

Synthesis of anhydrous formaldehyde

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Formaldehyde is commonly used as an intermediate in many branches of industry. There are two popular approaches to formaldehyde synthesis: the oxide process and the silver process (with complete or incomplete conversion of methanol) [1], [2]. However, while both processes are used on a commercial scale, a stoichiometric amount of water is formed in both cases. In contrast, the direct dehydrogenation of methanol opens up the possibility of avoiding the energy-consuming water separation process, as well as producing highly concentrated formaldehyde [3]. Despite this potential advantage, there is no industrially mature method for the production of anhydrous formaldehyde yet. One reason for that is the highly endothermic nature of direct dehydrogenation and the narrow residence time distribution. Studies have found, that alkali aluminates (e.g., NaAlO_2 or $\text{LiAlO}_2 \cdot \text{NaAlO}_2$) show high activity and selectivity for the dehydrogenation of methanol at 1000 - 1200 K [3]–[5]. Consequently, the aim of this research is to obtain water-free formaldehyde in a gas-phase reaction initiated by sodium vapours. An experimental set-up MEDENA – “Methanol dehydrogenation with evaporated sodium (Na) as catalyst” is being constructed for this purpose. The main objectives of this research are: the optimization of the reaction conditions, the development of dosing and a catalyst separation/recovery system, and the creation of suitable mixer and reactor concepts. This study might demonstrate that vaporized elemental sodium homogeneously catalyses the dehydrogenation of methanol to anhydrous formaldehyde with high activity and selectivity. A number of parameters, such as the amount of sodium, the mole fraction of methanol and temperature, play a key role in this type of reaction and will be investigated in detail.

Literature:

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