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The Physical Chemistry of the CatLiq® Process

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Abstract

The CatLiq® process is a thermochemical conversion process for wet biomass. It differs from other thermochemical conversions such as hydrothermal upgrading, gasification and pyrolysis in a number of ways including process conditions, catalysts and product. Possible reaction pathways have been investigated based on literature studies to give an overview of the reactions that may occur in the process. This includes the effect of both heterogeneous and homogeneous catalysts as well as acid/base related reactions.

At processing conditions the solubility of salts are very low due to a low dielectric constant, which means salts are likely to precipitate in the process. A model based on the extended Debye-Hückel equation has been developed to determine the solubility of salts at various pressures and temperatures. The method is based on calculating the saturation index which is the ratio between activities and solubility product. However for very soluble salts there is a significant deviance due to problems using the extended Debye-Hückel equation at high molalities. The model works at ambient conditions, however due to scarce solubility data at various pressures and temperatures it is difficult to validate the model without performing experimental determination of these solubilities for calculation of correction parameters.

Another model has also been developed for determination of phase distributions and compositions. This model is a multiphase flash routine which yields acceptable results compared with literature data of various mixtures, but some issues arise when using it on the CatLiq® system. Reasons for these include the lack of interaction parameters for the components, a very simplified composition used in the calculation and simple mixing rules. The composition and bubble point of the process stream has been measured experimentally, and based on the measured composition a model composition has been estimated. However, only a small fraction of the compounds in the process stream could be identified using GC/MS, meaning that the model composition is a very simplistic image of the actual composition.

A laboratory scale facility has been developed to perform fast screening experiments, and although being a batch reactor it does show comparable results with the measurement from the CatLiq® pilot plant.

Overall an overview of the CatLiq® process has been generated and models developed that although not perfect in their operation forms a solid base on which to perform further development.

Process Chemistry and Technology. Public Health, Environmental and Occupational Health. Radiation.Ä Evolution of the total number of citations and journal's self-citations received by a journal's published documents during the three previous years. Journal Self-citation is defined as the number of citation from a journal citing article to articles published by the same journal. Cites. Physical chemistry is the study of macroscopic, and particulate phenomena in chemical systems in terms of the principles, practices, and concepts of physics such as motion, energy, force, time, thermodynamics, quantum chemistry, statistical mechanics, analytical dynamics and chemical equilibrium. Physical chemistry, in contrast to chemical physics, is predominantly (but not always) a macroscopic or supra-molecular science, as the majority of the principles on which it was founded relate to the bulk... Since physical chemistry needs just a limited set of simple differentials and integrals, I would like to list the most important ones for basic functions y(x) of one variable x below: Ý•. àµŒ Ý"ÝŠ.Â On the other hand, physico-chemical processes are classified as following: 1. Isochor, i.e. the volume of the system is kept constant (dV = 0), 2. Isobar, i.e. the pressure is kept constant (dp = 0), 3. Isotherm, i.e. the temperature is kept constant (dT = 0), or 4. Adiabatic, i.e. no exchange of heat with. Learn about physical chemistry topic of chemistry in details explained by subject experts on vedantu.com. Register free for online tutoring session to clear your doubts.Â You can also give a reading of the â€œCurrent Physical Chemistryâ€, which is an essential journal that keeps physical chemists updated with the latest development and issues in physical chemistry. Scales in Physical Chemistry. While studying advanced physical chemistry, we need to understand the following major scales associated with this branch of chemistry -. The Macroscopic Scale: This scale deals with the substances that can be studied with the naked eye without taking the help of any optical equipment. Some of the major qualities estimated using the macroscopic scale are -. Boiling and Melting points. The physicochemical process of ionizing radiation interacting with silver halide crystals suspended as an emulsion in gelatin was one of the most thoroughly studied fields of dosimetry. Use of these films of emulsion to measure x- or gamma-radiation will be referred to here as â€œfilmâ€ dosimetry. The two types of emulsions are typically referred to as x-ray and nuclear (Table 15.2).Â An extensive treatment of the physical chemistry of light photography and film dosimetry was published by Mees (1954). One of the earliest explanations of the process of latent image formation was published by Gurney and Mott (1938).