

## ADSORPTIVE SEPARATIONS IN BIOFUELS PRODUCTION

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**ABSTRACT:** Although it is generally accepted that fuels and chemicals produced from a large variety of biomass sources can be one of the ways to reduce our dependence on oil and natural gas, the widespread use of these alternatives is advancing slowly. Given the low cost of oil and gas as sources for fuels and chemicals, even limited adoption of these routes requires strong political or regulatory pressure and almost inevitably subsidizing. The technical problems posed by the use of alternative fuels and the competition for biomass sources also used for food or more valuable products are other major hurdles. Production of high quality fuels or pure chemicals, especially on larger scales, requires the handling, pretreatment, selective conversion and above all separation and purification processes for very complex and often diluted feeds or intermediate streams, such as in fermentation. The handling of mixtures of polar and non-polar components, often in water with a variety of contaminants, makes the application of our traditional separation techniques difficult. This is especially posing problems for adsorptive separations where most materials have been developed and tuned for simple gas or liquid separations. Finding the proper adsorbent material for a given separation is the major although certainly not the only step in developing a process. Fortunately, apart from the traditional carbons, resins and silica materials, we can dig into the vast collection of existing or potential zeolites, MOF and other highly ordered nano-structured materials. The development of selective, high capacity and stable materials is essential for the successful application of adsorptive separations known for their reduced energy consumption and ability to extract components from mixtures based on small differences in component properties.

This presentation will obviously deal with the following topics:

- biomass sources, biorefineries, possible product range;
- alcohols such as bioethanol and biobutanol;
- other fuel or chemical products (biogas, biodiesel);
- technical, environmental and political issues;
- past, present and future of biofuels and chemicals,

but will be illustrated with examples from literature and our own work with strong focus on the science and technology needed for the development of materials and processes in this field.

**KEYWORDS:** biofuel, zeolite, MOF, activated carbon, fermentation, biogas, equilibrium, diffusion