A COMPARATIVE STUDY ON THE EFFICIENCY IN ACETIC ACID OBTAINED IN ACETIC FERMENTATION WITH 10 ACETOBACTER COLONIES

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Abstract

The study aims at proving the fermentative activity efficiency of 10 Acetobacter colonies, one industrial, noted A_i and 9 other colonies, isolated from native wines and from cider.
Keywords: *fermentation acetic acid, vinegar, Acetobacter*

Introduction

Acetic bacteria are widespread in nature, on vegetal products–the place of some alcoholic fermentation-in liquids with low alcohol content (beer, cider, wine), at the surface of which it can form a thin layer–more or less adherent to the walls of the container. These bacteria are aerobian, non-sporulated, mobile or immobile, most of them having sizes of 0.3–3 microns.

Vinegar industry is, in general, interested in acetic bacteria with superior fermentative potential, with a convenient bioconversion efficiency of ethanol into acetic acid, in different variants of the fermentation environments imposed by the available raw material.

Experimental

The purpose of the performed study, which refers to the practical efficiency of the acetic fermentation with 10 acetic bacteria colonies, one (A_i) industrial, and 9 other colonies isolated from wines and cider, was to select colonies in this respect. The 10 *Acetobacter* colonies have been experimented in growing environment with 6, 7, 8, 9, 10 and 12% alcohol, with 2% acetic acid and 1% corn extract used as nutrient for the acetic bacteria. The alcohol has been taken from the refined spirits with a concentration of 96%.

In preparing the growing environment in the 7 variants of concentration in alcohol, sterile drinking water was used.

The environments, distributed in glass containers of the same shape and capacity, 200 ml, have been inoculated with 5% from each *Acetobacter* colony and thermostated at 25°C.

The fermentation of each sample, carried on in a static system, has been followed for 49 days, with tests performed in days 7, 14, 21, 28, 35, 42 and 49.

The acidity, and finally, the alcohol and the pH have been supervised. The acidity test has been achieved by means of the titrimetrical method. The alcohol has been determined by means of the ebuliometrical method with tests performed by means of the distillation method, and the pH has been electometrically determined with the help of the pH meter.

The fermentation evolution and the efficiency of each *Acetobacter* colony activity under the conditions of the growing environment can be followed in the graphical material presented in figures I, II, III, IV, V, VI, VII, VIII, IX, X.

In figure XI, which contain the efficiency of the alcohol bioconversion in acetic acid with each *Acetobacter* colony in every variant of the environment colony, there is also presented an acetic bacteria colonies classification, depending on their fermentative activity efficiency. On this experimental database one may draw some conclusions on the fermentative potential of each *Acetobacter* colony, one may have some recommendations to make on the fermentation environment in which each *Acetobacter* colony is more efficient.

The classification of the 10 *Acetobacter* colonies and the presentation of the first three places, taking into account the efficiency with which they achieve ethanol's conversion into acetic acid, is presented in table 1.

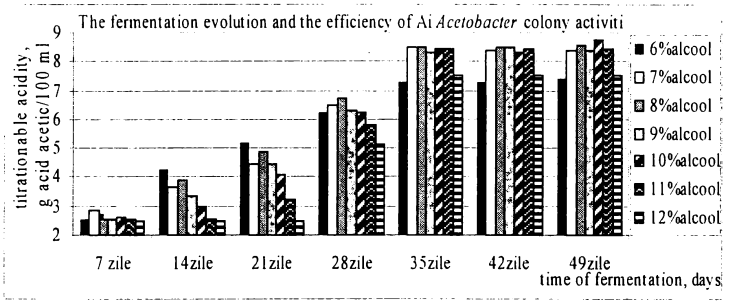

Fig. I: The fermentation evolution and the efficiency of Ai *Acetobacter* colony activity

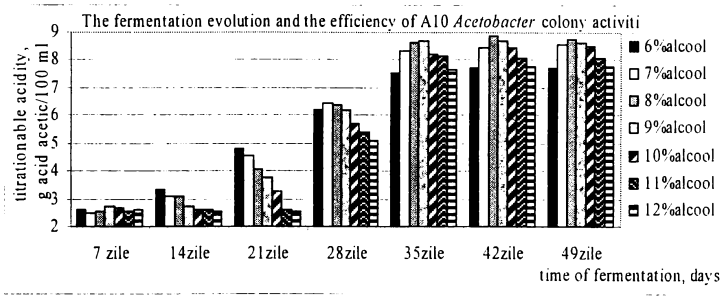

Fig. II: The fermentation evolution and the efficiency of A10 *Acetobacter* colony activity

