

# Fermentation and Maturation of Beer with Immobilised Yeasts

Dear Editor,

TEPRAL, the R & D Centre of the Kronenbourg Brewery and the European Brewery (Européenne de Brasseries) started in 1971 and managed the research of fermentation and maturation of beer using the technique of immobilised yeasts. Two partners were associated: the team of Professor Gilbert Durand of the INSA (Institut National des Sciences Appliquées) located in Toulouse, specialised on enzyme immobilisation and the team of Professor Henry Blachère of the INRA (Institut National de Recherche Agronomique) in Dijon, specialised on pharmaceutical fermenters. A pilot installation of fermentation and maturation of 5 L.h<sup>-1</sup> of beer was developed. This installation worked without any microbial contamination during 9 months of testing.

In the industry, before you are able to publish any results of R & D, it is essential to register patents. The first patent was registered in France, 1973 (73/23397), 20.06.1973 with an addition (73/38385), 19.10.1973. This patent has been registered in 14 countries, e.g. USA, Germany, UK etc. This R & D work was published in following places:

- Navarro J-M (1975). Fermentation en continu à l'aide de micro-organismes fixés. *Thèse Université de Toulouse*.
- Corrieux G *et al.* (1976). An immobilised yeast fermentation pilot plant used for production of beer. *Symposium Fermentation*, Berlin, 294.
- Navarro J-M *et al.* (1976). Mise au point d'un procédé continu de préparation de boissons fermentées. *Industries Alimentaires et Agricoles*, **93**:695–703.
- Moll M, Duteurtre B (1979). Préparation de bière en continu à l'aide de levures adsorbées. *Colloque Société française de Microbiologie*, Compiègne, 173–183.
- Moll M, Duteurtre B (1996). Fermentation and maturation of beer with immobilised microorganisms. *Brauwelt International*, **14**:248–252. This publication retraced the R & D work and the patents of TEPRAL where the diagram of 1973/77 shows details of the process.

An important number of publications and books ignore the chronology of this new fermentation and maturation technique. Neglecting by involuntary ignorance or superficial bibliography of the scientists? It seems desirable sometimes to re-examine the facts and to recall a certain

number of publications which have been kept under silence of our pioneer work in the field of fixed yeasts on inert support using two reactors of fermentation and maturation. Here some examples:

- Back W *et al.* (1998). Investigations into continuous beer maturation. *Brauwelt International*, **16**:222–226.
- Bamforth C W (2006). Brewing New Technologies (chapter 11: Virkajärvi I)
- Boulton C, Quain D (2001). *Brewing Yeast & Fermentation*. Blackwell Science Ltd. Oxford.
- Briggs D E *et al.* (2004). *Brewing Science and Practice*. CRC Press, Boca Raton, Boston, New York, Washington DC.
- European Brewery Convention: Monograph XXIV. E.B.C.-Symposium Immobilised Yeast Applications in the Brewing Industry, Espoo, Finland October 1995.
- Kourkoutas Y *et al.* (2004). Immobilisation technologies and support materials suitable in alcohol beverages production: a review. *Food Microbiology*, **21**:377–397.
- Pilkington P H *et al.* (1998). Fundamentals of immobilised yeast cells for continuous beer fermentation: a review. *Journal of the Institute of Brewing*, **104**:19–31.
- Smart K (2000). *Brewing Yeast Fermentation Performance*. Blackwell Science Ltd. Oxford.
- Tata M *et al.* (1999). Immobilised yeast bioreactor systems for continuous beer fermentation. *Biotechnology Progress*, **15**:105–113.
- Verbelen P J *et al.* (2006). Immobilised yeast cell systems for continuous fermentation applications. *Biotechnology Letters*, **28**: 1515–1525.
- Wackerbauer K *et al.* (2003). Measures to improve long term stability of main fermentation with immobilised yeast. *Monatsschrift für Brauwissenschaft*, **56**:210–215.
- Willaert R, Nedovic V A (2006). Review. Primary beer fermentation by immobilised yeast – a review on flavour formation and control strategies. *Journal of Chemical Technology and Biotechnology*, **81**:1353–1367.
- Yamauchi Y *et al.* (1995). Rapid maturation of beer using an immobilised yeast bioreactor. *Journal of Biotechnology*, **38**:101–108; 109–116.

Yours sincerely,

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