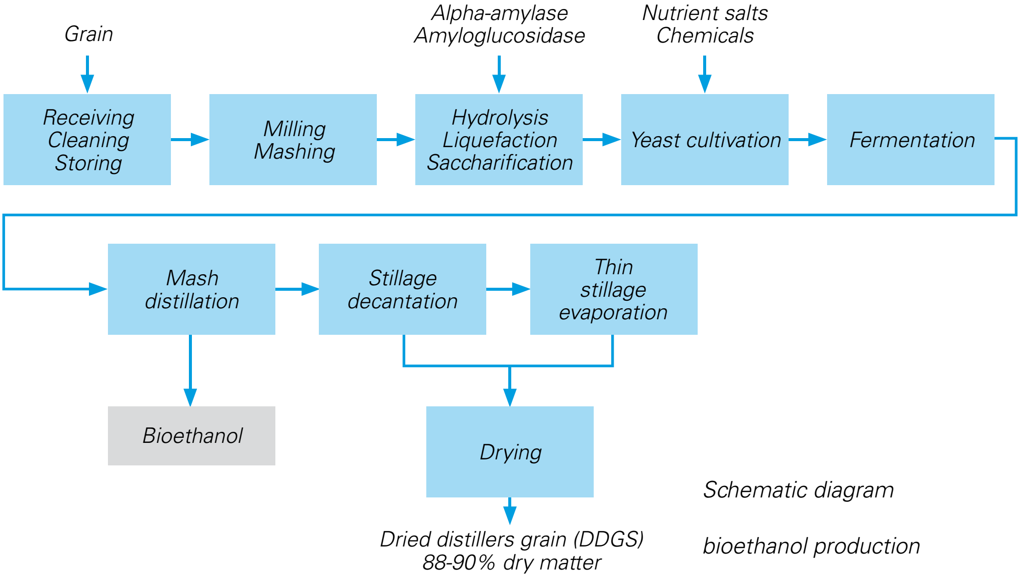
New BMA technology for the production of bioethanol from grain



Schematic diagram bioethanol production

Reducing greenhouse gas emissions has become a buzzword around the globe, and in the transport sector, too, this issue is given top priority. For this sector, the biofuels bioethanol and biodiesel are at present almost the only real alternatives to petroleum. Since bioethanol is produced from renewable raw materials, this energy source is considered to be CO_2 neutral. Possible grain-based raw materials are maize, wheat, millet, barley and rye. Other possible energy sources are rice, and the thin and thick juice obtained at a particular stage in the sugar production process.

Especially in the USA, the bioethanol market using maize as a raw material has grown dramatically in recent years. Many US federal states and metropolitan areas have made the admixture of typically 10% ethanol to gasoline mandatory. About 180 ethanol plants with capacities of up to 120 MMGY have already been put into service and some 15 other plants are under construction. It is known from various surveys that the energy balance of bioethanol production as currently practiced is only just positive. This is primarily due to the conventional drying process used for the stillage, which is obtained as a by-product. At about 35%, this process accounts for a considerable portion of the plant's total energy input. The above schematic diagram illustrates the technological steps in bioethanol production.

BMA has developed a new concept for drying the decanter products. The primary aim of this concept is to substantially improve the energy balance of the process, in addition to improving the product properties of DDGS (dried distillers grain with solubles). This product, which is conventionally dried in drum or ring dryers, is normally characterised by a wide particle size spectrum and a high dust content. When, for instance, transported by rail across several climatic zones, its flow properties after unloading tend to become unsatisfactory.

BMA's new concept introduces a process downstream of the stillage decanters. In decanters like these, the stillage is separated into decanter cake and thin stillage, and the stillage is normally evaporated to syrup to further increase the dry substance content of the thin stillage. The

CSD-10 during construction

DDGS pellets after drying

using BMA technology

Expander head for

the production of pellets

two components decanter cake and thin stillage cannot be processed into mechanically stable particles, which is why add-back is used as a third component. The components - decanter cake, syrup and add-back, and also a small amount of the dust separated in the dust arrester plant for the exhaust air leaving the fluidised-bed pellet cooler - are mixed in an expander. In the novel expander head, the material is shaped to pellets of near-uniform dimensions. This gives them the mechanical consistency required to be dried into stable pellets in the downstream fluidised-bed steam dryer. The fluidised-bed cooler, which is the next step in the process, cools the pellets to the temperature at which they can be stored, and also allows for dust separation.

The new BMA concept was commissioned for the fist time in an ethanol factory in North Dakota/ USA in spring 2009. The water evaporation rate of BMA's new, entirely cylindrical CSD-10 steam dryer that was achieved during its first ever practical application is 80 t/h. Since the vapour leaving the CSD-10 dryer is used for heating the distillation columns, the energy efficiency of the complete process is substantially improved. Primary energy consumption can be cut by up to 40% in comparison with conventional bioethanol production. The installations upstream of the steam dryer that give the moist pellets the desired shape offer two important advantages: with the near-uniform pellet shape with optimised dimensions, the CSD can achieve its maximum water evaporation rate. In addition to this, a dust-free pellet product with excellent flow properties is produced which is ideally suited for subsequent logistics processes. Drying takes place in an inert atmosphere. This eliminates the problem of partly charred DDGS particles that is often observed with conventional dryers, and the pellets are given a uniform golden yellow colour. Since most of the proteins contained in the pellets are preserved, DDGS can be sold as a high-quality feedstuff.

This is yet another project in which BMA has applied its experience in large-scale processing of renewable raw materials outside of the sugar industry. On this basis numerous other products can be processed with reduced energy input.

When this article went to press, the complete plant had not been fully commissioned. Detailed results will therefore be presented at a later date.

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