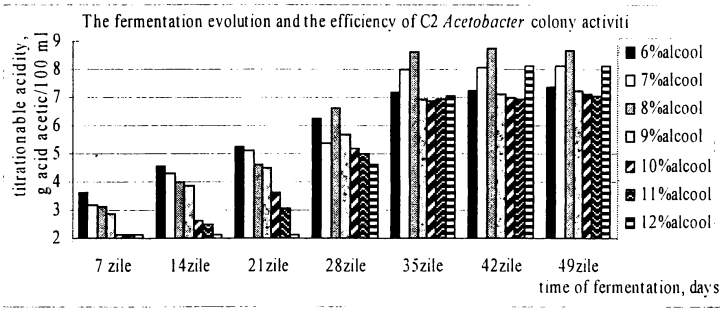

Fig. III: The fermentation evolution and the efficiency of C2 *Acetobacter* colony activity

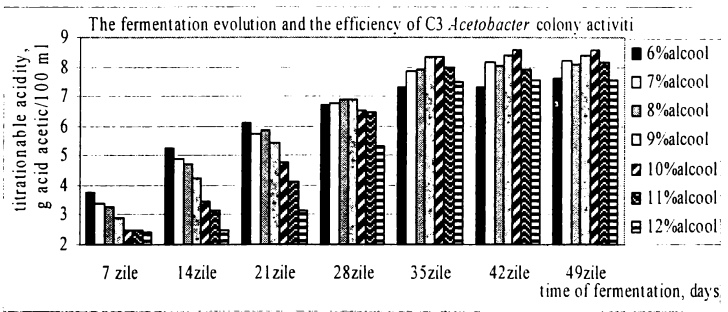

Fig. IV: The fermentation evolution and the efficiency of C3 *Acetobacter* colony activity

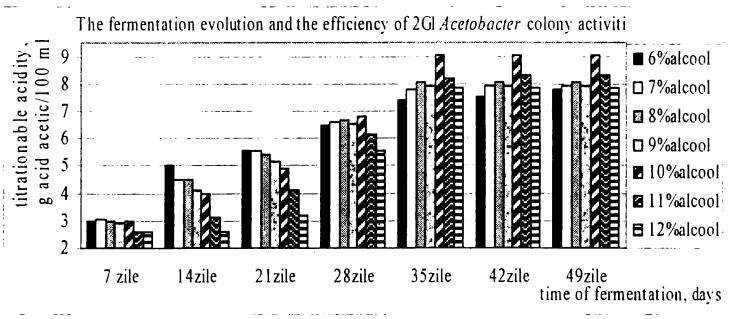

Fig. V: The fermentation evolution and the efficiency of 2Gl *Acetobacter* colony activity

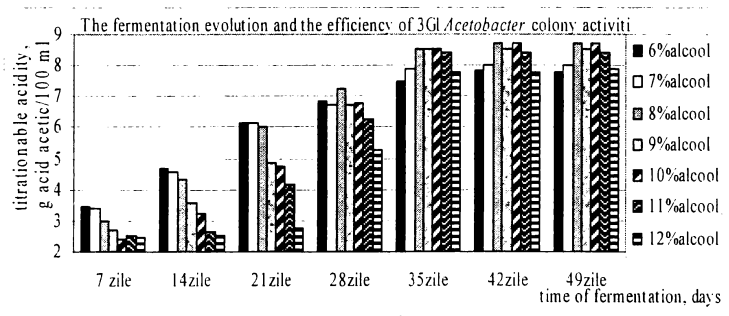

Fig. VI: The fermentation evolution and the efficiency of 3Gl *Acetobacter* colony activity

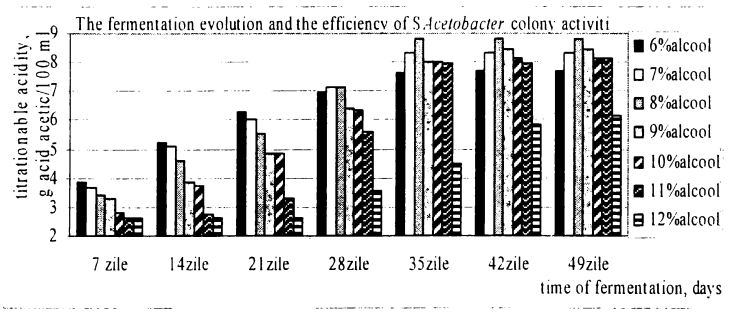

Fig. VII: The fermentation evolution and the efficiency of S *Acetobacter* colony activity

