THE INFLUENCE OF BOTTLED WATER STORAGE CONDITION ON MICROBIOLOGICAL QUALITY

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Introduction

The microbial cell, having a low mass, is strongly influenced by environmental conditions and reacts very quickly to various factors, either by adaptation or by disappearance. Thus, microbial growth is dependent on many physicochemical and biological factors, which have led, during evolution, to specific adaptations by establishing relationships between microorganisms and the environment.

Microorganisms are poikilothermic, so their temperature varies with that of the environment. Temperature has a great influence on physiological processes, because it stimulates or inhibits the activity of enzymatic equipment. Depending on the possible temperatures of the natural environment and, as a result, different species have certain optimal developmental temperatures. Water is essential for every form of life, being necessary for all biological processes. At the global level, water is a limited resource, fact which requires care in its use for a sustainable preservation of water resources. Clean, safe, and hygienic water are other aspects that people take care for assuring public health. The consumption of water of inadequate quality could lead to high rates of waterborne disease. The quality of tap water is not always the best, reason for which in the last years, consumption of bottled water has increased. But although people perceive the bottled water being clean and safe, this is not always the truth, the bottled water being also chemically or microbiologically contaminated, raising risks for diseases. One of the factors favoring the development of microorganisms in bottled water is the storage temperature.

Legally, there are three classes of bottled water: natural mineral water, spring water and other water. European Communities lays down the requirements for the marketing of these waters. After the water has been bottled, the trader must ensure storage and transport conditions so that it is not exposed to extreme temperatures.

Materials and methods

Between January and June 2021, 10 bottled water sources were tested to verify microbiological quality according to various exposure temperatures. The bottled waters were grouped and stored at -10℃, 0℃, 10℃, 20℃, 30℃, 40℃ and at the

same time exposed to light and darkness. The storage time was 5 days with monitoring every 24 hours for general bacterial density.

The microbiological indicators of CFU/ml were performed by incubation at 37°C for 48 hours on Yeast extract agar (Oxoid). The positive control with *Escherichia coli ATCC25922* of 100 CFU/ml and a blank control were analyzed.

Results and conclusions

Bacterial density results have shown that storage at temperatures below 10 degrees does not microbiologically affect water quality. In these cases, light and darkness did not influence the results, the water remaining microbiologically pure.

The samples that were stored at over 30°C began to show bacterial colonies after about 3-4 days, reaching an average of 25 CFU / ml after 5 days.

Although different types of water sources were selected, no significant differences in quality were recorded depending on storage conditions.

At the same time, the positive control sample reacted differently. *E. coli* density values were halved after 24 hours at 0°C, reaching 0 CFU / ml at -10°C after 24 hours.

The value of the bacterial density in the control sample stored at over 10 degrees increases exponentially with the storage time, reaching an average value of 1000 CFU / ml after 5 days. In this case, the light influenced the bacterial growth in proportion of 20% compared to the development of the colonies from the samples stored in the dark.

The total number of colonies developed at 37°C is regulated for bottled waters by national and international legislation at a limit value of 20 CFU / ml, which means that storage conditions play a very important role in ensuring the microbiological quality of bottled water.

Our experimental study demonstrates that a microbiologically pure bottled water has a risk of contamination after storage at a temperature above 30°C for 4-5 days. At the same time, if a bottled water has a density of mesophilic bacteria that falls within the legislative limit, storage at extreme temperatures can affect the number of microorganisms depending on the storage time. Thus, at negative temperatures, the number of bacteria decreases to 0 CFU / ml, and at temperatures higher than 30°C it can increase more than 10 times over. Also, the light conditions can favour the increase of the number of colonies.