

Ethanol Fermentation Test Plant

There is currently a trend towards using regenerative raw materials for producing bio energy and recently this has been increasingly the case in Europe. Tax alleviation for example for fuels gained from bio mass, is intended to create the necessary incentives for investments in this field. Essentially fuels gained from bio mass include bio gas, bio ethanol, bio diesel as well as natural vegetable oils.

BMA is backed by many decades of experience in planning and constructing ethanol plants for processing all kinds of different raw materials containing sugar and starch as well as for generating additional fermentation products. The BMA engineering department's experience from processing large amounts of regenerative raw materials in the field of sugar and starch production plants flows into the company's planning of bio ethanol plants.

The distillation/rectification and absoluteion processes for winning ethanol from fermenting amylaceous mashes and those containing sugar can be described as state of the art. However there is still much room for improvement in the fermentation process. So far it has not been possible to establish stable, continuous processes with regard to productivity, yield and process stability.

The immobilisation of bio catalysts, e.g. micro-organisms, frequently leads to a process stabilisation, to simpler and more cost effective process management and above all to a clear increase in productivity. These advantages can however only be implemented if suitable immobilisation technology and

suitable immobilisation material are used ensuring that the downstream process requirements are taken into consideration and the immobilisates produced are stable to use under simple condition over a long period.

As a result of the immobilisations used to date it is known that natural polymers (e.g. alginate, pectinate, chitosan, cellulose) used for this purpose result in considerable disadvantages such as insufficient mechanical stability, undesired biodegradability etc. In the field of encapsulation of bio catalysts by means of gel encapsulation, in initial laboratory trials, BMA has been testing a new development of FAL in Braunschweig. A chemical mass product which is available inexpensively is used as an immobilisation matrix. The resulting hydrogels produced are mechanically very elastic and stable and simultaneously not biologically degradable. This enables a long service life and non-sterile process management. In connection with a resource-saving immobilisation process and lentil shape, these immobilisates unite the advantages of a low input of precultivation with a high survival rate during production, good separation or retention ability of large immobilisate beads and minimal nutrient limitation of small immobilisate beads. By using the entire gel volume for the material conversion, huge bio mass quantities can be used in the reactor volume and as a result high productivity levels are achieved.

The tests running over several months in a 3-phase laboratory reactor cascade with non-sterile molasses as a substrate have shown that high productivity levels of up to 18g EtOH / l x h can be attained and a five to ten-fold increase of the specific fermenting productivity can be expected.



PLC user surface of the Lentikat pilot plant

For a long-term test a large-scale test plant will go into operation in Summer 2003. This should consolidate the results gained to date and prove the long-term stability of the hydrogels. The plant is intended to run automatically through the adapted measurement and control equipment as well as the corresponding configuration of the software. Intervention options and monitoring functions can be realised online via modem. Simultaneously, tests for using immobilised bacteria (*Zyomonas mobilis*) are taking place. A further essential increase of productivity levels is to be expected.

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Reactor system of the Lentikat pilot plant

Customer benefits

- High space / time exploitation
- High throughputs / turnover rates
- Very reliable / safe operation
- Reduction of personnel costs
- High yield
- Reduction of raw material and energy consumption
- Minimum service and maintenance costs
- Short amortisation time