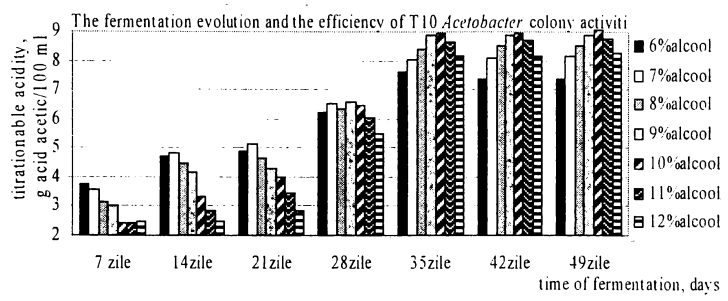

Fig. VIII: The fermentation evolution and the efficiency of T10 *Acetobacter* colony activity

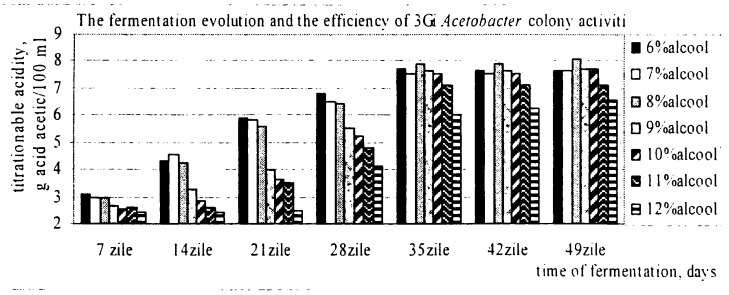

Fig. IX: The fermentation evolution and the efficiency of 3Gi *Acetobacter* colony activity

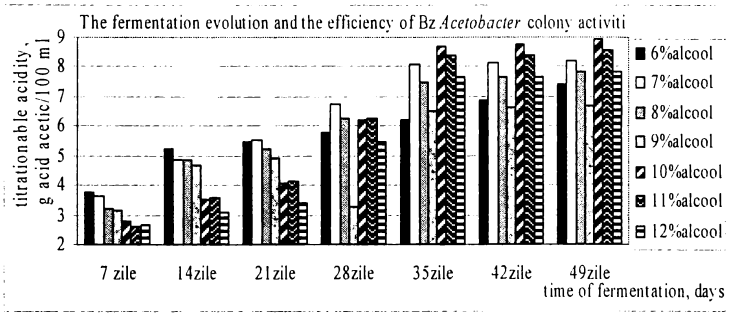

Fig. X: The fermentation evolution and the efficiency of Bz *Acetobacter* colony activity

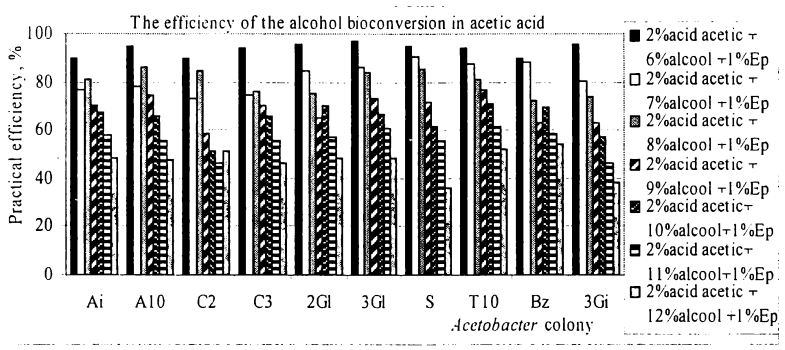

Fig. XI: The efficiency of the alcohol bioconversion in acetic acid with each *Acetobacter* colony

Table 1: The classification of the 10 *Acetobacter* colonies taking into account the efficiency with which they achieve ethanol's conversion into acetic acid

