Procedure for the preparation of a fermented product

KEYWORDS

- ❑ MICROGRAVITY
- ❑ YEAST
- ❑ FERMENTATION
- ❑ BEER
- ❑ MICROORGANISMS

AREA

- ❑ AGRIFOOD

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Co-Ownership
Sapienza University of Rome 70%, Università degli studi di Perugia 30%.

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Industrial & Commercial Reference
Interested industry is the food industry and in particular the beer and baking industry.

Time to Market
Our procedure is suitable for obtaining a final product (bottled beer) like the commercially available one. For this reason, TLR is 7/8.

Availability
Cession, Research, Development, Experimentation, Collaboration, Start-up and Spin-off.

Fig. 1 Simulated microgravity machine (RCCS)
Simulated microgravity has been obtained using the machine in the picture manufactured by NASA and based on the reproduction of free fall seen on board of the International Space Station (ISS) owe to the equilibrium between the free fall due to the earth attraction and the revolution around the earth. Top image shows the power supply used to set the revolution velocity. Bottom image shows the structure with the 4 engines used to insert the plates and the, by rotating, keep the yeast in free fall.

Fig. 2 Top, image of 4 plates with wart and yeast stopped after 5 days in simulated microgravity. Note the presence of a large quantity of yeast (white mass) at the bottom of the plates. Bottom, magnification of one of the 4 plates during simulated microgravity to show the turbidity due to the rapid growth to the yeast.

Abstract
It is known that microgravity can increase the growth of microorganisms. However, there are no studies regarding the usage of S. cerevisiae, grown in microgravity, for the fermentation process to produce beer. To this effect, the present invention provides a new usage of simulated microgravity to increase the growth and fermentation of the yeast. In particular, proponents of the present invention have discovered that microgravity increases the growth of the yeast in the wort and that this same yeast possess a higher fermentation rate while maintaining vitality and fermentation ability after freezing.

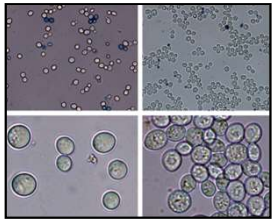

Fig. 3 S. cerevisiae yeast in bright field
Yeasts were grown in normogravity (left side) and microgravity (right side) for 5 days. At the end of the treatment, the yeasts were collected and observed at optical microscope at 20 x (images at the top) and 40x (images at the bottom). Note the increased number of yeasts in microgravity (right side) compared to normogravity (left side) as well as the higher number of vacuoles in yeasts in simulated microgravity (bottom right).

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Technical Description

The present invention foresees the usage of simulated microgravity to increase propagation and fermentation as well as freezing resistance in yeast compared to a yeast grown in normogravity. Microgravity is simulated through instruments usually used to study its effects on ground without going to the International Space Station. The yeast grown and conditioned in simulated microgravity can then be used to obtain beer and other edible products requiring fermentation maintaining their organoleptic characteristics.

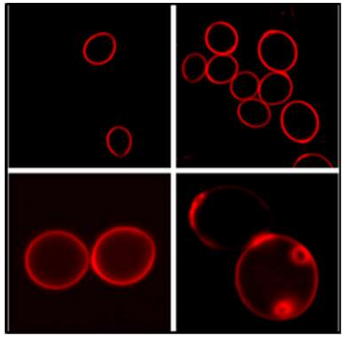

Fig. 4 Images of the S. pastorianus yeasts taken with a confocal fluorescent microscope exploiting the red autofluorescence of the yeast. To the left side the yeast grown in normogravity and to the right side the yeast grown in microgravity for 5 days and visualized at 20x (top) and 60 x (bottom). It is important to notice the higher number of cells (top left) and the presence of vacuoles inside the yeast grown in simulated microgravity (bottom right).

Technologies & Advantages

The state-of-the-art shows that microgravity increases the proliferation of microorganisms. However, there are no disclosures regarding the usage of simulated microgravity to the fermentation processes. The present invention provides, therefore, a procedure to prepare a fermented product using simulated microgravity and that includes in vitro propagation of fermentative microorganisms and fermentation of a product containing sugar by the same fermentative microorganisms. Thanks to the simulated microgravity, the velocity of propagation of the fermentative microorganisms and the same fermentation rate, are increased compared to a similar procedure performed in normogravity. In this way we can obtain the same product in **less** time. Moreover, the inventors have observed that simulated microgravity increases the resistance to freezing of the yeasts that maintain high vitality and fermentation capacity after thawing.

Applications

Being a methodology that increases the propagation and fermentation of yeast, our invention has a large number of applications along the food sector that uses yeast and that, therefore, goes beyond the beer production on which such methodology has been tested. Interested industries are those producing beer or baking products. Moreover, since such methodology uses simulated microgravity showing that it is possible to obtain foods even under such condition, our invention could be interesting also for the space industry or space agencies (European and American) and used in deep space travels or satellite (Moon)/ planets (Mars) colonization.

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