product properties sometimes requires that the a_w -value should be set and controlled within a small a_w -range.

The a_w – value of a product can be changed by different actions. E.g. by adding different ingredients such as salt, sugar, alcohol (so called “Humectants”) etc., the guarantee of favourable ripening and storage conditions, use of adequate packaging material, etc.

Water control in cheese production

Water in cheese plays a relevant role for the curd consistence and the bacterial metabolism, and consequently for the processes during cheese ripening. The influence of the water content and the water activity on the cheese quality is very complex. Not only due to the chemical composition but also because of the progressive ripening in the product.

Cheese contains beside high molecular proteins also low molecular compounds which are partly produced during ripening or as in the case of NaCl, are added during manufacturing. The low molecular soluble compounds have the biggest influence on the water activity in cheese.

Milk enzymes and starter cultures gradually hydrolyse milk compounds and lower the water activity. Such transformations are relatively small in fresh and soft cheese but very distinctive in semi-hard and hard cheese. The treatment with salt and the loss of water during the storage have an additive effect to lower the water activity.

By the help of the sorption isotherm determination both mentioned phenomena as the binding of water through cheese components and the water activity can be recorded.

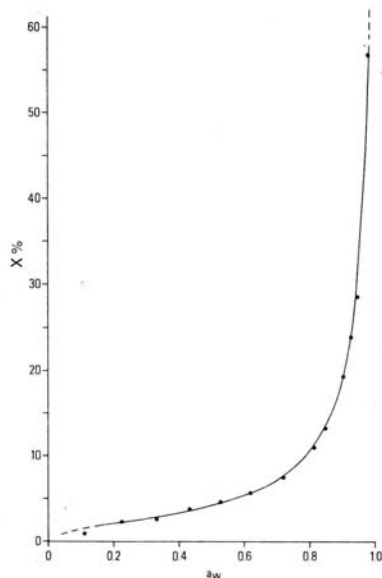


Figure 1: Sorption-Isotherm of a 90 days old Emmenthaler cheese

A typical example of a sorption isotherm of Emmenthaler cheese at 25°C is shown in figure 1.

As expected the represented isotherm shows a sigmoid form. This curve is characteristic for swellable substances with a high amount of protein.

Possibilities for the control of water content and water activity in cheese

Cheese making may be considered as a transformation of milk, a perishable liquid, into a semi-solid product with a more or less extended shelf life. In this process water activity is an important biophysical factor. The cheese maker has several direct and indirect possibilities during manufacturing of cheese to adjust the water content as well as the water activity.

There are two ways to influence the water activity. The water content, more specific the amount of "free" water, and the amount of solutes can be controlled to a great extent by the cheese maker. Among these factors to adjust the a_w -value there are further factors to set the water content, such as syneresis, the course of acidification and the structure of curd grain.

On the other hand brining is the most important factor for lowering a_w in soft and unripe cheese. For hard cheese, proteolysis also plays an important role. It has been shown that low molecular weight components from the casein hydrolysis have about the same a_w -lowering effect as NaCl.

For most cheese varieties, the salt to moisture ratio is the most important and easy to control parameter to influence the water activity.

During the selection of starter strains and cultures the a_w -value and salt tolerance must be carefully considered for an optimal cheese quality.

To produce a stable and sensory attractive product there should be monitoring performed during the production according to the HACCP regulations, and where the a_w -value measurement describes a part of it.

Do you have any problems about the quality and shelf life of dairy or combined products?

The water activity measurement may help you to find an answer!

Further information about the Novasina water activity meters you can find on our web page www.pedak.nl

Author: Claudio Zigerlig, Manager Marketing & Verkauf, Novasina AG

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