The composition of the growing environment	The place occupied in the classification by the studied acetic bacteria colonies depending on their practical efficiency			Observations
	1st place	2nd place	3rd place	
6%alcohol+2%acetic acid+1%Ce	3 Gl	2 Gl and 3 Gi	A10 and S	The T10 *Acetobacter* stems are to be noted due to their fermentative potential efficiency.
7%alcohol+2%acetic acid+1%Ce	S	Bz	T10	
8%alcohol+2%acetic acid+1%Ce	A10	S	C2	
9%alcohol+2%acetic acid+1%Ce	T10	A10	3 Gl	
10%alcohol+2%acetic acid+1%Ce	T10	2 Gl	Bz	
11%alcohol+2%acetic acid+1%Ce	T10	3 Gl	Bz	
12%alcohol+2%acetic acid+1%.Ce	Bz	T10	C2	

Results and Discussions

1. All 10 *Acetobacter* colonies considered in the experiment can better or poorly develop, with different degrees of efficiency regarding acetic acid production in growing environments with 6–12% alcohol, 2% acetic acid and 1% corn extract (C.e.).

2. The alcohol bioconversion into acetic acid can be achieved with different degrees of efficiency, depending on the alcohol concentration in the growing environment and on the *Acetobacter* colony, used as fermentation agent. The more the growing environment alcohol concentration grows, the more efficiency decreases.

3. In a growing environment with 6% alcohol, all *Acetobacter* colonies totally ferment the alcohol with an efficiency of 89,8–97,1%. The maximum efficiency under these environment conditions is obtained by the acetic bacteria colony noted 3 Gl.

4. In a growing environment with 7% alcohol, depending on the *Acetobacter* colony used in fermentation, the practical efficiency in acetic acid varies between 73,2–90%. In this growing environment an acidity of 8,33% is reached with a maximum efficiency of 90% achieved by the colony S, for which these environment conditions are most propitious.

5. In the acetic bacteria growing environment with 8% alcohol, depending on the fermentation agent, the efficiency in acetic acid varies between 72,2–86,1%. The colony A10 is to be noted here, colony with which an acidity of 8,89% is obtained, expressed in acetic acid, with the maximum efficiency of 86,1%.

6. As a result of growing the 10 acetic bacteria in an environment with 9% alcohol, an acidity of 8,89% is reached with a maximum efficiency of 76,5% by the T10 *Acetobacter* colony. Under these environment conditions in the time period the alcohol is totally fermented only by the colonies T10 and Bz. In this fermentation environment the minimum efficiency of 58,4% is achieved by the colony C2.

7. The bioconversion of alcohol in the growing environment with 10% alcohol takes place with an efficiency in acetic acid between 51,3–70,8%. The maximum acidity of 9,08% is obtained with a maximum efficiency, achieved by the T10 colony, which proves to be more resisting to alcohol concentration.

8. In the growing environment with 11% alcohol, the acetic acid efficiency obtained with the studied acetic bacteria varies between 46,1–61,4%. The maximum efficiency is also obtained with the T10 colony, followed by the colonies 3Gl and Bz.

9. In the 12% alcohol environment, the development and the fermentative activity of the 10 *Acetobacter* colonies is weaker. The alcohol which remains in the environment is 1,85–5% and only 3 *Acetobacter* colonies (Bz, T10 and C2) achieve an efficiency of over 50% in acetic acid.

10. In the growing environments with 6, 7 and 8% alcohol, the colonies 3Gl, S and A10 are recommended. In the 9 and 10% alcohol environments the T10 colony is recommended, an acetic bacterium with superior fermentative properties.

11. In the growing environment with 6% alcohol, the industrial colony Ai is outrun as efficiency in acetic acid by 7 colonies out of the 10 studied. In the 8 and 9% alcohol environments, Ai is outrun as fermentative potential by 5 and 4 colonies out of the experimented ones. In the growing environments with 10 and 11% alcohol, the industrial colony is outrun as efficiency by the colonies T10, 2Gl, 3Gl and Bz. In the growing environment

with 12% alcohol, the industrial colony develops weakly with an acetic acid efficiency of under 50%.

12. The final pH of all sample variants is between 2,24–2,38.

References

Dan, Valentina. (2001). Food microbiology. Ed. ALMA Galați.
Oancea, Ioana. (1996). Food microbiology. Târgoviște.
Tarhon, Maria Cristiana. (2006). The vinegar manufacturing technology. Ed. Universitary „Dunăreade Jos". Galați.