

Ethanol Drying with Molecular Sieves CECA offers the full range !

Production of ethanol (or other alcohols) with a very low residual water content is made possible by the use of Molecular Sieve drying units. They process the wet stream at its azeotropic composition in Pressure Swing Adsorption (PSA) systems.

Depending on the end-use, different levels of alcohol purity have to be reached. For example, specifications for the fuel ethanol are not as stringent as organoleptic standards for food applications.

Molecular Sieve suppliers usually propose a single type of adsorbent, which may not be optimised for the purpose of the PSA unit. On the other hand, having understood the specific needs of its customers, CECA has developed and commercialises two different Molecular Sieve grades for the drying of alcohol :

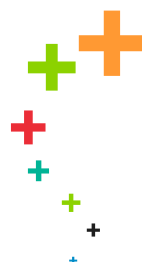
In units where the best drying efficiency, throughput and reliability have to be ensured, **SILIPORITE® EPX3B** is preferred. This grade fits particularly well the bio-fuel and industrial alcohol production.

In units designed for high purity ethanol grades, with no by-product formation, **SILIPORITE® EHP** is recommended. Agrofood, cosmetic and pharmaceutical industries are typical users of this grade. EHP is also optimised for high temperatures systems (150°C/300°F or more).

Both adsorbents have a uniform pore opening of 3 Angstroms, able to trap water molecules while preventing ethanol co-adsorption. Using EPX3B or EHP in a properly designed PSA system enables to reach low water contents (99.98% or 199.6 proof is common), from a wide range of feed stocks : corn, sugarcane, wine, synthesis, ...

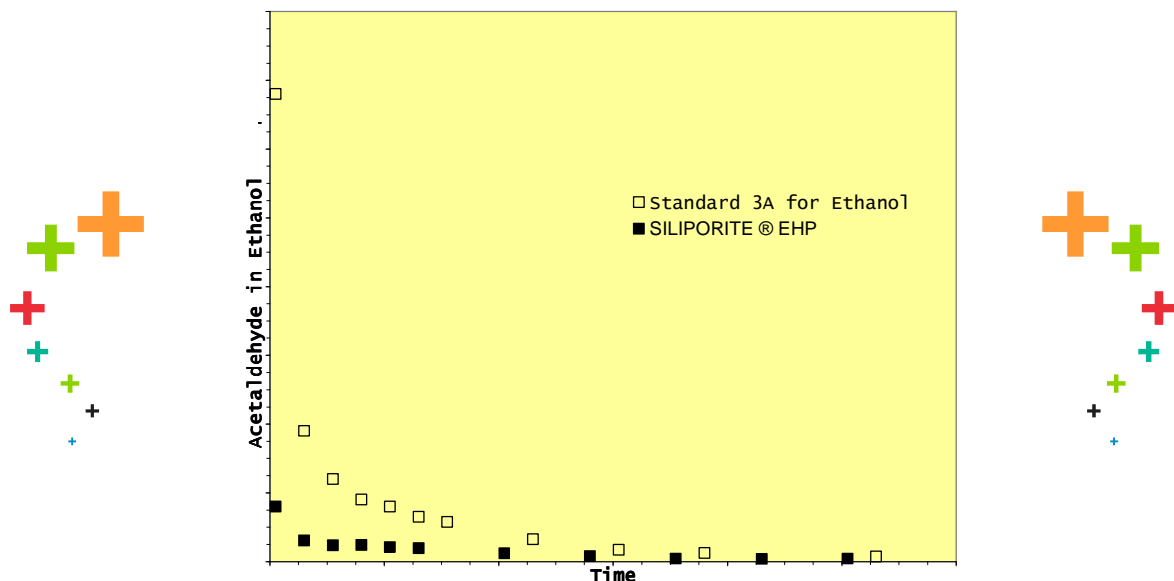
For each manufactured batch of both grades, some key parameters are controlled :

- ✓ **Mechanical strength and resistance to attrition** : due to the short-cycled pressure changes in the columns, particles of Molecular Sieve are subject to mechanical stress. With some products, attrition (friction between beads) and even powdering can be such that drying performances of the unit get poor, while operation costs increase due to the extra pressure drop through the bed. To produce beads resistant enough, CECA constantly tunes its manufacturing process and fixes severe specifications for bed crushing strength
- ✓ **Water adsorption capacity** at the high operating temperatures of the PSA



- ✓ **Adsorption kinetics** : with the development of very large ethanol plants for the biofuel industry, size of the equipment has dramatically increased. Using adsorbents with superior drying performances helps keeping compact standalone systems, and reducing both capital and operating costs. Kinetic properties of the **SILIPORITE® EPX3B** and **EHP** are checked to ensure a significant reduction of the gas-to-solid water transfer length in the column
- ✓ **Hydrothermal Stability** especially in case of upset conditions (liquid plugs...)
- ✓ **Ethanol co-adsorption** which can induce changes in adsorbent structure
- ✓ **Coking tendency** with some typical impurities present in certain alcohol feeds
- ✓ **By-products formation** : due to the catalytic activity of the Molecular Sieve, some impurities can appear in the alcohol such as acetaldehyde, diethyl ether & acetate... These by-products of ethanol conversion reactions may cause off-spec or odorous alcohol. By carefully selecting formulations, CECA products limit catalytic conversion to a minimum, and allow the use of ethanol in pharmaceutical or beverage industries

In order to validate product formulation and processing at our R&D facilities, extensive laboratory tests are carried out in exacerbated conditions. By-product formation can be measured in dynamic pilot operation :



As an example, this chart clearly shows the effect of by-product minimization with SILIPORITE® EHP : levels of impurities are always near detection limit. Other methods (odour testing...) confirm it is the preferred grade for ultra-pure ethanol.

Both **SILIPORITE® EPX3B** and **SILIPORITE® EHP** are used in all kind of industrial units worldwide (references on request). Products are shipped in metal drums or Big Bags. Lifetime of the bed is typically around 8 years, but can go beyond 12 years.

CECA experts can give you more details on applications & **SILIPORITE®** products.
For more information contact us at siliporite@ceca.fr or visit www.siliporite.com !