





Controlling contamination during yeast fermentation

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Contamination Control 1

- Using yeast in anaerobic or aerobic fermentation often has problems with bacterial contamination.
- In ethanol fermentation, the most common contaminating bacteria are Lactobacillus fermentum and Lactobacillus vini.
- The main contamination control in Brazil is the Melle-Bionot technique of yeast recycling with a sulphuric acid wash (U.S. Patent 2,230,318, 1936) (cell-recycle batch fermentation)
- This is expensive, dangerous, has water disposal problems, and is capital-intensive, but allows months-long continuous fermentation





Contamination Control 2

- Antibiotics are also widely used for contamination control, including in Brazil, but lead to antibiotic resistance in people if it enters the food chain.
- Sulfite is sometimes used for contamination control, but can't enter the food chain, reducing the value of residual yeast as fodder.
- Control of bacterial contamination permits continuous fermentation for long periods, which is much more economical than batch fermentation.



Contamination Control 3



- Fermentation with yeast is easily contaminated by both bacteria and contaminating yeasts, during aerobic and anaerobic fermentation.
- Bacteria need nickel to grow on urea (needed by the urease enzyme). Bacteria don't have the urea amidolyase enzyme.
- Yeasts need biotin to grow on urea (needed by the urea amidolyase enzyme). Candida utilis and Yarrowia lipolytica are biotin prototrophic (make their own biotin) but other yeasts, need added biotin.







- Saccharomyces cerevisiae grows much faster than common contaminating yeasts such as Dekkera bruxellensis when urea is the nitrogen source.
- The fastest growth of *S. cerevisiae* and *Candida utilis* is when growing using urea as the nitrogen source.
- Testing of this contamination control technique has been successfully completed and the patent application is being examined in US, RU, CN, BR, IN.





Problems & Solutions 1

- 1) If urea is added faster than consumed by yeast, the yeast will secrete ammonia into the broth, allowing growth of bacteria.
- Solution: Reduce the rate of addition of urea when pH increases (a sign of ammonia).
- 2) Stainless steel leaches nickel into the broth in an acidic solution containing chloride ions, and the nickel allows growth of bacteria using urea.
- Solution: Use titanium in heat exchangers and possibly polymeric (plastic) food-safe coatings inside fermenters.





Problems & Solutions 2

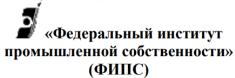
- 3) Urea and ethanol form ethyl carbamate at high temperatures, especially during distillation. This is a known carcinogen.
- Solution: Ensure that all urea is consumed by yeast before sending a portion of the broth to the fermenter.
- 4) Some sugar sources don't contain enough biotin for yeast to use the urea.
- Solution: Biotin costs \$350/kg, need 2 micrograms per liter, so added biotin costs only \$0.0007 per 1000 liters.





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На № 9-P24059RU от 29.02.2024 Наш № 2024102870/10(006079) При переписке просим ссылаться на номер заявки Исходящая корреспонденция от **14.03.2024** Форма N 91 ИЗ-2017 910,371

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УВЕДОМЛЕНИЕ

о положительном результате формальной экспертизы заявки на изобретение

- (21) Заявка № 2024102870/10(006079)
- (85) Дата начала рассмотрения международной заявки (РСТ) на национальной фазе 06.02.2024
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- (71) Заявитель(и) ХЭМРИК Эдвард Брайан, US
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NOTIFICATION

about the positive result of the formal examination invention applications

- (21) Application No. 2024102870/10(006079)
- (85) Commencement date for examination of the international application (PCT) in the national phase 02/06/2024
- (22) Application date 12/08/2023
- (71) Applicant(s) HAMRICK Edward Bryan, US
- (54) Title of the invention Control of infection when growing yeast





Patent Status

"CONTAMINATION CONTROL WHEN GROWING YEASTS"

U.S. Patent App. No. 18/532,043, filed on December 7, 2023

International Patent App. No. PCT/US2023/083031, filed on December 8, 2023





Некоторые патенты компании

- «Aerobic fermentation using pneumatic foam», application number 63/530,954
- «Contamination control when growing yeasts», application number 63/534,123
- «Methods and systems for producing fermentation products from carbohydraterich substrates», US9428772B2
- «Method for producing ethanol from sugar beets», application number 62/585,560
- «Methods and apparatus for separating ethanol from fermented biomass,»
 WO2018182874A1
- Method for fermenting stems of the Poaceae family, ES2689944T3

РСТ подается в Россию, США, Китай, Индию, Бразилию, ЕС, Катар







Спасибо за внимание!

Задавайте любой вопрос

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