

ANALYSIS OF THE PH-INDEPENDENT EFFECTS OF SOLUBILISED BENZOIC ACID AND SORBIC ACID ON THE GROWTH OF MICRO-ORGANISMS

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Keywords: Benzoic acid, sorbic acid, micro-organism inhibition, solubilisation

Solubilised sorbic and benzoic acids produced by AQUANOVA AG (Germany) showed an overall better preserving performance - higher solubility in water and oil as well as a stronger and pH-independent anti-bacterial activity - than the unsolubilised samples.

Introduction

Preserving agents are indispensable in food technology. With increasing variety of products there is a rising demand on preserving agents which can be handled easily. That concerns in particular solubility and anti-microbial effects. Since water and fat in food products are milieus for microbes and germs a highly effective agent should have amphiphilic properties, i.e. soluble in water and fat. Amphiphilic agents are able to preserve meat and fat-rich products as well as beverages.

The aim of this study was to investigate the effect of solubilisation on the inhibition of micro-organisms by a comparison of solubilised and unsolubilised sorbic and benzoic acids.

Materials and Methods

Five different germs (*Escherichia coli*; *Pseudomonas aeruginosa*; *Staphylococcus aureus*; *Lactobacillus plantarum* und *Saccharomyces cerevisiae*) were tested with solubilised as well as unsolubilised sorbic and benzoic acids. The culture medium was produced in a doubly concentrated form (standard I-bouillon for the bacteria; malt-bouillon for the yeast and MRS-bouillon for the *Lactobacillus*). Then, the bouillons were adjusted to various pH-values (*P. aeruginosa*; *St. aureus* und *E. coli* ► pH 6.0; *Lactobacillus plantarum* ► pH 5.0 and *Saccharomyces cerevisiae* ► pH 3.8 and 5.0). The culture media were mixed with a preserving agent and filled into a 10 ml test tube. The resulting solution was inoculated with the test organism and incubated at appropriate temperature. After 7, 14 and 21 days the incubated samples did not show any visible growth of microbes (cloudiness and/or sediment) using the drop plating method. To get more detailed information on growth performance of the micro-organisms and inhibiting effects of the preserving agents the germs were counted and recorded.

Results and Discussion

As shown in figures 1 and 2 for *Escherichia coli* and *Staphylococcus aureus*, the solubilised preserving agents are considerably more effective than the unsolubilised samples. While the unsolubilised sorbic and benzoic acids achieved only a tenfold reduction of the colony building units, the number of germs in the specimens treated with the solubilised preserving agents was reduced from 10^8 to 10^2 colony building units. This clearly shows that despite a high number of germs in the beginning and a pH-value of 6.0 a highly advantageous reduction of the number of germs could be achieved for a long period of time.

The result of the inhibiting activity on germs differs due to the varying resistance of micro-organisms towards the preserving agents.

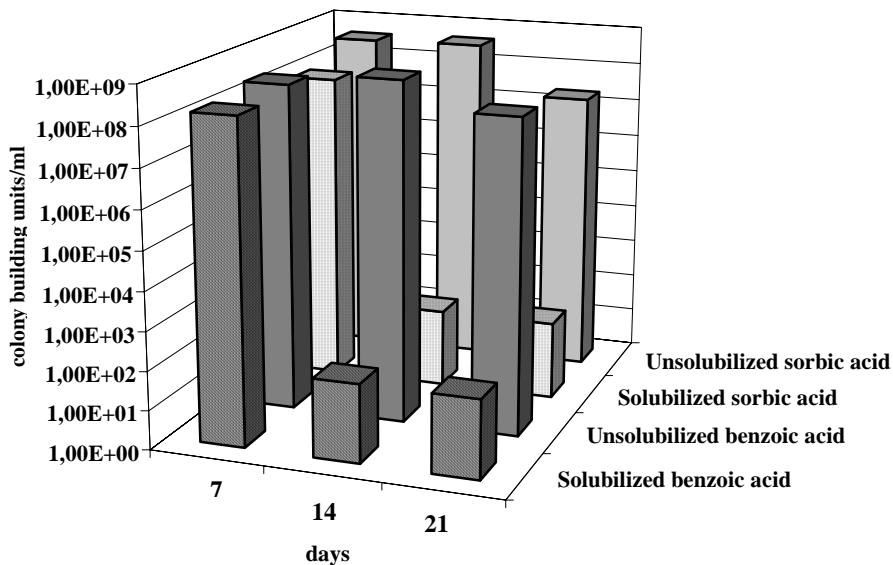


Fig. 1: Escherichia coli + preservative concentration of 0.125 % and pH 6.0

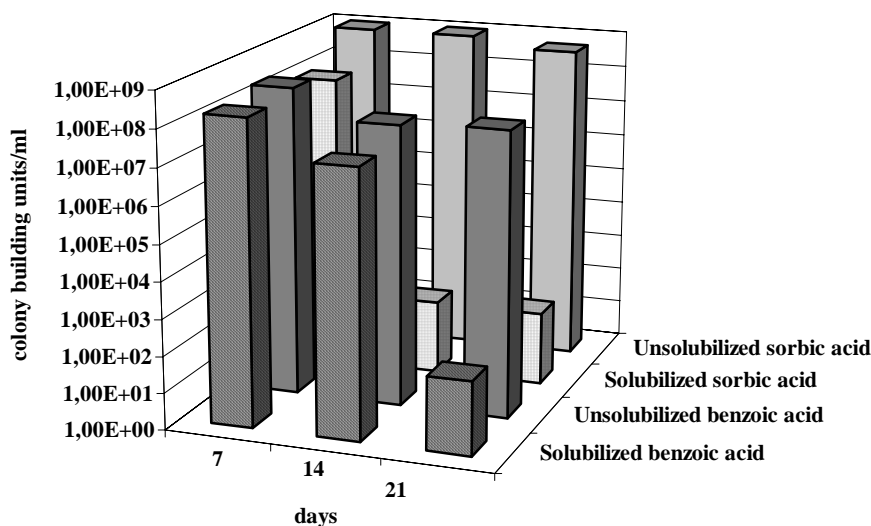


Fig. 2: Staphylococcus aureus + preservative concentration of 0.125 % and pH 6.0

Conclusions

Benzoic acid possesses an inhibiting effect only in its undissociated form at $\text{pH} > 4$. The activity of the solubilised sample is independent on the pH due to the micellar protection of the undissociated state of the preserving agent. The micelles carry the agent to the outer membrane of the micro-organism where they are released from the micelles and absorbed by the micro-organism. This was impressively shown by an investigation with yeast malt broth at $\text{pH} 6.2$ where regular benzoic acid had no effect on the yeast growth, but the solubilisate inhibited the growth resulting in a germ count of zero after appr. 2 weeks.

Advantages of the solubilised agents are:

- clear, soluble liquids,
- high efficiency,
- water- and fat soluble (amphiphilic),
- ready to use and easy to prepare,
- thermo- and pH -stable,
- proven superior penetration
- lower dosis.

References

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