ANALYSIS OF THE pH-INDEPEDENT EFFECTS OF SOLUBILIZED BENZOIC ACID AND SORBIC ACID ON THE GROWTH OF MICROORGANISMS

Barbara de Melo Mauricio and Herbert Weber*
University of Applied Sciences Berlin, Department of Food Technology,
Luxemburger Str. 10, D-13353 Berlin, Germany, E-mail: dr.web@t-online.de

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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-indepent antibacterial activity - than the unsolubilzed samples.

Introduction

Preserving agents are indispensable in food technology. With increasing variety of products there is an 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 product 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 solubilization on the inhibition of microorganisms by a comparison of solubilized and unsolubilzed sorbic and benzoic acids.

Materials and Methods

Five different germs (Escherichia coli; Pseudomonas aeruginosa; Staphylococcus aureus; Lactobacillus plantarum und Saccharomyces cerevisiae) were tested with solubilized as well as unsolubilzed 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). Than, 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 (ratio :) 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 microorganisms 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 solubilized preserving agents are considerably more effective than the unsolubilized samples. While the unsolubilizes sorbic and benzoic acids achieved only a tenfold reduction of the colony building units, the number of germs in the specimens treated with the solubilized 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 results of the inhibiting activity on germs differs due to the varying resistance of microorganisms towards the preserving agents.

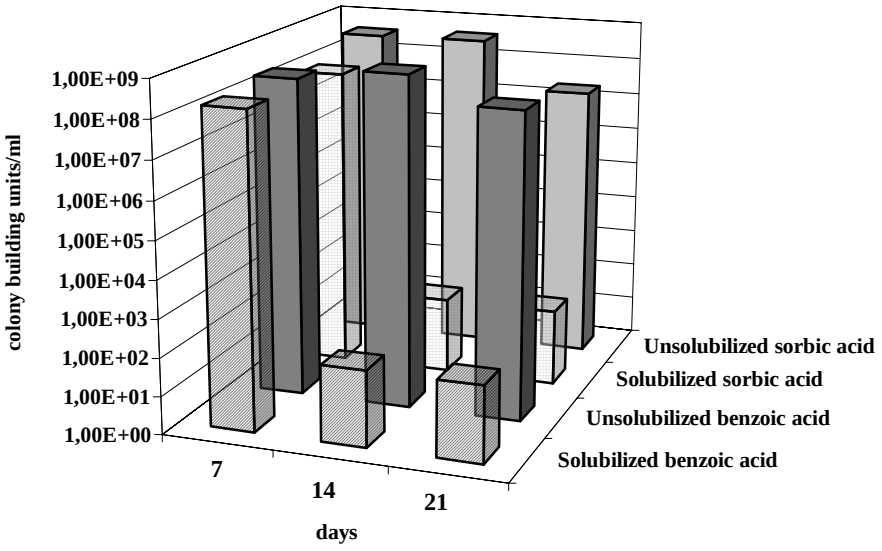

Fig. 1: Escherichia coli + preservative concentration of 0,125 % and pH 6,0

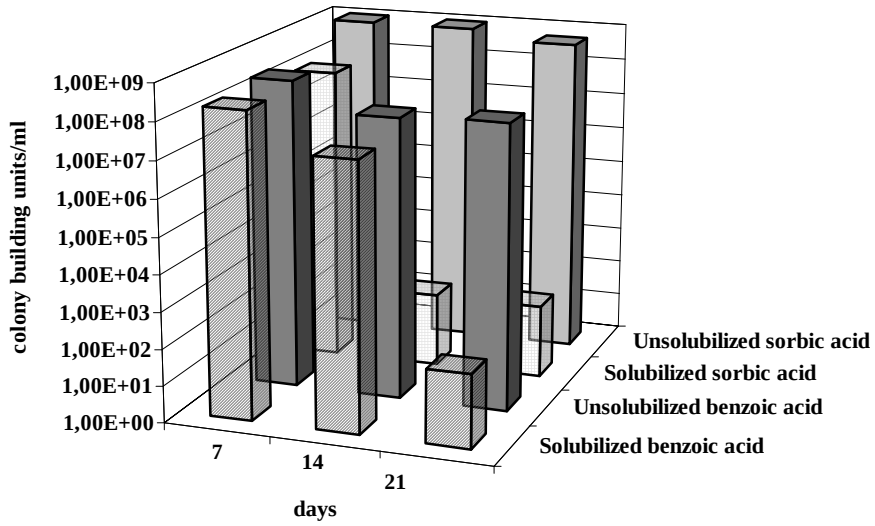

Fig. 2: Staphylococcus aureus + preservative concentration of 0,125 % and pH 6,0

Conclusions

Benzoic acid possess an inhibiting effect only in its un-dissociated form at pH > 4. The acitivity of the solubilized sample is indepent on the pH due to the micellar protection of the undissociated state of the preservating agent. The micelles carry the agent to the outer membrane of the microorganism where they are released from the micelles and absorbed by the microorganism. This was impressively shown by an investigation with yeast malt broth at 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 solubilized agents are:

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

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